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30% Draft Submittal

Documented Safety Analysis for Investigation, Remediation, and Restoration of Material Disposal Area B Nuclear Environmental Site

Los Alamos
NATIONAL LABORATORY
EST. 1943

Prepared by the
Environmental Stewardship–Environmental Remediation and Surveillance Division

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Approval:

Signature	Title	Organization	Date
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CONTENTS

Appendixes

Figures

Tables

1.0 INTRODUCTION

Los Alamos National Laboratory (LANL or the Laboratory) prepared this documented safety analysis (DSA) for the investigation, remediation, and restoration (IRR) of nuclear environmental site (NES) Technical Area (TA) 21 Material Disposal Area (MDA) B in accordance with Title 10 of the Code of Federal Regulations Part 830 (10 CFR 830), Subpart B, "Safety Basis Requirements." The Laboratory's Nuclear Waste and Infrastructure Services (NWIS) division is the steward for the NES on Laboratory property. This NES is not active now and will not serve as an active disposal facility in the future.

There are 10 NES, eight of which comprise engineered and constructed disposal units with defined boundaries intended to isolate the waste inventory from the environment. The U.S. Department of Energy (DOE)/National Nuclear Security Administration (NNSA) approved a DSA (LANL November 2004) to provide safety basis coverage for ongoing surveillance and maintenance (S&M) activities to ensure that site contaminants do not migrate from their current location. MDA B currently falls under the scope of the S&M DSA. This DSA evaluates the hazards and identifies needed controls for the IRR of MDA B. When this DSA is approved, it will provide the safety envelope for MDA B and the S&M DSA will no longer be applicable to MDA B.

The purpose of this DSA is to ensure that workers, the public, and the environment are protected from the radiological, chemical, and other hazardous materials associated with the IRR of TA-21 MDA B. Section 1 of this report provides the background and requirements for the DSA and describes site characteristics, locations, and area features. General site characteristics and those that apply specifically to this NES are discussed. An operational history of MDA B and its current status are also presented. Section 2 presents a detailed description of the phases/activities and tasks covered in this DSA. Section 3 presents the safety assessment for the IRR of MDA B. Appendix A includes definitions for terms and acronyms used in this report. Appendix B provides a hazard-barrier matrix with postulated hazard scenarios and the barriers associated with preventing and/or mitigating each postulated hazard scenario. Appendix C provides the contaminants of concern identified for MDA B. Technical safety requirements (TSRs) for the activities in this DSA are described in "Technical Safety Requirements for Investigation, Remediation, and Restoration of Material Disposal Area B Nuclear Environmental Site" (LANL *****).

1.1 Background

DOE administers, and the University of California operates, the Laboratory and the 32 TAs currently active within the Laboratory boundaries. Figure 1.1-1 shows the Laboratory and TA locations and the boundaries and locations of all of the NES, including TA-21 MDA B. For more than sixty years, the Laboratory has been the location for experimental nuclear weapons and science programs. The NES are legacy sites associated with the disposal of materials related to these programs. On November 26, 2003, the DOE NNSA concurred with the Laboratory's initial hazard categorization of TA-21 MDA B as a hazard category (HC) 3 NES (Steele 2003).

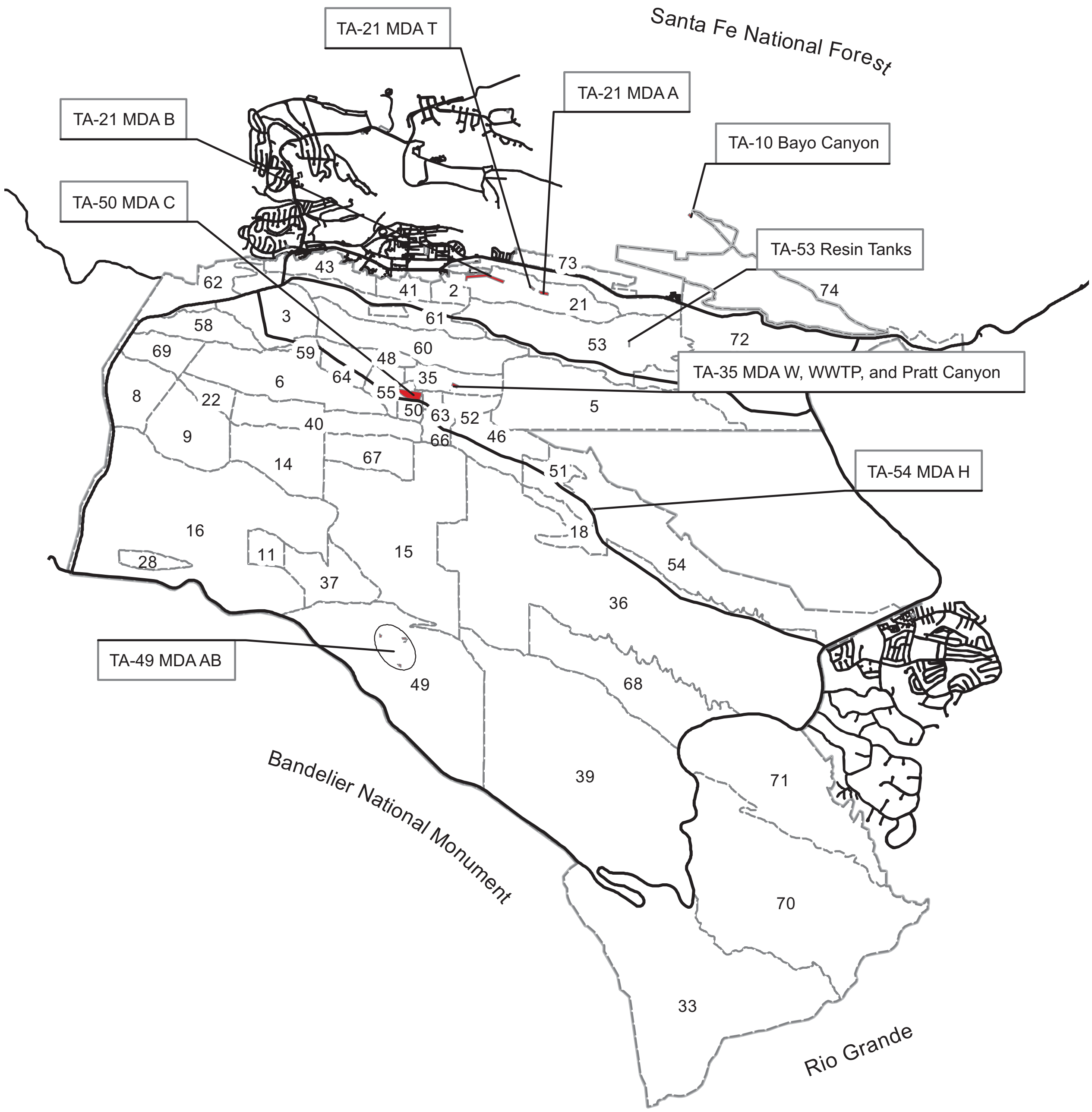


Figure 1.1-1. Locations of NES and Laboratory TAs

1.2 Requirements

This DSA is compiled in accordance with the following codes and standards:

- 10 CFR 830, "Nuclear Safety Management"
- DOE Standard 1120-2005, "Integration of Environment, Safety, and Health into Facility Disposition Activities, Volume 1 of 2: Documented Safety Analysis for Decommissioning and Environmental Restoration Projects" (DOE April 2005)
- DOE Standard 1120-2005, "Integration of Environment, Safety, and Health into Facility Disposition Activities, Volume 2 of 2: Appendices" (DOE 2005)
- 29 CFR 1910.120, "Hazardous Waste Operations and Emergency Response"

1.3 Approach

During excavation, a temporary enclosure will be constructed over the active work area but no permanent structures are planned. Because none of the IRR activities require working within a permanent structure, the Laboratory concluded that the Safe Harbor described in 10 CFR 830 Subpart B, Appendix A, Table 2, for nuclear facility type 6, provides the appropriate methodology for this analysis. Accordingly, LANL prepared this DSA to comply with the methodology in DOE Standard 1120-2005 (DOE 2005) and the provisions of 29 CFR 1910.120.

DOE Standard 1120-2005 applies to HC2 and HC3 environmental restoration activities and decommissioning projects as defined in 10 CFR 830, Subpart B (DOE 2005). Fundamentally, environment, safety, and health (ES&H) directives appropriate to operational activities are not necessarily appropriate to disposition activities such as investigation and remediation. Preparing and implementing an analysis consistent with DOE Standard 1120-2005 and 29 CFR 1910.120 ensures the evaluation and control of radiological and toxicological hazards to workers, the public, and the environment during MDA B IRR.

The implementation guide for developing DSAs (DOE 2003) dictates the use of "a graded approach" such that the level of detail, analysis, and documentation will reflect the complexity and hazard associated with a particular facility or activity. The IRR of MDA B involves potential hazards primarily associated with intrusion into buried inventory. Since workers can be affected in such a case and because members of the public may be very near the activities, it is imperative that all hazards be identified and controlled. Due to the large uncertainty regarding the form, content, and quantity of the inventory, a rigorous quantitative analysis of potential impacts is not possible and would not provide meaningful direction to develop controls. In applying a graded and semi-quantitative approach consistent with MDA B IRR activities, LANL analysts concluded that a barrier analysis is the appropriate and adequate basis for the safety assessment in this DSA. The barrier analysis methodology enables safety analysts to determine physical and administrative barriers needed to ensure protection of workers, the public, and the environment. Safety analysts use barrier analysis to evaluate hazards and identify the appropriate type, level, and number of hazard controls.

1.4 Laboratory Site Description

1.4.1 Location

The Laboratory and the residential and industrial areas associated with the town site of Los Alamos (inclusive of the White Rock community) are located in Los Alamos County in north-central New Mexico, approximately 96.6 km (60 mi) north-northeast of Albuquerque and 40 km (25 mi) northwest of Santa Fe. The area surrounding the Laboratory, including portions of Los Alamos, Sandoval, Rio Arriba, and Santa Fe Counties, is largely undeveloped. Santa Fe National Forest, the Bureau of Land Management, Bandelier National Monument, the General Services Administration, and Los Alamos County own and/or manage large tracts of land north, west, and south of the Laboratory. Thirteen Native American pueblos are located within an 80 km (50 mi) radius of the Laboratory. San Ildefonso Pueblo borders the Laboratory to the east.

1.4.2 Transportation and Access

1.4.2.1 Roads and Vehicular Access

Three state highways and the Los Alamos Airport allow vehicular access to the Laboratory and the town site of Los Alamos. State Highway 502 enters Los Alamos from Pojoaque and areas to the southeast of Los Alamos and is the main access route for commuters from outlying communities. State Highways 4 and 501 enter Los Alamos from the Jemez Mountains to the west and southwest.

Traffic on State Highway 502 is moderate to heavy on workdays during the peak morning and evening commute. During off-hours and weekends, traffic is typically light to moderate on all three roads. The University of California has the authority, delegated by DOE, to limit access to DOE-controlled roads at the Laboratory during emergency situations and for transport of hazardous and radioactive materials (Bellows 1993).

1.4.2.2 Airports and Air Traffic

The Los Alamos Airport runway is located approximately 0.48 km (0.3 mi) north of MDA B adjacent to and north of State Highway 502. The airport consists of a single east-west runway and primarily serves the general public, with some occasional commercial or military traffic. Almost all air traffic enters from and exits to the east due to local atmospheric conditions and airspace restrictions.

Los Alamos Airport has the capacity to handle 500 to 600 private flights and 200 to 300 commercial flights per month. Data obtained in 1997 for frequency of aircraft operations at the airport recorded approximately 4860 general-aviation and 1980 commercial takeoffs and an equal number of landings per year (Heindel 1998).

1.4.3 Population

The total population within 80 km (50 mi) of the Laboratory is about 224,000. Santa Fe is the largest city in the area, with a population of about 67,000. The Albuquerque metropolitan area, which is approximately 97 km (60 mi) to the south-southwest, has an estimated population of 670,000 (US Census Bureau 1997).

In 2002, Los Alamos County had a population of 18,305 individuals (US Census Bureau 2003). The Los Alamos community has an estimated population of 11,400 persons. The White Rock area (including the residential areas of White Rock, La Senda, and Pajarito Acres) has approximately 6800 residents. A few permanent residents reside at the Bandelier National Monument, but during summer operational hours the population at the Monument can be as high as 1000. Approximately 12,350 University of California and subcontractor employees work within Laboratory boundaries.

1.4.4 Climate

Los Alamos County has a semiarid, temperate mountain climate. “Los Alamos Climatology” (Bowen 1990) provides detailed discussion of the Los Alamos climate and includes frequency analyses of extreme climatologic events.

1.4.4.1 Wind Conditions

Los Alamos is considered a light-wind site, with surface winds at the Laboratory averaging 3.1 m/s (7 mph). Wind speeds are strongest from March through June and weakest in December and January. Wind gusts exceeding 80 km/hr (50 mph) are common during the spring. Wind distribution varies with location, height above ground, and time of day. The highest recorded wind gusts in recent history were 124 km/hr (77 mph) on November 15, 1998. No tornadoes have been reported to touch down in the Los Alamos area in recent history. However, a funnel cloud was reported near White Rock on August 23, 1983. In addition, numerous funnel clouds were reported near Santa Fe on August 24 and 25, 1987, and a tornado touched down in Albuquerque on September 20, 1985. Five meteorological monitoring stations measure wind speed and direction around the Laboratory.

1.4.4.2 Temperature

Summer afternoon temperatures in Los Alamos County typically range between 20 and 25ºC (75 and 80ºF) and only infrequently reach 32ºC (100ºF). Nighttime temperatures typically range between 10 and 15ºC (35 and 50ºF) (Carter and Gardner 1995). Typical winter temperatures are between 1 and 10ºC (30 to 50ºF) in the daytime and between -10 and -3ºC (15ºF and 25ºF) at night. Winter nighttime temperatures occasionally drop to -17ºC (0ºF) or below (LANL 1992).

1.4.4.3 Precipitation

Annual average precipitation at Los Alamos is about 36 cm (14 in.), with about 36% occurring as brief, intense thunderstorms during July and August (Carter and Gardner 1995). Hail can be frequent and severe during the thunderstorms. Most hailstones have diameters of about 0.64 cm (0.25 in.). Snowfall is greatest from December through March, with heavy snowfall infrequent in other months. Annual snowfall averages about 1.30 m (51 in.). Variations in precipitation from year to year can be quite large, and annual precipitation extremes in Los Alamos range from 17 cm (6.8 in.) to 77 cm (30.3 in.). Daily rainfall extremes of 2.54 cm (1 in.) or greater occur in most years, and the estimated 100-year daily rainfall extreme is about 6.4 cm (2.5 in.). Precipitation generally increases westward toward the Jemez Mountains.

1.4.4.4 Lightning

Lightning associated with thunderstorms in Los Alamos can be frequent and dense. The National Oceanic and Atmospheric Administration provides a lightning-density map for the US on its web site. The density in the Los Alamos area shown on this map is four to eight strikes per square km per yr (National Weather Service Lightning Safety 2004).

1.4.5 Atmospheric Dispersion

The terrain at Los Alamos is irregular and affects atmospheric turbulence and dispersion both favorably and unfavorably. Increased dispersion promotes greater dilution of contaminants released into the atmosphere. The complex terrain and forests create an aerodynamically rough surface, forcing increased horizontal and vertical turbulence and dispersion. However, dispersion is greatly restricted within the area's canyons. Also, dispersion generally decreases at lower elevations, where the terrain becomes smoother and less covered in vegetation. The frequent clear skies and light winds cause good vertical daytime dispersion, especially during the warm season. Daytime heating during the summer can force strong vertical mixing to 900 to 1800 m (3000 to 6000 ft) above ground level (AGL). The generally light winds have a limited effect on the horizontal dilution of contaminants (Bowen 1990).

The clear skies and light winds have a negative effect on dispersion at night, causing strong, shallow surface inversions to form. These inversions can severely restrict near-surface vertical and horizontal dispersion. The inversions are especially strong during the winter. Shallow drainage winds can fill lower areas with cold air, thereby creating deeper inversions. A deeper inversion is common toward White Rock and the Rio Grande Valley on clear nights with light winds. Canyons also can limit dispersion by channeling airflow. A large-scale inversion during the winter can limit vertical mixing to under 3000 m (10,000 ft) above sea level (Bowen 1990).

Dispersion is generally greatest during the spring, when winds are strongest. However, deep vertical mixing is greatest during summer, when the atmosphere is unstable up to 1500 m (4875 ft) AGL or more. Low-level dispersion is generally the least during summer and autumn, when winds are light.

1.4.6 Geology

The 111 km^2- (43 mi^2) Laboratory site and the adjacent communities are situated on the Pajarito Plateau, a shelf approximately 16 to 24 km (10 to 15 mi) wide and 72 km (45 mi) long. The Pajarito Plateau consists of a series of east-trending finger-like mesas separated by deep canyons cut by streams. The mesa tops range in elevation from approximately 2400 m (7800 ft) on the flanks of the Jemez Mountains to about 1900 m (6200 ft) at their eastern termination above the Rio Grande Valley. The Laboratory is located at altitudes ranging from 1800 to 2500 m (6000 to 8000 ft) on the eastern slopes of the Jemez Mountains.

The Pajarito Plateau is formed of consolidated ash (tuff) from two major volcanic eruptions in the Jemez Mountains that took place about 1.61 and 1.22 million yr ago. These eruptions produced widespread, massive deposits known as the Otowi and Tshirege Members of the Bandelier Tuff. Smaller eruptions that occurred between the two major events produced an interbedded sequence of silica-rich (rhyolitic) tuffs and sediments that occur commonly, but not uniformly, between the Otowi and Tshirege Members.

Surface sediments across the Pajarito Plateau are composed of thin soils developed on the mesa top, alluvial (water-deposit) and colluvial (slope-deposit) residues on the mesa flanks, and alluvial deposition in the canyon bottoms. The sediments consist of coarse-grained colluvium on steep hill slopes and fine-grained materials on the flatter mesa tops. Alluvial deposits in the canyons are composed of loose (unconsolidated) fine and coarse sands of quartz, sanidine crystal fragments, and broken pumice fragments that are weathered and transported from the mesa top and sides. The slopes between the mesa tops and canyon bottoms often consist of rocky outcrops and patches of undeveloped colluvial soil. South-facing canyon walls are steep and sometimes have no soils, but north-facing walls generally have areas of very shallow, dark soils (DOE 1999).

1.4.7 Seismicity and Volcanism

Seismic source zones at Los Alamos include the Rio Grande Rift, the Jemez Volcanic Province, the Colorado Plateau Transition Zone, the Southern Rocky Mountains, and the Great Plains Provinces.

The Laboratory is situated near the western edge of and within the Rio Grande Rift, a tectonically, volcanically, and seismically active province in the western US. The instrumental and historical records of earthquakes in New Mexico extend back only about 100 yr.

The most recent volcanic activity within the Jemez volcanic field occurred about 50,000 to 60,000 yr ago. Studies have found more evidence for recurring seismic activity along the Pajarito Fault System than for recurring volcanic activity in the Jemez volcanic field (Reneau, Gardner, and Forman 1996; Olig et al. 1996). The three most significant and closest fault zones to the Laboratory are the Pajarito, Guaje Mountain, and Rendija Canyon Faults, which are accompanied by numerous smaller secondary faults. The larger faults are clearly expressed by surface offsets at some locations; their presence at other locations is inferred from geologic evidence (Wong et al. 1995).

The Woodward-Clyde study evaluated the seismic measurements recorded by the Laboratory from 1973 to 1992 (Wong et al. 1995). Only one well-located earthquake has occurred in the vicinity of the Laboratory or the three local faults. The maximum depth of seismic activity in the northern Rio Grande Rift is about 12 km (7.5 mi), which is consistent with elevated temperatures in the crust. Focal mechanisms show normal and strike-slip faulting generally on northerly striking planes. Consistent with the Rio Grande Rift zone, an approximately east-to-west extension characterizes the tectonic stress field.

The Pajarito Fault is thought to mark the currently active western boundary fault of the Española Basin (Carter and Gardner 1995). This fault forms the western boundary of the Pajarito Plateau and is easily visible above West Jemez Road as an east-facing escarpment about 91 m (300 ft) high. The Rendija Canyon and Guaje Mountain Faults are shorter than the Pajarito Fault. All three faults are geologically young and are capable of producing earthquakes.

The Pajarito Fault zone trends north along the western boundary of the Laboratory. The Rendija Canyon Fault zone is located 3.2 km (2 mi) east of the Pajarito Fault zone and trends north to south across the Laboratory. The Guaje Mountain Fault zone is located 1.6 to 2.4 km (1 to 1.5 mi) east of the Rendija Canyon Fault zone and also trends north to south. Maximum magnitudes for the random earthquakes within these provinces range from 6.0 to 6.5 Mw (Wong et al. 1995). Table 1.4-1 lists the approximate length, type, most recent movement, and maximum earthquake for each fault.

Table 1.4-1
Major Faults in the Laboratory Area

Name	Approximate Length (km/mi)	Type[a]	Most Recent Movement	Maximum Earthquake (Mw)[b]
Pajarito	26/16.3	Normal, east side down	100,000 to 200,000 yr ago, multiple in the past	6.9
Rendija Canyon	9.6/6	Normal, west side down	8000 to 9000 yr ago	6.5
Guaje Mountain	8/5	Normal, west side down	4000 to 6000 yr ago	6.5

[a] "Normal Fault" describes a steep to moderately steep fault for which the movement is downward for the rocks above the fault zone.

[b] "Mw" denotes the moment magnitude scale, which is physically based and calibrated to the Richter local magnitude scale at the lower values.

1.4.8 Hydrology

1.4.8.1 Surface Flow

Springs on the flanks of the Jemez Mountains supply base flow into the upper reaches of some canyons on the Pajarito Plateau. Runoff from summer storms on the Pajarito Plateau reaches maximum discharge in less than 2 hr and generally lasts less than 24 hr (Devaurs and Purtymun 1985; Purtymun and Kennedy 1970). High-discharge rates can transport large masses of both suspended and bed sediments for long distances down the canyons. Spring snowmelt runoff occurs over several weeks to several months at a low discharge rate.

Surface flow in Pueblo Canyon is perennial in the form of effluent from the Los Alamos townsite. Runoff from heavy thunderstorms or heavy snowmelt reaches the Rio Grande several times a year. Large-scale flooding is not common in New Mexico and has never been observed in Los Alamos. Most of the Laboratory TAs are located on top of the finger mesas near drainage divides in areas that are not subject to flooding.

1.4.8.2 Groundwater

Groundwater in the Laboratory area occurs in shallow alluvial systems in canyons; in perched zones beneath some canyons and along the Jemez Mountains within the Bandelier Tuff, the Cerros del Rio Basalt, and the upper part of the Puye Formation; and in the regional aquifer. The regional aquifer is the only groundwater source that can serve as a municipal and industrial water supply. Eighteen deep aquifer wells, located in Otowi and Guaje Canyons and on the Pajarito Plateau, supply water to the Laboratory and the townsite of Los Alamos (inclusive of the White Rock community). The average saturated thickness of the aquifer penetrated by the Pajarito Field wells is 550 m (1800 ft). Regional aquifer waters date to a few thousand years to more than 40,000 yr, with the most recent waters in the western portions of the aquifer and the oldest in portions to the east.

The principal recharge to the main aquifer is from the intermountain basin of the Valles Caldera in the Jemez Mountains west of Los Alamos. The integrity of the aquifer results from its confinement below ground; compromise from flooding, earthquakes, or volcanic eruption is unlikely. Water in the aquifer moves from the major recharge area east toward the Rio Grande, where the water discharges as seeps and springs in White Rock Canyon (Purtymun, Peters, and Owens 1980). The Rio Grande is the principal groundwater discharge for the regional aquifer, with annual discharge to an 18-km (11-mi) reach of the Rio Grande in White Rock Canyon of about 6.8 million m^3 (5500 acre-ft) (LANL 1995).

The aquifer extends to the south into Bandelier National Monument, where water movement trends more southerly than easterly. North of Frijoles Canyon, the aquifer surface is slightly above river level; south of the canyon, the aquifer surface is below river level (Purtymun, Peters, and Owens 1980).

1.5 Descriptions of Features Near MDA B

In addition to the general site characteristics described in the preceding sections, this DSA considers several specific site characteristics relative to safety and inventory isolation at the NES. These characteristics include facilities and potential energy sources, MDA B location relative to public receptors and nearby sites, access control to MDA B, the proximity of MDA B to utilities and roads, vegetation relative to fuel-loading, and the potential for surface water to impact buried inventory. The following subsections discuss these characteristics of TA-21 MDA B.

1.5.1 Energy Sources and Facilities with Proximity to MDA B

A natural gas line (46 m/150 ft east), a 100,000-gal. water tower; and overhead electric power lines are located in the vicinity of MDA B. Vehicular traffic and buried county utilities are also nearby. Other energy sources will be associated with IRR activities and will be described with those activities and with the hazard analysis in section 3.

1.5.2 General Access and Proximity to Workers and the Public

MDA B is located between Delta Prime (DP) Canyon and Los Alamos Canyon south of DP Road west of the main TA-21 complex within a LANL-controlled area with a fenced boundary. Public access to DP Road is not currently controlled. The nearest public receptor is located at businesses about 20 m (65 ft) to the north, across DP Road, and there is a residential area about 640 m (2100 ft) to the north.

1.5.3 Proximity to Roads and Utilities

MDA B lies along DP road, which is a public road. There is a natural gas line along the western half of the site to north of DP Road and a sewer line northwest and north of DP Road. An abandoned underground radioactive liquid waste line, that served other LANL facilities, runs along the southern boundary of the site outside the fence line. A Los Alamos County sanitary sewer lift station is outside the fence near the southeast corner of the site. Buried water and communications lines are located under the area between the north fence and DP Road. A water hydrant is located inside the northwest corner of the fence and an air-monitoring station is positioned on the outside of the east fence. The radioactive liquid waste line and utilities are not considered part of MDA B. Overhead electric power lines run along the east and west ends of MDA B.

1.5.4 Vegetation

The Laboratory site and surrounding areas are generally forested and have high fuel loadings. MDA B borders forested areas containing indigenous evergreen trees and wild vegetation. It is separated from large forested areas with high fuel loadings to the south by Los Alamos Canyon, separated from State Highway 502 by a thinly forested canyon to the north, and separated from the Jemez Mountains by the urban Los Alamos townsite to the west.

1.5.5 Surface Water Impact

Surface water has the potential to erode the cover from, infiltrate into, or destabilize former disposal units such as MDA B. Evaporation, transpiration, and infiltration generally deplete surface flow in the upper reaches of the canyons of the Pajarito Plateau before it can flow across the Laboratory and the NES. Some storm or snowmelt events could provide sufficient runoff for short periods (days or weeks) to initiate flow across MDA B (Devaurs and Purtymun 1985; Purtymun and Kennedy 1970). The potential for surface water runoff to impact this NES is considered to be low or moderate, depending upon site conditions and cover thickness.

1.6 Detailed Description of TA-21 MDA B NES

TA-21, also known as DP Site, is located on DP Mesa situated immediately east-southeast of the Los Alamos townsite at an elevation of 7140 ft. Runoff from TA-21 drains into Los Alamos Canyon to the south and DP Canyon to the north. Depth to groundwater is approximately 1150 ft beneath the mesa top. TA-21 was the site of chemical research for refining plutonium and plutonium metal production from 1945 to 1978.

MDA B, which is listed as Solid Waste Management Unit (SWMU) 21-015, is located within TA-21 just west of the fenced area of TA-21 and south of commercial businesses on DP Road. MDA B was a radioactive and chemical waste-disposal facility from approximately 1945 to 1948; currently the site is inactive. MDA B is located at the western edge of TA-21, approximately 488 m (1600 ft) east of the intersection of DP Road and Trinity Drive. The northern, fenced boundary of the NES is within a short distance (approximately 1.5 m/5 ft) of DP Road. MDA B covers approximately 24,400 m^2 (6.03 acre).

Historical documents and records indicate the presence of at least five burial pits at MDA B. With the exception of the hazardous materials pit, which documents describe as a trench 12 m (40 ft) long, 0.6 m (2 ft) wide, and 0.9 m (3 ft) deep, documents describe the pits as 91 m (300 ft) long, 4.6 m (15 ft) wide, and 3.7 m (12 ft) deep. Cover at this NES consists of asphalt and soil overburden. The estimated asphalt coverage is 0.1 to 0.15 m (4 to 6 in.) over 75% of the site. Estimated soil overburden is 0.15 m (6 in.) in the asphalted area and 0.45 m (18 in.) in the non-asphalted area.

The principal radioactive contaminants consist of the types of radioactive materials used at the time: plutonium, polonium, uranium, americium, curium, radioactive lanthanum, actinium, and waste products from the water boiler reactor (Meyer 1952). Approximately 90 percent of the waste consisted of radioactively contaminated paper, rags, rubber gloves, glassware, and small metal apparatuses placed in cardboard boxes by the waste originator and sealed with masking tape. The remainder of the material consisted of metal, including air ducts and large metal apparatuses. The latter type of material was placed in wood boxes or wrapped with paper (Meyer 1952). At least one truck, contaminated with fission products from the Trinity test, is believed to be buried in MDA B (DOE 1986).

Initial categorization of MDA B used the inventory reported in a 1971 memorandum from Meyer (Meyer 1971). According to the Meyer inventory, the maximum plutonium-239 inventory in MDA B is 100 g:

"At the time they were in use, Pu was scarce and only that which was present as contamination was buried. I would estimate that the entire pit area contains no more than 100 grams of ^{239}Pu."

According to the report, "Initial Categorization of Environmental Sites in Accordance with 10 CFR 830" (LANL 2003), very little sampling data exists to describe the radioactive material content buried in MDA B. Categorization of MDA B was based on some surface and shallow depth sampling data from areas adjacent to MDA B for strontium-90, cesium-134, thorium-228, and plutonium-239, and on the bounding plutonium-239 quantity referred to in the Meyer memo. Table 1.6-1 presents the radionuclide inventory estimates for MDA B.

Table 1.6-1
MDA B Inventory

Radionuclide	Inventory (Ci)	Inventory (g)
strontium-90	2.85E-01	2.09E-03
cesium-134	5.49E-03	4.26E-06
thorium-228	1.82E-01	2.22E-04
plutonium-239	6.22E+00	1.00E+02

There are some indications hazardous chemicals may be present at MDA B. Drager (1948), commenting on a 1948 fire, reported there was some evidence chemicals had been disposed of in the dump in an unauthorized manner (i.e., in cardboard containers used for the regular disposal of common laboratory waste). In the fire, several cartons of waste caused minor explosions, and on one occasion, a cloud of pink gas arose from the debris in the dump. Documented employee interviews (DOE 1986) stated chemical disposal occurred at the east end of MDA B. Chemicals disposed of included old bottles of organic chemicals, including perchlorate, ethers, and solvents. The 1986 DOE document also stated lecture bottles, mixtures of spent chemicals, old chemicals, and corrosive gases may be at the east end of MDA B (DOE 1986).

Inventory at MDA B exists in slit trenches and pits separated by undisturbed bed rock and covered with fill and/or asphalt, as previously described. Figure 1.6-1 shows the location of MDA B relative to DP Road and area businesses.

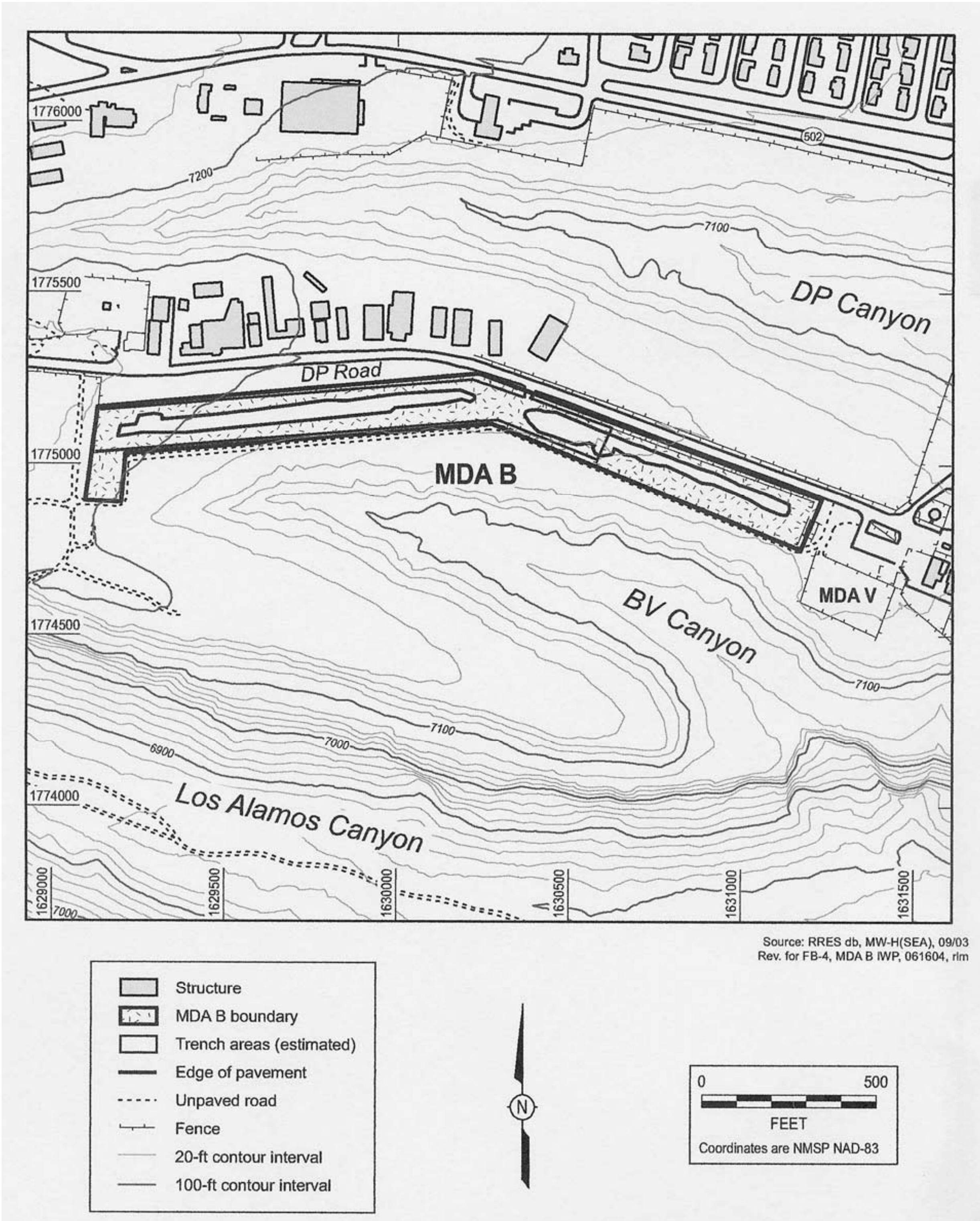


Figure 1.6-1. TA-21 MDA B NES location

1.6.1 Operational History

The "Investigation Work Plan for Material Disposal Area B at Technical Area 21, Solid Waste Management Unit 21-015" (LANL June 2004) provides a historical investigation report for MDA B. According to this report, MDA B received waste from various areas of the Laboratory including the DP Site: DP East and DP West. By the fall of 1944, the LANL Chemistry Division (located at DP West) had developed several separation techniques to recover plutonium from residues. The DP West plutonium purification facility used a separation process based on double plutonium precipitation using trioxalate and plutonyl acetate. Other processing operations produced solutions (from supernatants) containing iron, potassium, sulfates, nitrates, phosphates, chloride, iodine, bromine, and carbon dioxide; all contained traces of plutonium. During the early 1940s, the acceptable discharge concentration for plutonium was 10^{-4} g/L. Noncombustibles as well as halogenated waste solutions containing organic chemicals were treated and extracted to recover plutonium. These recovery efforts generated the bulk of the solid and liquid waste streams, which were either stored or treated before discharge. In addition, solids from incinerator reduction operations were dissolved in nitric and hydrofluorous acids to recover trace amounts of plutonium. Hydrochloric acid was used almost exclusively during 1945 and 1946 for dissolution of plutonium metal, but in 1947, the dissolution was primarily accomplished with hydrogen iodide (Merrill 1990).

Much of the process waste produced at TA-21 between 1945 and 1948 was disposed of at MDA B, but no formal waste inventory was ever maintained. Historical documents and memos suggest that the waste was highly heterogeneous, primarily radioactively contaminated laboratory waste and debris. Limited volumes of liquid waste are believed to have been emplaced in at least one chemical disposal trench at the eastern end of MDA B. Rogers (1977) indicates wastes were emplaced by the truckload in piles filling the entire trench depth and width rather than in vertical layers. The material was subsequently covered weekly with fill dirt using a bulldozer. In addition, no effort was made to keep waste types or loads separate (Meyer 1952). Figure 1.6-1 shows the probable locations of the trenches at MDA B based on historical information and geophysical survey data. The following information published in the TA-21 Resource Conservation and Recovery Act (RCRA) facility investigation (RFI) work plan (LANL June 2004; LANL 1991) summarizes what is known about MDA B operations:

- In 1945, pits at MDA A were being filled at such a rate that additional waste disposal pits were necessary. MDA B was a favorable location because sufficient space was available. It was suggested that a trench 15 ft wide by 300 ft long be dug at the eastern end of MDA B. It was further suggested that the excavation of this waste pit was to be continued until a depth of 12 ft was reached or until September 1, 1945, whichever came sooner. It is not known if the completed pit achieved the dimensions of 15 ft by 300 ft by 12 ft deep or precisely where it was located.
- Other memos indicated there were additional pits. Meyer (1952) said that four pits were dug in MDA B by 1945 and that space was exhausted by 1948. The locations of these pits are not precisely known; however, their dimensions and orientations to fence lines are known. Personal testimony and reference to common Laboratory practice at the time suggested that four disposal pits 300 ft long, 15 ft wide, and 12 ft deep were located parallel to the fence line along DP Road and that two pits of uncertain length were located in the north-south leg of MDA B at the western end of the site (Rogers 1977).
- Several sources indicated that additional trenches for chemical disposal were located at the easternmost part of MDA B. A 1964 memo stated that a covered shallow trench 2 ft wide by 40 ft long by 3 ft deep was located at the extreme eastern end of MDA B. Another source indicated several small slit trenches, 3 to 4 ft deep, 2 ft wide, and less than 40 ft long, were reportedly dug in this area for chemical disposal.

- A fire occurred at MDA B in 1948. The fire was estimated to have lasted two hours, had great intensity, and covered a waste area of 2500 ft^2. The probable cause was spontaneous combustion of mixed chemicals in waste, probably containing plutonium, americium, and fission products. The location of this fire is not well known. Buckland and Enders had different recollections regarding where the fire occurred (Rogers 1978).
- Another disposal site location was selected near Ten Site because of the seriousness of the fire at MDA B and its close proximity to living and working areas (Rogers 1977). After the fire, MDA B was no longer used for contaminated waste disposal. Shortly after MDA B was closed, subsidence occurred. This was remedied by using the area for disposal of uncontaminated concrete and soil from construction sites (Rogers 1977).
- MDA B was probably fenced as early as 1944 as indicated by the Meyer's memo (1952). In 1966, another request was made to replace the then-current fence with an 8-ft chain link fence.
- The western two-thirds of MDA B was fenced and compacted in 1966 and leased by DOE to Los Alamos County for trailer storage. The former location of the storage area is indicated by the paved area. Los Alamos County was asked to vacate use of this site as a trailer storage area by September 30, 1990.
- Surface stabilization of the east-end of MDA B began on July 6, 1982 and was completed by October 15, 1982. The fence was moved outward by 10 ft, surfaces were decontaminated, vegetation was removed, and the area was covered with soil, compacted, and re-seeded. Capping studies were initiated on the east end of MDA B in 1987 to evaluate alternative cover designs.

1.6.2 Current Condition

MDA B can be divided into three main areas:

- the small soil-covered, unpaved area at the extreme western end of MDA B (approximately 32 m/105 ft by 46 m/150 ft);
- the large asphalt-paved area occupying the long western leg and the central portion of the site (approximately 457 m/1500 ft long by 37m/120 ft wide); and
- the unpaved area occupying the eastern leg of MDA B (approximately 183 m/600 ft long by 46m/150 ft wide).

The three areas currently have no surface structures, and the entire site is enclosed by galvanized steel chain link fencing. Vegetation has penetrated through cracks in the asphalt pavement, and trees line a portion of the northern and southern boundary of the site.

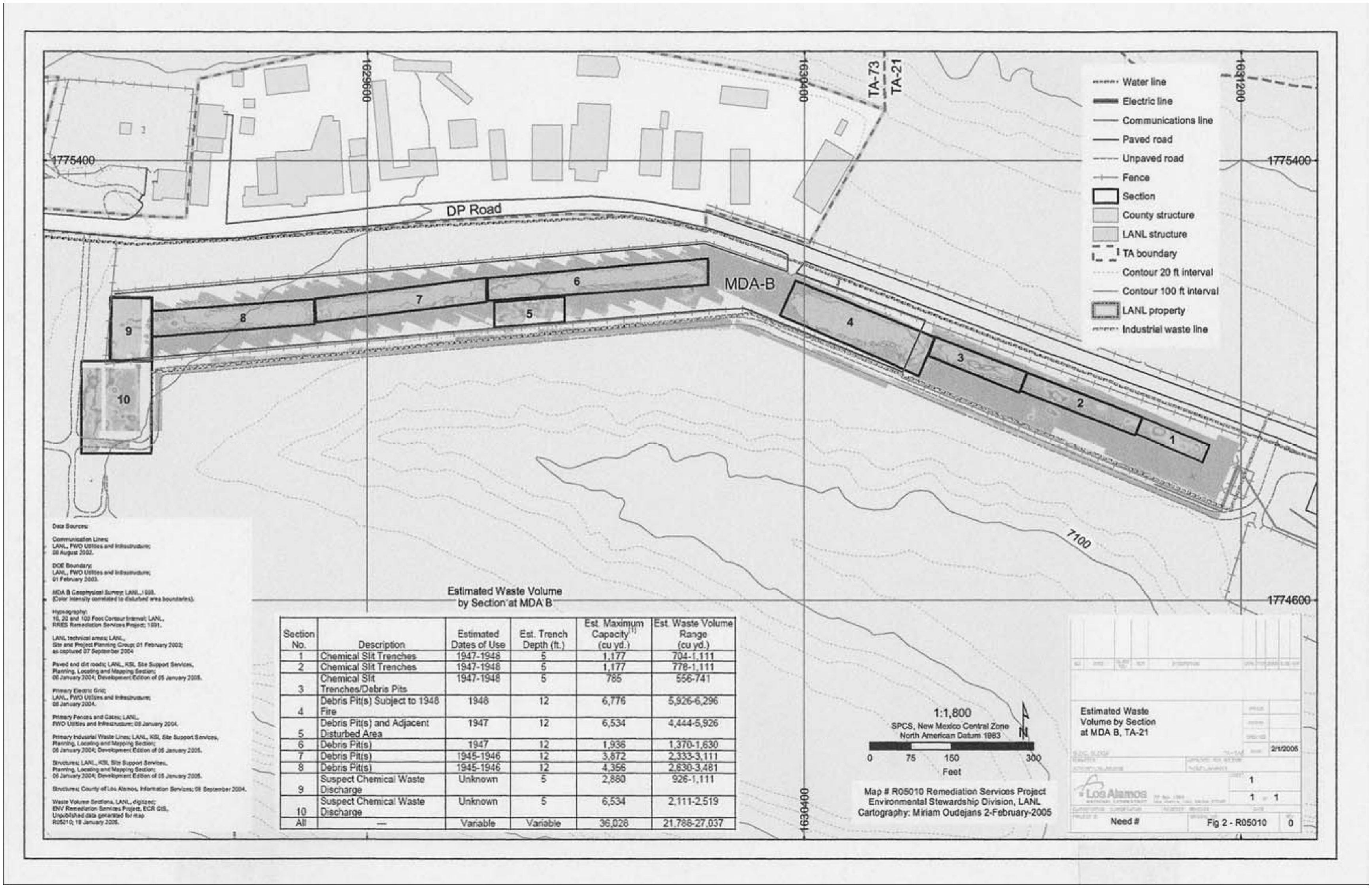
Numerous surface and subsurface environmental investigations have been conducted at and in the vicinity of MDA B beginning in 1966 (LANL June 2004). Early (non-RFI) investigations focused on collecting data to support site stabilization efforts at the disposal area. RFI have focused on defining the nature and extent of contamination migration outside of the disposal trench areas following cessation of waste disposal and subsequent installation of both asphalt and soil covers over the disposal area. The most recent investigation was conducted in 2001. Review of data from the field investigations of MDA B indicates the data were of sufficient quality and quantity to support the following statements:

- Some radionuclides and metals are present at concentrations greater than background values in surface soils along the perimeter of the site in areas not covered by asphalt or the 1982 cover.
- Volatile organic compounds (VOCs) were detected in the subsurface soil pore gas in all seven angled boreholes drilled beneath the disposal area in 1998.
- Tritium, plutonium-239, uranium, and lead are present at concentrations above background values in three of the seven boreholes drilled beneath the disposal area in 1998. (***Note:*** Tritium concentrations are mesa-wide and are the result of atmospheric releases from DP East.)
- Other inorganic compounds were detected above background values.
- The average moisture content in soils beneath the asphalt (10.6 wt%) is elevated compared with the surrounding surface soils (5.1 wt%) and subsurface materials (5.6 wt%).
- Elevated radionuclides, organic chemicals, and inorganic chemicals were detected in some surface soil samples.

Surface releases appear to be related to past disposal operations that distributed primarily isotopic plutonium to the surface soils along the perimeter of MDA B. The cessation of disposal operations and the placement of an interim cover of soil and asphalt have prevented additional releases. Current soil contamination is available for additional migration by wind entrainment and surface water runoff.

A subsurface release to tuff of low concentrations of contaminants is limited in extent. The primary subsurface contaminants are tritium (as noted above) and VOCs in the vapor phase. Additionally, some limited aqueous phase releases occurred based on borehole detections of iso-plutonium. However, the vertical extent of these releases is very limited indicating this release mechanism is minor and not active and the distribution of contamination was the result of disposal practices, which may have included liquid disposal. The sources of subsurface contamination appear to be limited to past disposal practices at the trenches and diffusion of vapor-phase tritium from a DP East atmospheric release and VOCs in low concentration from the disposed waste.

In workshops conducted during 2004, as documented in the “Preliminary Documented Safety Analysis Package for Material Disposal Area B” (LANL October 2004), subject matter experts (SMEs) divided MDA B into 10 sections for investigation. Figure 1.6-2 shows the locations of those 10 sections.



Section No.	Description	Estimated Dates of Use	Est. Trench Depth (ft.)	Est. Maximum Capacity[1] (cu yd.)	Est. Waste Volume Range (cu yd.)
1	Chemical Slit Trenches	1947-1948	5	1,177	704-1,111
2	Chemical Slit Trenches	1947-1948	5	1,177	778-1,111
3	Chemical Slit Trenches/Debris Pits	1947-1948	5	785	556-741
4	Debris Pit(s) Subject to 1948 Fire	1948	12	6,776	5,926-6,296
5	Debris Pit(s) and Adjacent Disturbed Area	1947	12	6,534	4,444-5,926
6	Debris Pit(s)	1947	12	1,936	1,370-1,630
7	Debris Pit(s)	1945-1946	12	3,872	2,333-3,111
8	Debris Pit(s)	1945-1946	12	4,356	2,630-3,481
9	Suspect Chemical Waste Discharge	Unknown	5	2,880	926-1,111
10	Suspect Chemical Waste Discharge	Unknown	5	6,534	2,111-2,519
All	—	Variable	Variable	36,028	21,788-27,037

Figure 1.6-2. MDA B investigative sections

The 1998 TA-21 MDA B geophysical survey locations map (Plot ID: G107140), estimated trench depths, and historical aerial photos were used to estimate the waste volume in each of the 10 sections. Table 1.6-2 provides the results of the waste estimates.

Table 1.6-2
Estimated Waste Volume by Section at MDA B

Section	Description	Estimated Dates of Use	Estimated Trench Depth (ft)	Estimated Maximum Capacity (yd^3)	Estimated Waste Volume Range (yd^3)
1	Chemical slit trenches	1947-1948	5	1177	704–1111
2	Chemical slit trenches	1947-1948	5	1177	778–1111
3	Chemical slit trenches/debris pits	1947-1948	5	785	556–741
4	Debris pit(s) subject to 1948 fire	1948	12	6776	5926–6296
5	Debris pit(s) and adjacent disturbed area	1947	12	6534	4444–5926
6	Debris pit(s)	1947	12	1936	1370–1630
7	Debris pit(s)	1945-1946	12	3872	2333–3111
8	Debris pit(s)	1945-1946	12	4356	2630–3481
9	Suspect chemical waste discharge	unknown	5	2880	926–1111
10	Suspect chemical waste discharge	unknown	5	6534	2111–2519

The following waste types are assumed to make up the waste volume at MDA B:

- industrial waste – debris, clean soil, asphalt, and recycle material;
- low-level radioactive waste (LLRW) – soil, debris, and radioactively contaminated asbestos;
- mixed low-level radioactive waste (MLLRW) – soil, liquids, and debris;
- hazardous waste/RCRA waste – soil, acid carboys, lab packs, lecture bottles, debris, repackaged liquids, gas cylinders, and shock-sensitive containers; and
- Toxic Substances Control Act (TSCA) waste – asbestos-containing material and polychlorinated biphenyls (PCBs).

2.0 PHASES/ACTIVITIES AND TASKS

2.1 Introduction

This section describes comprehensively the broad set of MDA B IRR Program phases/activities and tasks included within the scope of this DSA and required to achieve the following objectives:

- assess nature and extent of hazardous constituents in MDA B,
- assess distribution of waste types,
- assess waste handling and treatability concerns,
- allow for the disposition of high-hazard materials requiring immediate health and safety attention,
- analyze and estimate volumes of differing wastes, and
- select and complete the final remediation alternative.

The descriptions contained in this section are part of the basis for analyzing hazards and, along with other information presented in this DSA, provide sufficient detail for developing the appropriate type, level, and number of controls. Section 2.2 describes the MDA B IRR Program phases and activities.

Completing each MDA B IRR Program phase and activity requires performing tasks. Some tasks are unique to a certain phase/activity, but most tasks will be needed to complete many of the phases and activities. The DSA separates the description of phases and activities from the description of tasks to eliminate the redundancy that would occur if each task were described for multiple phases/activities. Tasks that are unique to a phase or activity are described within that phase/activity. Section 2.3 presents detailed descriptions of the tasks that apply to more than one phase or activity. Table 2.1-1 lists the tasks and the MDA B IRR Program phases and activities to which they may apply.

2.2 Description of Phases/Activities

The MDA B IRR Program is broken into four phases and two ongoing activities:

- Phase 1 – Work Planning
- Phase 2 – Basic Removal, Trenching, and Test Pit Program
    - ♦ Phase 2a – Extended High-Hazard Material Removal
    - ♦ Phase 2b – Extended MDA B Section Removal
- Phase 3 – Evaluation and Alternatives Assessment
- Phase 4 – Implementation of Final Remediation Alternative
    - ♦ Phase 4a – Comprehensive Removal and Restoration
    - ♦ Phase 4b – Removal and Restoration of Selected Sections
    - ♦ Phase 4c – Closure and Stabilization of Site in Existing Condition
- Onsite transportation activities

- Mobile laboratory and Definitive Identification Facility (DIF) activities

Figure 2.2-1 presents a logic flow diagram relating the planned phases of the MDA B IRR Program. Onsite transportation, mobile laboratory, and DIF activities are expected to be ongoing throughout the MDA B IRR Program and are, therefore, not represented in Figure 2.2-1. Figure 2.2-2 depicts the flow of material during the MDA B IRR Program phases and activities.

Table 2.1-1
General Relationship of Tasks to Phases/Activities

TASKS[a]	PHASES/ACTIVITIES									
	Phase 1[b]	Phase 2	Phase 2a	Phase 2b	Phase 3	Phase 4a	Phase 4b	Phase 4c	Onsite Transportation Activities	Mobile Laboratory and DIF Activities
Technical Analyses; Engineering and Design	X				X					
Mobilization		X								
Removal, Sampling, and Staging of Overburden		X	X	X		X	X			
Visual Inspection	X	X	X	X	X	X	X			
Point of Identification Sampling		X	X	X		X	X			
IDLH Screening		X	X	X		X	X			
Removal of Interstitial Soils and Fill		X	X	X		X	X			
Collection of Lab and Analytical Samples		X	X	X		X	X			
Stabilization of Unstable Waste Forms		X	X	X		X	X			
Removal from Trench and Relocation of Waste within Enclosure		X	X	X		X	X			
Packaging/Repackaging of Waste for Transport		X	X	X		X	X			X
Sample Field Screening		X	X	X		X	X			
Implementation of Inventory Tracking System		X	X	X		X	X		X	X
Removal, Storage, Sampling, and Processing of Water from Trench		X	X	X		X	X			
Verification Sampling		X	X	X		X	X			
Removal of Trench Wall and Base Layers		X	X	X		X	X			
Implementation of Stabilization and Surface Water Diversion Measures		X	X	X		X	X			
Implementation of Final Restoration Measures		X	X	X		X	X			
Test Pit Placement and Investigation		X								
Borehole Placement and Investigation		X								
Demobilization		X	X	X		X	X	X		

Table 2.1-1 (continued)

TASKS[a]	PHASES/ACTIVITIES									
	Phase 1[b]	Phase 2	Phase 2a	Phase 2b	Phase 3	Phase 4a	Phase 4b	Phase 4c	Onsite Transportation Activities	Mobile Laboratory and DIF Activities
Preparation and Evaluation of Results and Documents					X					
Vegetation Maintenance	X	X	X	X	X	X	X	X		
Erosion Control and Maintenance Measures	X	X	X	X	X	X	X	X		
Access Control and Maintenance Measures	X	X	X	X	X	X	X	X		
Field Preparation (Re-Mobilization)						X	X			
Placement of Topsoil/Native Seed Mix						X	X	X		
Placement of Additional Barriers, Roads, and Paths						X	X	X		
Loading/Unloading of Onsite Transportation Vehicles[c]									X	
Onsite Transportation[c]									X	
HazCat Screening[c]										X
Radiological Screening[c]										X
Definitive Identification[c]										X
Waste Management		X	X	X		X	X			X
Environmental Monitoring		X	X	X	X	X	X	X	X	X
Temporary Site Stabilization		X	X	X		X	X			
Site Restoration		X	X	X		X	X			

[a] Some tasks may only occur once or twice during the MDA B IRR Program but have the potential to occur during any one of the phases; such tasks are identified for each phase that there is the potential for occurrence (e.g., if Phases 2, 2a, and 2b are all implemented, demobilization will occur only in Phase 2b).

[b] Field activities noted under Phase 1 refer to current S&M activities covered under the scope of the NES S&M DSA, TSR, and SER.

[c] Task is anticipated to be ongoing during most phases but is addressed as a separate activity in this DSA (i.e., as Onsite Transportation or Mobile Laboratory and DIF Activities).

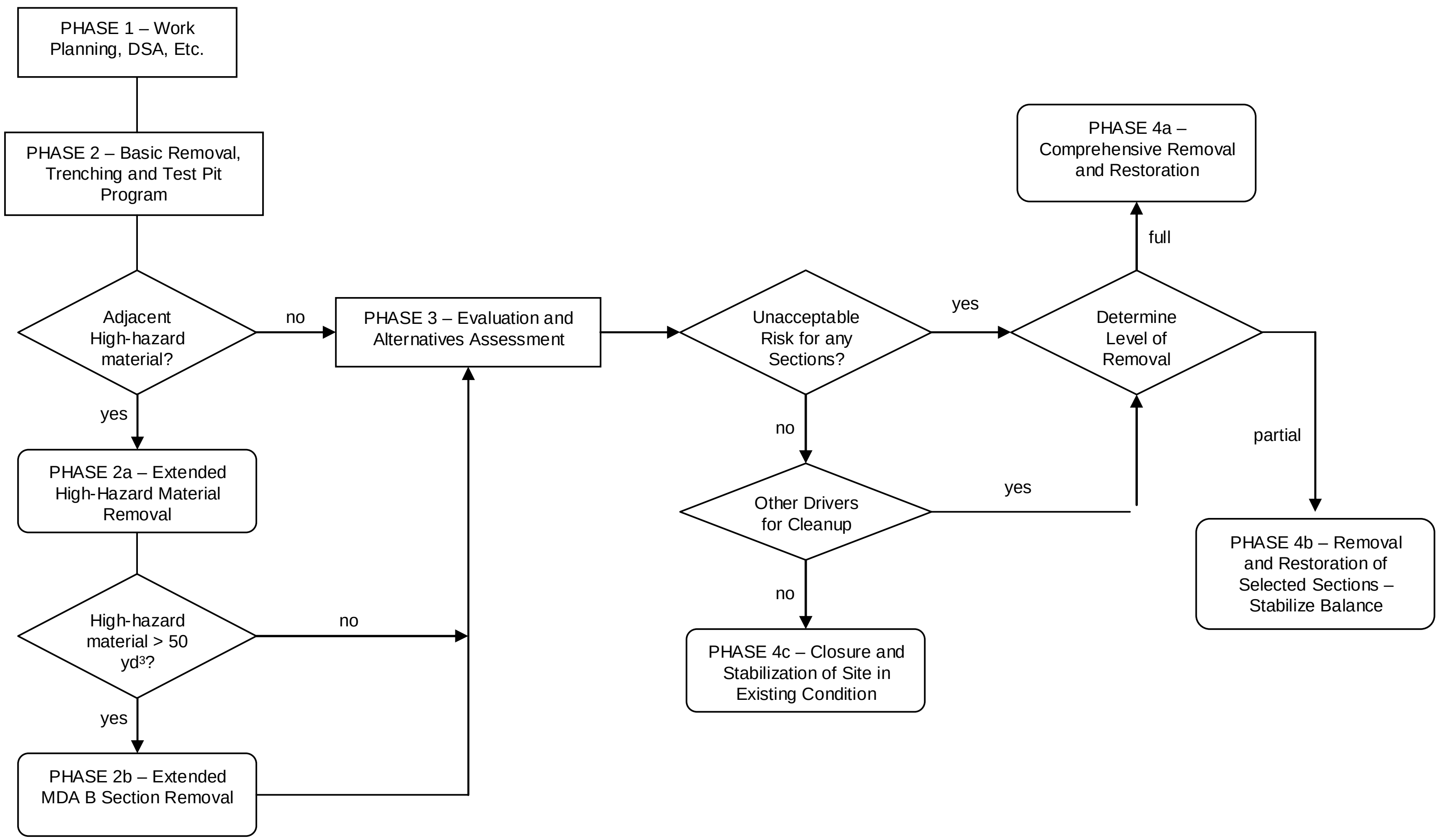


Figure 2.2-1. MDA B IRR Program phases logic flow diagram

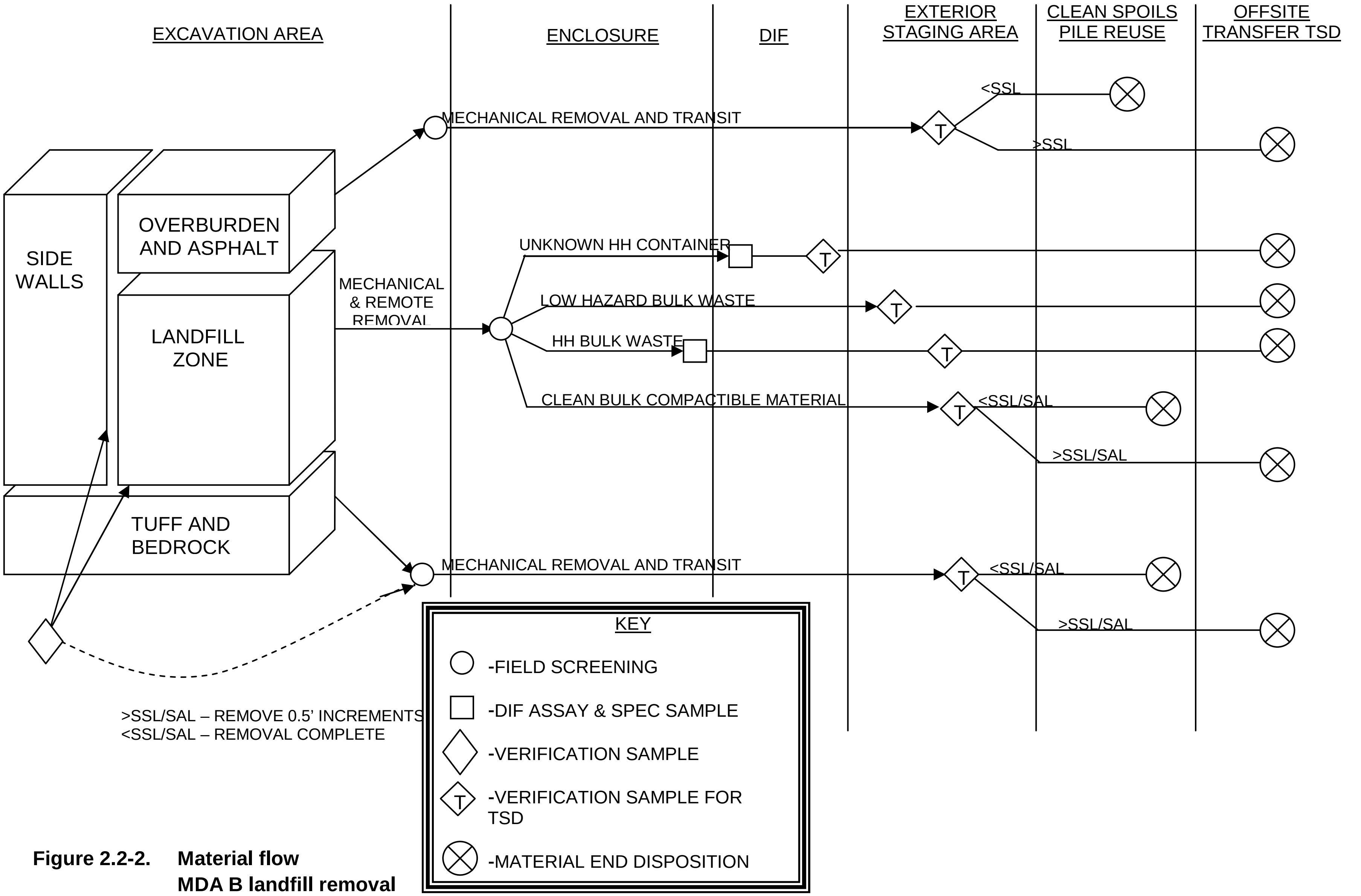


Figure 2.2-2. Material flow MDA B landfill removal

As can be seen in Figure 2.2-1, Phases 2a, 2b, 4a, 4b, and 4c are optional phases and will be performed as determined necessary. Phases 2a and 2b may be implemented at any time during investigative trenching (Phase 2) and may be implemented more than once depending on the trench contents encountered. Phases 2a and 2b also might not be implemented at all. Phase 4a, 4b, or 4c will be chosen to be implemented based on the results of the evaluation and alternatives assessment (Phase 3). (It should be noted that, although the descriptions of the phases are presented in a sequential fashion, the actual implementation of the phases may not proceed in such a sequential fashion. Actual field work will require flexibility in the implementation of phases/activities and tasks.)

The material flow depicted in Figure 2.2-2 will be described further in the phase/activity and task descriptions.

2.2.1 Phase 1: Work Planning

Phase 1 of the MDA B IRR Program is currently in process. Phase 1 includes technical analyses and engineering and design tasks including preparation of planning documents (e.g., this DSA) for all phases of field work. The Trenching Investigation Implementation Plan (TIIP) is one such document and will include

- trench sequencing and technical approach,
- enclosure and work area design,
- a mobilization plan,
- a plan for sample collection and data reporting,
- the waste management plan (WMP),
- a site-specific health and safety plan (SSHASP),
- a National Emission Standards for Hazardous Air Pollutants (NESHAPS) analysis/storm water pollution prevention plan (SWPPP),
- the quality management plan (QMP),
- a temporary elevation and restoration plan (TERP),
- a radiation protection program,
- the borehole drilling program plan and specifications, and
- an emergency response and management plan (ERMP).

A rigorous application of applicable codes, standards, procedural controls, verification activities, documentation requirements, and a formalized maintenance program will be adhered to during work planning and all subsequent phases and activities of the MDA B IRR Program.

2.2.2 Phase 2: Basic Removal, Trenching, and Test Pit Program

Phase 2 will include the execution of an integrated trenching/test pit investigation and high-hazard waste removal program. Investigation observations and sampling results in the trenching will be used to assess the nature and extent of hazardous constituents in MDA B, the distribution of waste types, and waste handling and treatability concerns that may affect the final remediation alternative.

During this phase, high-hazard waste will be removed from the landfill, processed, and prepared for transport for offsite disposal. Approximately 12 trenches and 40 investigative test pits will be placed at representative locations on MDA B sections 1 through 10. Investigations in sections 1 through 3 will be initiated following work in sections 4 through 10. Investigative actions will initiate from uncontaminated areas near the waste trenches. Each investigative trench waste volume to be processed (includes removal of high-hazard waste) will be between an estimated 70 and 300 yd^3, not including overburden and low-hazard wastes, comprised primarily of diffuse material. Additionally, a minimum of two deep boreholes will be placed adjacent to the site (with no disturbance of inventory), with the intent of assessing contaminant migration to the Cerro Toledo interval (a sequence of pumice beds, alluvium, and soils formed between 1.61 and 1.22 million yr ago).

Phase 2 includes

- mobilization,
- trench investigation for MDA B sections 4 through 10,
- trench investigation for MDA B sections 1 through 3,
- test pit placement,
- borehole investigation, and
- demobilization.

Each of these activities is briefly described in the following subsections. Specific tasks associated with these activities are described in further detail in section 2.3.

2.2.2.1 Mobilization

Mobilization will be the start of field work activities at MDA B. Mobilization prepares the site for all IRR Program phases and activities to be performed at MDA B and will include

- modification and/or installation of utilities to support administrative facilities and projected work zones;
- preparation of the lay-down area for all necessary products and equipment and for stockpiling, waste staging, and loading material removed during site work;
- installation and modification of access and haul roads and routes;
- installation of administrative facilities including, but not limited to support trailers, laboratory facilities, laundry, and lavatory;
- installation or creation of site staging and work areas including but not limited to, decontamination pads, waste storage and processing pads, and the DIF;
- installation of the work area enclosure;
- installation and testing of all enclosure, DIF, or other work area safety systems;
- installation of run-on diversion structures to minimize storm water impacts to the site and prevent migration of site contaminants;

- maintenance, enhancement, and repair of all fencing around the MDA B perimeter to ensure site security and access control;
- completion of all pre-fieldwork surveys, including land surveys, radiological surveys, and biological surveys;
- collection of all supplemental background samples for comparison of underlying tuff contaminant concentrations;
- installation of all area and perimeter monitoring systems and equipment; and
- execution of emergency response drills with site personnel.

Near-surface earthwork in the overburden may be performed to prepare the area for placement of the work area enclosure and other structures; however, this disturbance will be limited to an approximate vertical depth of 0.8 m (2.5 ft) from the current grade.

2.2.2.2 Trench Investigation for MDA B Sections 4 through 10

Investigative trenching for MDA B sections 4 through 10 will include approximately eight investigative trench locations. Each trench size will be such that a minimum of 70 yd^3 of material is investigated and 30 ft^2 of tuff area is exposed following processing of trench contents. The investigative trenches will help define the nature of disposal trench contents. This trench investigation will include

- removal of overburden from first trench location to expose contents;
- sampling of overburden;
- staging of overburden for reuse or contaminated disposal, as necessary;
- visual inspection of trench contents;
- point-of-identification sampling;
- removal of interstitial soils and fill material;
- collection of laboratory analytical samples;
- stabilization of unstable waste forms;
- relocation of high-hazard waste to staging areas in the work area enclosure;
- packaging of unknown containers for transport to the DIF;
- sample field screening;
- implementation of the inventory tracking system; and
- removal, storage, sampling, and processing of any water from trenches that is present as the result of run-on or infiltration.

The following will be performed at the completion of Phase 2 (or 2a or 2b if one or both of these phases is used to conclude Phase 2):

- verification sampling of exposed base and wall surfaces;
- iterative removal in 0.5-ft layers of base and wall surfaces until unrestricted release criteria are achieved should initial sample results exceed unrestricted release criteria;
- implementation of stabilization and surface water diversion measures, as well as temporary stabilization requirements while trench is open and awaiting verification sample data; and
- implementation of final restoration measures, including the placement and compaction of backfill to the amount of contaminated material removed from applicable MDA B sections.

Trench investigations will take place within the work area enclosure. Trenching will begin at the eastern edge (farthest from public businesses) of MDA B section 4. The investigative excavations will be advanced through the entire landfill thickness and at least 1 ft into the underlying tuff to expose a full profile of the buried waste. In general, the excavations will be advanced laterally across the entire width of the disposal trenches, where practicable. All high-hazard waste and low-hazard bulk waste non-compactable (LHBWN) will be removed from trenches and subject to offsite treatment, storage, and disposal (TSD) as depicted in Figure 2.2-2; low-hazard bulk waste compactable (LHBWC) will be returned to the trenches following the completion of the trench investigation. Large objects such as vehicle bodies may be exposed for examination but will not be removed from the trench.

2.2.2.3 Trench Investigation for MDA B Sections 1 through 3

Investigative trenching for MDA B sections 1 through 3 will include approximately four investigative trench locations. The process used for this trench investigation will follow the same general approach as for Sections 4 through 10, but will begin with removal of overburden from the first trench location in section 1.

2.2.2.4 Test Pit Placement

The test pit investigation will consist of approximately 40 test pits placed with an estimated distribution of 20 test pits for the western end, 15 test pits for the eastern end, and five test pits for the far western area of MDA B. A test pit is a limited-area investigation method that will be used to obtain visual information and in-situ radiological and chemical screening data for near-surface MDA B contents.

Test pits will be excavated between the planned investigative trench locations within the work area enclosure. The test pits will provide targeted supplemental characterization data and an additional means of characterizing and estimating quantities of waste without sampling or necessarily digging to the bottom of the waste zone. Test pit investigations will rely primarily on visual observation and immediately dangerous to life and health (IDLH) screening rather than sampling, because they are intended to be quick, flexible, and less complex than the investigative trenches. Additional characterization of landfill contents, soil, and tuff encountered in the test pits may be performed as conditions warrant. This may include sampling, hazard characterization (HazCat) screening, definitive identification of chemicals and materials, and chemical bottle removal. Test pit placement will include

- sampling of overburden;
- staging of overburden for reuse or contaminated disposal, as necessary;
- visual inspection of trench contents; and

- point-of-identification sampling.

The locations and depths of the test pits will be determined in the field based on the findings in the investigative trenches and other test pits. No waste processing or removal is planned for the test pits; however, material that may result in serious health consequences or material that is in an unstable condition will be removed following DOE authorization. Overburden removed from the test pits will be stockpiled within the work area enclosure and covered with plastic sheeting. Overburden will be processed and prepared for transport for offsite disposal or reuse as clean fill. Test pits will be covered immediately following investigation by the placement and compaction of soil backfill.

2.2.2.5 Borehole Investigation

Following the completion of the trenching and test pit investigations of Phase 2 (or 2a or 2b if one or both of these phases is used to conclude Phase 2), a minimum of two deep boreholes will be placed adjacent to the MDA B site, with the intent of assessing contaminant migration to the Cerro Toledo interval. Boreholes will be completed with a steel surface casing set to approximately 10 ft below ground surface and 3 ft above ground. Samples and core will be continuously collected and geologically logged from these vertical deep boreholes extending to the base of the Cerro Toledo interval (approximately 365 ft). Boreholes will either be completed as monitoring wells, as determined by contaminant profile and water zones, or abandoned. Upon completion and nominally 30 days later, each borehole will be monitored for pore-gas vapor, using a packer assembly, for VOCs and tritium analyses. A rotating, hollow-stem auger will be used to drill the boreholes. Geophysical logging of boreholes will include caliper, neutron, natural gamma, and optical imaging.

2.2.2.6 Demobilization

Demobilization will take place at the conclusion of Phase 2 (or 2a or 2b if one or both of these phases is used to conclude Phase 2). At this point in the MDA B IRR Program, demobilization will be used to prepare the site and structures for interim S&M. (***Note:*** It may be possible to assess the alternatives before all trench investigations are concluded and proceed to Phase 4a, 4b, or 4c without demobilizing.)

2.2.3 Phase 2a (Optional): Extended High-Hazard Material Removal

To effectively reduce the potential hazards as encountered in investigative trenches, it may be necessary to remove additional high-hazard wastes outside of the planned trench volume. Phase 2a will include the removal of high-hazard wastes adjacent to investigative trenches placed in sections 4 through 10 and in sections 1 through 3, if deemed necessary. This type of removal action will continue to a maximum of 50 yd^3 additional high-hazard wastes generated per trench (600 yd^3 maximum), as required. Should field observations indicate volumes of material beyond this criterion, the investigative trench will be safely secured, and subject to an interim evaluation for further removal as defined by Phase 2b.

Implementation of Phase 2a will abide by the following criteria:

- Adjacent high-hazard material will be removed in association with basic trench contents removal; no project shutdown is anticipated.
- Adjacent high-hazard material may be located within disposal trench boundaries, through walls adjacent to investigative trenches, and below disposal trench boundaries.
- High-hazard materials contiguous to planned investigative trenches (as found in the field) are subject to removal under this option; high-hazard materials identified with investigative test pits will not be subject to removal under this phase.

The process used for extended high-hazard material removal will follow the same general approach as for the trench investigation (section 2.2.2.2). Only high-hazard material will be removed during this phase; all LHBWN and LHBWC will be returned to the investigative trenches.

2.2.4 Phase 2b (Optional): Extended MDA B Section Removal

In the event execution of Phases 2 and 2a do not adequately remove high-hazard wastes encountered or other low-hazard materials deemed by DOE and LANL to warrant removal, Phase 2b may be applied to selectively and immediately remove entire sections of MDA B based on their hazard potential, prior to demobilization of the trenching program. In the event such removals are necessary, the sections of highest hazard will be identified, and approximately 11,000 yd^3 of waste will be removed.

Implementation of Phase 2b will abide by the following criteria:

- Extended section removal (up to two of the 10 sections) may be applied by LANL and DOE if, during investigative trenching activities, entire sections of MDA B are determined by DOE to pose a risk to the public such that immediate removal and processing of contents is required.
- Implementation of Phase 2b activities will require complete exhumation of designated MDA B section contents, to approximately 11,000 yd^3.

The process used for extended MDA B section removal will follow the same general approach as for the trench investigation (section 2.2.2.2) and will include low-hazard material as well as high-hazard material removal. All material, regardless of waste type, will be removed from selected MDA B sections as determined by LANL and DOE, and processed and prepared for transport for offsite disposal or reuse as clean fill as depicted in Figure 2.2-2.

2.2.5 Phase 3: Evaluation and Alternatives Assessment

Phase 3 will involve the evaluation of trenching investigation results and reporting documents leading to the preparation of revised safety basis materials, lessons learned analyses, trench investigation reports, and remedial alternatives assessment. It is anticipated that the alternatives evaluation process will lead to one of the final remediation and restoration options described in Phases 4a through 4c. Phase 3 may also require the preparation of revised operational readiness review documentation prior to Phase 4 field activities. During this phase, MDA B will be in an interim S&M mode.

Interim S&M of MDA B will commence following demobilization at the conclusion of Phase 2 (or 2a or 2b if one or both of these phases is used to conclude Phase 2). Interim S&M will include activities designed to maintain waste-isolation characteristics and identify any changes in the physical setting that could significantly affect waste-isolation characteristics. Interim S&M will ensure that cover material is sufficient and is not altered or modified such that the potential for release of materials that could impact the public, workers, or the environment is increased. Interim S&M activities may include

- vegetation maintenance,
- erosion control and cover maintenance,
- sampling and surveying,
- geological mapping, and
- visual inspections.

2.2.6 Phase 4a (Optional): Comprehensive Removal and Restoration

Phase 4a will include the comprehensive removal and restoration of the balance of MDA B, should this alternative be chosen. A comprehensive removal will include the removal and processing of all trench contents for appropriate offsite waste treatment and disposal, removal of contaminated tuff underlying the excavated disposal trenches to approximately 12 ft below grade, backfill, and restoration of the entire site. At the end of comprehensive removal, site data will be evaluated to ensure that any remaining contamination poses no unacceptable risk under an industrial land use scenario.

The process used for extended MDA B section removal will follow the same general approach as for the trench investigation (section 2.2.2.2) and will include low-hazard material as well as high-hazard material removal. Total waste volume to be removed in this phase has been estimated to be 24,000 yd^3. Phase 4a will also include

- field preparation and readiness review;
- removal of all material, regardless of waste type, from MDA B sections as determined by LANL and DOE, and processed and prepared for transport for offsite disposal or reuse as clean fill;
- verification sampling of exposed base and wall surfaces;
- iterative removal in 0.5-ft layers of base and wall surfaces until unrestricted release criteria are achieved should initial sample results exceed unrestricted release criteria;
- implementation of stabilization and surface water diversion measures, as well as temporary stabilization requirements while trench is open and awaiting verification sample data;
- implementation of final restoration measures, including the placement and compaction of backfill to the amount of contaminated material removed from applicable MDA B sections;
- placement of topsoil/native seed mix; and
- placement of additional barriers, roads, and paths, as determined necessary.

2.2.7 Phase 4b (Optional): Removal and Restoration of Selected Sections

Phase 4b will include the partial removal and restoration of selected sections of MDA B, should this alternative be chosen. Remediation and removal activities will be determined based on outcomes of alternatives analyses and other investigation findings, as well as the needs of and potential impacts to the neighboring community as determined by DOE. The selection of this phase will require the removal of selected MDA B sections, side walls, and underlying tuff to approximately 12 ft below grade. Upon full remediation of selected section contents and underlying contaminated tuff, site restoration will occur. Following partial removal activities, the site may retain some level of institutional control.

The process used for extended MDA B section removal will follow the same general approach as for the trench investigation (section 2.2.2.2) and will include low-hazard material as well as high-hazard material removal. The total waste volume to be removed in this phase is estimated to be 11,000 yd^3. Phase 4b will also include

- field preparation and readiness review;
- removal of all material, regardless of waste type, from MDA B sections as determined by LANL and DOE, and processed and prepared for transport for offsite disposal or reuse as clean fill;

- verification sampling of exposed base and wall surfaces;
- iterative removal in 0.5-ft layers of base and wall surfaces until unrestricted release criteria are achieved should initial sample results exceed unrestricted release criteria;
- implementation of stabilization and surface water diversion measures, as well as temporary stabilization requirements while trench is open and awaiting verification sample data;
- implementation of final restoration measures, including the placement and compaction of backfill to the amount of contaminated material removed from applicable MDA B sections;
- placement of topsoil/native seed mix; and
- placement of additional barriers, roads, and paths, as determined necessary.

2.2.8 Phase 4c (Optional): Closure and Stabilization of Site in Existing Condition

Should this alternative be chosen, Phase 4c will include the closure and stabilization of MDA B in its existing condition following Phase 2 (or 2a or 2b if one or both of these phases is used to conclude Phase 2). Should the evaluation and alternatives assessment of Phase 3 indicate that remaining materials at MDA B are acceptable in place, this phase will involve the restoration of investigative trench areas and the balance of the site. MDA B will retain some level of institutional control following the completion of this phase. Phase 4c includes placement of topsoil/native seed mix and placement of additional barriers, roads, and paths, as determined necessary.

This DSA assumes that all investigative trenches and test pits will have been backfilled and stabilized prior to Phase 4c activities.

2.2.9 Onsite Transportation

MDA B onsite transportation activities include the transport of hazardous material containers and samples between the work area enclosure, DIF, mobile laboratories, and any other onsite facility. Onsite transportation of hazardous materials/substances may be conducted using LANL or contractor vehicles or equipment.

Additionally, the necessary movement (i.e., without hazardous materials onboard) of any LANL or contractor vehicles or equipment onsite, but exterior to the work area enclosure and other MDA B facilities, is also included in onsite transportation activities. Transfer of hazardous material from MDA B to an offsite location is not included within the scope of this DSA.

2.2.10 Mobile Laboratory and DIF Activities

MDA B will be equipped with mobile laboratories as well as the DIF. The mobile laboratories will be used for HazCat screening and screening for radiological components. The DIF will be utilized if the results from IDLH and HazCat screening are inconclusive or if further characterization or quantification is necessary for waste profiling or characterization.

2.3 Description of Tasks

Some tasks are unique to a certain phase/activity, but most tasks will be needed to complete many of the phases and activities. Tasks that are unique to a phase or activity are described within that phase/activity. This section presents the detailed descriptions of the tasks that apply to more than one phase/activity.

2.3.1 Removal, Sampling, and Staging of Overburden

Overburden may consist of soils of varying composition, asphalt, gravel, or concrete. Overburden will be removed, sampled, and staged for reuse or contaminated disposal as necessary. Removal of overburden will be completed using an excavator to carefully expose and remove landfill contents for inspection and identification. Overburden removed from the trenches will be stockpiled inside the work area enclosure and covered with plastic sheeting.

Overburden will be sampled to identify potential contaminants of concern, radionuclides, and matrix or waste type. Samples will be identified for field screening or verification sampling.

The contractor chosen to perform the tasks identified by this DSA will specify the exact methods by which overburden will be removed and sampled, and the location of staging areas.

2.3.2 Visual Inspection

Field personnel will conduct visual inspections of trench contents continuously during the removal of overburden and contents from the trench. Visual inspection allows for the determination of additional sampling needs or precautionary measures. Personnel may conduct visual inspections using a camera mounted on the excavator and a closed-circuit television system (CCTV).

During interim S&M, visual inspection activities to assess MDA B security and physical surface characteristics will include patrolling and visually observing MDA B and performing other assessments that use information gathered by visual observation. Personnel will perform inspections and security patrols regularly. Personnel will also perform security or other visual inspections in response to non-routine natural phenomena, such as heavy rains and lightning, and to events such as traffic accidents or reported unusual or suspicious activities. Inspections may also be performed during other MDA B IRR Program phases and activities. Information gathered during inspections and patrols will be used to evaluate MDA B features and surface expressions, assess changes in the physical attributes of MDA B, and assess physical damage such as corrosion, erosion, collapse, settlement, or animal burrowing. Visual inspections will also include inspecting existing structures and fences to determine their integrity.

The contractor chosen to perform the tasks identified by this DSA will specify the exact procedures and goals for visual inspection.

2.3.3 Point-of-Identification Sampling

The contractor chosen to perform the tasks identified by this DSA will specify the exact procedures for point-of-identification sampling.

2.3.4 IDLH Screening

Field personnel will continuously monitor IDLH conditions during investigative trenching and removal of trench contents. The principle IDLH constituents are radiation (gross alpha, beta, gamma), VOCs, combustible gases, and pyrophoric materials.

Several IDLH screening tools will be used for health and safety monitoring. Radiological monitoring equipment will include a gamma dose rate meter (ion chamber), sodium iodide detector, a neutron dose rate meter, and a continuous air monitoring (CAM) instrument. VOCs will be screened for using a flame ionization detector (FID)/photoionization detector (PID). Gases will be screened for using Drager tubes for acid gases, basic gases, carbon monoxide, hydrocyanic acid, nitrous gases, and others as appropriate. Combustible gases will be screened for using a multigas detector if voids within the disposal area are present. Field personnel will regularly monitor the heat of investigative trench contents using a handheld infrared thermometer. The infrared thermometer will also help monitor for pyrophoric materials.

Health and safety requirements may preclude personnel entry into the excavations; it may be necessary to equip the end of the boom of the excavator with a camera or continuous monitoring tools. Remote sensing instruments may also be used to monitor conditions and identify materials in the open excavation that could pose an immediate threat to site personnel.

The contractor chosen to perform the tasks identified by this DSA will specify the exact methods and equipment to be used for IDLH screening.

2.3.5 Removal of Interstitial Soils and Fill

Field personnel will iteratively remove interstitial soils and fill to carefully expose landfill contents for inspection and identification. Vacuum excavation methods may be used in some areas such as the chemical disposal trenches to carefully remove soil and fill from around containers and prevent breakage. Remote excavation methods may also be employed.

The contractor chosen to perform the tasks identified by this DSA will specify the exact methods by which soils and fill will be removed and the equipment to be used.

2.3.6 Collection of Lab and Analytical Samples

Sample analyses will include all analytes required by the New Mexico Environment Department (NMED) Order (NMED 2005). VOCs, semivolatile organic compounds (SVOCs), radionuclides, target analyte list (TAL) metals, PCBs, pH, high explosives (HE), dioxins, furans, nitrates, perchlorate, and cyanide will be included in sample analyses. Since no record of HE production or HE usage at TA-21 has been found, the Laboratory’s approach will use field screening for HE to determine if HE needs to be analyzed for in the MDA B disposal trenches.

The contractor chosen to perform the tasks identified by this DSA will specify the exact methods and equipment to be used for the collection of lab and analytical samples.

2.3.7 Stabilization of Unstable Waste Forms

The contractor chosen to perform the tasks identified by this DSA will specify the exact procedures for stabilization of unstable waste forms.

2.3.8 Removal from Trench and Relocation of Waste within Enclosure

The contractor chosen to perform the tasks identified by this DSA will specify the exact methods for removing waste from trenches and relocation within the enclosure (including a layout of the enclosure).

2.3.9 Packaging/Repackaging of Waste for Transport

Field personnel will appropriately containerize for offsite disposal those waste materials excavated from MDA B and not returned to the excavation. Waste packaging will be performed within the work area enclosure. Waste will be repackaged or overpacked in U.S. Department of Transportation (DOT) compliant packaging and will be in compliance with treatment, storage, and disposal facility (TSDF) waste acceptance criteria (WAC). Waste packaging may include supersacks, B-25 boxes, and stainless steel 55-gallon drums.

The contractor chosen to perform the tasks identified by this DSA will specify the exact methods and criteria for how waste is packaged/repackaged and types of packaging to be used.

2.3.10 Sample Field Screening

Sample field screening includes, but is not limited to the use of HazCat kit analyses, x-ray fluorescence (XRF), direct reading radiation detection instrumentation used on debris and objects, portable gas chromatograph, gross alpha and beta-gamma counting of soil and debris samples, portable gamma spectroscopy, and liquid scintillation counting. Sample field screening will take place within the work area enclosure, the DIF, or a mobile laboratory, depending upon the screening method used.

The contractor chosen to perform the tasks identified by this DSA will specify the exact methods and criteria for performing sample field screening (e.g., when will this be done).

2.3.11 Implementation of Inventory Tracking System

The inventory of excavated materials will be recorded in an electronic database developed specifically for MDA B data collection requirements and will be populated with data from each step in the investigatory activities. The database will contain fields for capturing

- type, location, and volume of excavated materials;
- physical descriptions, IDLH screening results, and initial hazard classification;
- HazCat screening results and hazard categorization;
- definitive identification screening results;
- waste volume, compositing, packaging, storage, and shipping details;
- sample collection, analyses, and tracking records for excavated materials and in-situ soil and tuff samples;
- descriptions, volumes, and sample results of excavated materials redeposited into the investigative trenches;
- geodetic survey data for locations of key features in the excavations, such as disposal trench geometry, disposal trench contents, and sampling locations; and
- excavation backfill volumes and analytical data for both clean or returned waste.

2.3.12 Removal, Storage, Sampling, and Processing of Water from Trench

Water present in the trenches as a result of run-on or infiltration will be removed from the trench and stored, sampled, and processed for disposal.

The contractor chosen to perform the tasks identified by this DSA will specify the exact methods and equipment used for the removal, storage, sampling, and processing of water.

2.3.13 Verification Sampling

Field personnel will collect verification samples of exposed walls and bottoms of trenches during Phase 2 and 2a (if applicable). Samples related to major excavations resulting in a final objective of demonstrating compliance with unrestricted release criteria are anticipated following Phases 2b, 4a, and 4b activities.

During Phase 2 and 2a (if applicable) activities, verification sampling will be performed for the exposed, underlying tuff/bedrock zone, adjacent walls, and for bulk materials returned to the excavation. As a standard practice, verification samples will also be collected of any stained soil or native material beneath removed waste.

For MDA B sections or portions thereof subject to full removal/corrective action (Phase 2b, 4a, or 4b), verification sampling will be instituted on side walls and exposed bottom surfaces. The frequency and distribution of verification samples will be determined by LANL. Field personnel will collect verification samples on 0.5-ft increments from the initial grade of the exposed tuff/bedrock to a minimum of one foot beyond the layer exhibiting concentrations that do not exceed the unrestricted release criteria.

The excavator bucket will be used to obtain verification samples from the trenches. Once material is brought to the surface, samples will be collected using a spade and scoop method. Care will be taken to prevent cross-contamination by collecting material not in direct contact with the excavator bucket.

All verification samples will be field screened for gross alpha, beta, and gamma, and submitted to the Sample Management Operation at LANL for transportation to the appropriate analytical laboratory. Verification samples will be analyzed for chemical and radiological compounds. Analytes will include TAL metals, radionuclides analyzed by gamma spectroscopy, isotopic uranium, isotopic plutonium, tritium, strontium-90, VOCs, SVOCs, dioxins/furans, PCBs, perchlorate/nitrate, and cyanide.

The contractor chosen to perform the tasks identified by this DSA will specify the exact methods and equipment for verification sampling.

2.3.14 Removal of Wall and Base Layers

Field personnel will remove the wall and base surfaces iteratively in 0.5-ft layers until unrestricted release criteria are achieved should initial sample results exceed unrestricted release criteria. Extended limits of excavation are applicable to Phase 2b, 4a, or 4b. All iterative removal of contaminated layers will be ceased at a maximum depth of 12 ft below the top grade of the trench as surveyed following overburden removal. It is anticipated that this constraint will limit the complexity of excavation and result in the removal of all fill material to the bedrock/tuff layer. If tuff/bedrock is not encountered within this 12-ft interval (only trench contents and disturbed fill), the excavation will be temporarily stabilized and the excavation measures will be redefined.

The contractor chosen to perform the tasks identified by this DSA will specify the exact methods and equipment used to accomplish the removal of wall and base layers.

2.3.15 Implementation of Stabilization and Surface Water Diversion Measures

The contractor chosen to perform the tasks identified by this DSA will specify the exact methods and equipment used to implement stabilization and surface water diversion measures.

2.3.16 Implementation of Final Restoration Measures

Field personnel will backfill trenches and test pits, compact them, and place clean soil cover material over the impacted area. Excavations extending beyond the limits of the disposal trenches will be backfilled with clean fill material only. The clean fill material will be shipped from offsite. Removed asphalt will be segregated from other cover material and stockpiled for disposal. It will not be replaced or used as fill. The cover thickness and composition will be consistent with the existing landfill cover material.

If it is deemed necessary to preserve access to trench bottom sample locations for future drilling activities, a steel conductor casing will be installed at each of the sample locations. If steel casing is installed to preserve access to investigative trench bottom sample locations, it will be inspected by a driller to ensure the feasibility of future drilling access.

Equipment that may be used to implement final restoration measures includes excavator(s), loader(s), fuel/oil/grease truck(s), dump truck(s), dozer(s), compactor(s), pick-up truck(s), and fuel truck(s).

The contractor chosen to perform the tasks identified by this DSA will specify the exact methods and equipment to be used for final restoration.

2.3.17 Demobilization

Demobilization will occur prior to interim S&M activities (Phase 3) and will include

- stabilization of overburden, soil storage piles, and work areas;
- confirmation that site perimeter fencing and gates are not damaged and functional;
- decontamination of equipment;
- containment of all decontamination fluids and water for verification sample collection and analysis;
- processing of all decontamination and water for unrestricted discharge according to notice of intent to discharge, or hazardous/radioactive disposal;
- removal of temporary facilities and utility hookups that are unlikely to be used in future remediation and redevelopment activities;
- demolition of an existing overhead power line and installation of a new overhead power line;
- removal of support and heavy equipment not anticipated to be reused within three months; and
- dismantling of the work area enclosure, securement in a shut-down condition at the final trench location (including shutdown or securement of safety and auxiliary systems), or relocation of the work area enclosure for storage offsite.

Final demobilization will occur following Phase 4a, 4b, or 4c, depending on which phase is chosen as the final remediation alternative. Final demobilization will include all of the elements described above, as well as the complete removal of all facilities and equipment. MDA B will be left in a condition conducive to industrial reuse standards or some level of institutional control, depending upon the final remediation alternative chosen.

A decontamination station with a containment dike will be constructed for the purposes of decontaminating the equipment. A pressure washer, tanker truck, and pickup will be used for decontaminating the equipment. Other equipment to be used during demobilization will include excavator(s), loader(s), dozer(s), compactor(s), dump truck(s), crane with 60-ft boom, bucket truck with cable tensioning reel, and fuel/oil/grease truck(s).

The contractor chosen to perform the tasks identified by this DSA will specify the exact methods and equipment to be used for demobilization.

2.3.18 Vegetation Maintenance

MDA B vegetation may require maintenance. This activity will involve tasks such as mowing, clearing brush, removing debris, and removing trees to maintain site surface characteristics and to limit combustible materials. If trees require removal, they will be cut and the stump will be ground down to grade level. While vegetation maintenance is identified specifically in section 2.2 for interim S&M (Phase 3), vegetation maintenance is expected to be ongoing during much of the MDA B IRR Program, particularly during mobilization (Phase 2).

The contractor chosen to perform the tasks identified by this DSA will specify the exact methods and equipment to be used for vegetation maintenance.

2.3.19 Erosion Control and Maintenance

Erosion control and maintenance includes maintaining the surface and near-surface soil, overburden, and cap layers that isolate the MDA B contents from the near-surface environment. Erosion control and maintenance may also include implementing and maintaining additional erosion controls and water diversions to prevent surface water from transferring potential radiological and chemical contamination at the surface into or away from the MDA B site or from eroding cover materials. Cover augmentation or other small repairs in response to erosion or biological actions, such as burrows, will be completed as necessary. Erosion control and maintenance may involve light site preparation and addition and compaction of clean fill material in areas where the cover is thin or as a preventive measure to ensure the cover is not thinned by erosion.

The contractor chosen to perform the tasks identified by this DSA will specify the exact methods and equipment to be used for erosion control and maintenance.

2.3.20 Access Control and Maintenance

Access control and maintenance includes the repair and upkeep of roads, parking and storage areas, and walkways; filling of potholes and other areas that require minor repair; and the maintenance of drainages, road barriers, and rights-of-way. Access control and maintenance also include visual inspection, replacement of damaged or poorly visible signage, and repair of fencing and posts.

Removal of snow, mud, and other debris may be necessary to keep access areas clear and can entail the use of graders, front-end loaders, bobcats, or other heavy equipment. Repairing fences and installing signage can involve minor site preparation, such as light scraping and removal of vegetation, and can include digging holes, placing concrete, setting posts, and using a “come along” or other suitable light equipment to stretch fencing materials.

While access control and maintenance measures are identified specifically in section 2.2 for interim S&M (Phase 3), this task is expected to be ongoing during much of the MDA B IRR Program.

The contractor chosen to perform the tasks identified by this DSA will specify the exact methods and equipment to be used for access control and maintenance.

2.3.21 Field Preparation (Re-Mobilization)

Prior to the implementation of Phase 4a or 4b, should one of these two phases be chosen as the final remediation alternative, MDA B will require field preparation or re-mobilization.

The contractor chosen to perform the tasks identified by this DSA will specify the exact methods and equipment to be used for re-mobilization.

2.3.22 Placement of Topsoil/Native Seed Mix

Field personnel will restore all impacted surfaces to original grade, reseed, fertilize, and apply a straw mulch to help stabilize the surface. Additionally, existing roadways will be repaved. Equipment that will be used includes excavator(s), loader(s), fuel/oil/grease truck(s), dump truck(s), dozer(s), pickup truck(s), fuel truck(s), hydro-seeder(s), flatbed truck(s), asphalt paving machine(s), and smooth drum roller(s).

The contractor chosen to perform the tasks identified by this DSA will specify the exact methods and equipment to be used for placement of topsoil/native seed mix.

2.3.23 Placement of Additional Barriers, Roads, and Paths

The contractor chosen to perform the tasks identified by this DSA will specify the exact methods and equipment to be used for the placement of additional barriers, roads, and paths.

2.3.24 Loading/Unloading of Onsite Transportation Vehicles

The contractor chosen to perform the tasks identified by this DSA will specify the exact methods and equipment to be used for loading/unloading of transportation vehicles.

2.3.25 Onsite Transportation

The contractor chosen to perform the tasks identified by this DSA will specify the specific requirements for onsite transportation (e.g., speed limit).

2.3.26 Hazard Characterization Screening

The HazCat screening process will provide the basic information needed for segregating waste materials by physical form (solid, liquid, or gas) and hazard class (radioactive, reactive, corrosive, or flammable). This screening will also ensure the safe segregation and compatibility of materials in waste staging areas.

HazCat screening will use representative samples of the waste materials from MDA B to perform a battery of qualitative and quantitative analytical tests to rapidly identify primary physical, radiological, and chemical hazards. Based on the historic information available about MDA B, the primary hazard characteristics for rapid identification will be radioactivity, flammability, corrosivity, oxidation potential, physical properties, and reactivity with air and water. To perform HazCat screening, field personnel will use a combination of American Society for Testing and Materials (ASTM) and LANL Environmental Restoration (ER) standard operating procedure (SOP) methods. These include (in order of performance)

- field monitoring for surface and volume radioactivity levels using a rad meter inside a fume hood;
- physical description screening analysis in waste (color, turbidity, viscosity, physical state, layering, and incidental odor) using physical observations on a bench-top lab with a fume hood;
- compatibility of screening analysis of waste (Test Method C – water compatibility) using a bench-top lab with a fume hood;
- screening of pH in waste using indicator paper and/or a pH meter inside a bench-top lab with a fume hood;

- standard test methods for screening of reactive sulfides in waste using indicator paper inside a fume hood;
- flammability potential screening analysis using an open flame inside a fume hood;
- screening of oxidizers in waste using indicator paper inside a bench-top lab with a fume hood;
- screening test method for screening apparent specific gravity and bulk density of waste using physical observation and/or a hydrometer and/or a pycnometer inside a fume hood;
- compatibility of screening analysis of waste (Test Method A – commingled waste compatibility test method) using a thermometer and physical observation inside a fume hood; and
- screening of PCBs in soil (only performed on oily or suspect PCB-contaminated waste materials) using immunoassay inside a fume hood.

The contractor chosen to perform the tasks identified by this DSA will specify the exact methods and equipment to be used for HazCat screening.

2.3.27 Radiological Screening

Field personnel will conduct screening for radiological components within a mobile laboratory. The mobile laboratory will have the capability for gamma spectroscopy, low background alpha/beta counting, and alpha spectroscopy. These screening capabilities will be flexible to account for other materials recovered from the investigative trenches.

The contractor chosen to perform the tasks identified by this DSA will specify the exact methods and equipment to be used for radiological screening.

2.3.28 Definitive Identification

Field personnel will institute controlled characterization and/or stabilization of materials removed from trenches/enclosure work areas within the DIF. Definitive identification screening of investigative trench contents will be implemented if the results from IDLH and HazCat screening are inconclusive or if further characterization or quantification is necessary for waste profiling or characterization. Advanced screening may also be necessary to ensure the positive identification of chemicals and substances to ensure safe handling. The DIF will be equipped with portable analytical instruments, including a gas chromatograph (GC), immunoassay kit, and an XRF spectrometer.

The contractor chosen to perform the tasks identified by this DSA will specify the exact methods and equipment to be used for definitive identification.

2.3.29 Waste Management

A WMP will be in place and adhered to during the MDA B IRR Program. Personnel will manage and handle waste in accordance with 90-day RCRA waste storage and/or area of contamination (AOC) handling requirements, using waste accumulation areas, where appropriate.

The wastes will be characterized through laboratory analyses for the purposes of segregating waste materials for treatability and/or disposal. This level of characterization will be required for comparison with offsite TSDF WAC, for selection of appropriate waste packaging, and compliance with DOT requirements.

In general, all high-hazard waste will be removed from the trenches and stabilized. All low-hazard soils/fill material will be sampled and staged during processing and returned to the trench following the investigation. Should an MDA B section require complete removal, low-hazard bulk materials will be subject to sampling, analysis, and comparison to the unrestricted release criteria. Only compactable soil/fill will be retained at the site for reuse. All other materials will be subject to offsite shipment.

Compositing of waste streams designated for return to the trench will be completed given waste streams are compatible and that adequate verification sampling is performed within the AOC boundary. Compositing of waste streams designated for offsite TSD will be performed based on packaging requirements, shipping configuration, and WAC.

All non-compactable industrial waste will be prepared for shipment to an industrial landfill. All contaminated non-compactable waste will be sampled and prepared for shipment to an acceptable land disposal facility based on appropriate waste characterization and classification. All TSCA waste will be removed from trenches, packaged, and disposed of at a TSCA-approved disposal facility. Items and material that are potentially classified will be identified and the LANL University Technical Representative (UTR) and LANL S Division will be notified.

Water removed from any subsurface excavation will be containerized, sampled, and stored at the site until final contaminant content, treatment, and disposition are identified.

The contractor chosen to perform the tasks identified by this DSA will specify the exact waste management procedures that will be followed.

2.3.30 Environmental Monitoring

Air monitoring systems will be used to monitor activities within the work area enclosure. The systems will survey airborne radioactive particles inside the work zone and outside the work area enclosure at specific locations around the site. Monitoring stations will also be located along the DP Road corridor to detect offsite releases during trenching activities. In particular, beta and/or alpha activities will be monitored to ensure they remain below action levels. VOCs and airborne particulates (dust) will also be monitored.

Swipes will be performed daily at the completion of work. Swipes will be taken of the internal and external work area enclosure walls.

The contractor chosen to perform the tasks identified by this DSA will specify the exact environmental monitoring procedures that will be followed.

2.3.31 Temporary Site Stabilization

Temporary site stabilization (TSS) will be required when field activities are unexpectedly suspended for more than five days in which active site monitoring is not performed. Field personnel will secure all open excavations to ensure no release of materials to the environment and no infiltration of surface water occurs. If requested by LANL/DOE, any open excavations will be backfilled with clean fill or other material selected for replacement to the trenches.

Environmental monitoring activities will continue through TSS. All stored wastes will be processed and prepared for transport for offsite TSD as appropriate.

All barriers, fences, control points, and areas of egress will be secured and subject to routine inspection for integrity. All equipment, hazardous materials, fuel sources, and utility connections will be placed in a secure condition.

The contractor chosen to perform the tasks identified by this DSA will specify the exact TSS procedures that will be followed.

2.3.32 Site Restoration

All material retained for replacement to the trenches will be homogenized based on waste type, sampled as necessary, and placed in documented layers of the trench excavation. For example, LLRW soil/fill will not be blended with soils with hazardous constituents only. The boundaries that separate underlying trench contents from replacement material will be physically marked (for Phases 2 and 2a). Material may include, but is not limited to, gravel, plastic sheeting, and sand.

Contaminated replacement material will be returned to the bottom of trenches above the boundary marker and tuff or trench contents. Boundaries separating clean materials from underlying contaminated layers will be physically marked (in the event of deep excavation in Phase 2b, 4a, or 4b). Material will be placed and compacted per the TIIP. The balance of the excavated trench will be filled with clean fill material and compacted and finished according to the TIIP. The filled trench excavation will be returned to grade to drain and seeded in accordance with the TIIP. All pavement conditions will be restored to match existing pavement.

Site restoration drainage controls will be provided to prevent, retard, or contain soil and sediment erosion. Site restoration will include raking and re-contouring of disturbed areas, mulching, and reseeding with approved mixtures of seed to stabilize disturbed areas. Drainage and erosion controls will include surrounding the site with silt fence and construction of rock check dams and straw/hay bale check dams. Equipment that will be used during site restoration includes excavator(s), loader(s), fuel/oil/grease truck(s), dump truck(s), flatbed truck(s), pickup truck(s), dozer(s), crane with 60-ft boom, and backhoe/loader(s).

The contractor chosen to perform the tasks identified by this DSA will specify the exact methods and equipment to be used for site restoration.

3.0 HAZARD-BARRIER ANALYSIS

3.1 Introduction

This section provides the hazard-barrier analysis for the MDA B IRR Program. The hazard-barrier analysis includes the identification of hazards that may be present during MDA B IRR Program phases and activities as well as the identification of barriers intended to prevent and/or mitigate those hazards. The hazard-barrier analysis incorporates three elements related to safety management:

- identification of hazards,
- identification and evaluation of barriers to prevent and/or mitigate hazards, and
- analysis of actual and potential accident sequences for insights into effective accident prevention.

Hazards have been identified for the MDA B IRR Program using the checklist approach. An experience-based checklist was used to identify known types of hazards. Both preventive and mitigative barriers were identified and evaluated to ensure all hazards are effectively controlled. Hazard scenarios were postulated to ensure the most complete and effective set of barriers has been identified.

The barriers described in this section will form the control sets that are implemented through the TSRs. For each barrier, qualitative expectations will be established to guide implementation of the control sets and to define the acceptance criteria for each of the controls.

Section 3.2 provides the hazardous material/energy sources identified for the MDA B IRR Program phases and activities. Section 3.3 presents the hazard categorization for MDA B. Section 3.4 provides a list of the barriers identified for the MDA B IRR Program, a description of each barrier, and an evaluation of each barrier's preventive and/or mitigative function. Analysts postulated and evaluated potential hazard scenarios for those hazards not screened from further consideration. Appendix B presents those hazard scenarios along with the barriers identified for the prevention/mitigation of each scenario in the form of hazard-barrier matrices.

3.2 Hazard Identification

Analysts used a hazard identification checklist to identify hazards (hazardous materials and energy sources) associated with MDA B IRR Program phases and activities. The "What-If" analysis performed for the "Preliminary Documented Safety Analysis Package for Material Disposal Area B" (LANL October 2004) provided the primary input for the checklist. Additionally, SMEs were consulted.

Only those hazards that could result in a radiological and/or chemical spill or release during MDA B IRR Program phases and activities were carried forward to the hazard-barrier analysis. Analysts eliminated from further consideration those hazards considered to be standard industrial hazards (SIH) only. SIHs are hazards that are routinely encountered in general industry and construction, and for which national consensus codes and/or standards (e.g., Occupational Safety and Health Administration [OSHA], transportation safety) exist to guide safe design and operation, thus eliminating the need for special analysis to devise safe design and/or operational parameters. SIHs were considered in the hazard analysis only to the extent that they are initiators and/or contributors to hazard scenarios.

Table 3.2-1 provides the results of the hazard identification process. The first column, Hazard Type, of Table 3.2-1 lists the specific checklist items used to facilitate the identification of hazardous material/energy sources (second column) specific to MDA B IRR Program phases and activities.

Table 3.2-1
Results of Hazard Identification

HAZARD TYPE	HAZARDOUS MATERIAL/ENERGY SOURCE	APPLICABLE PHASE/ACTIVITY
Chemical Reaction (non-fire) • Disassociation of product into separate components • Combination to form new product from mixture • Corrosion, rust, etc. • Rapid oxidation – air reaction	• Incompatible materials (e.g., materials that react to water, air, metal, etc.) in trenches/pits • Incompatible materials (e.g., materials that react to water, air, metal, etc.) processed/ staged/stored above ground • Rusted containers in trenches/pits	Phase 2 Phase 2a Phase 2b Phase 4a Phase 4b Onsite transportation Mobile laboratory and DIF activities
Deceleration • Impacts (sudden stops) • Failure of brakes, wheels, tires, etc. • Fragments or missiles	• Onsite moving vehicles and equipment	Phase 2 Phase 2a Phase 2b Phase 4a Phase 4b Phase 4c Onsite transportation
Electrical • Shock • Burns • Overheating • Ignition of combustibles • Electrical explosion • Static	• Electrical components of vehicles/equipment • Portable generators • AC electrical connections to service lines • Live overhead electric wires • Electric utility pole	Phase 2 Phase 2a Phase 2b Phase 4a Phase 4b Phase 4c Onsite transportation Mobile laboratory and DIF activities
Explosions • Commercial explosive present • Explosive gas • Explosive liquid • Explosive dust	• Natural gas line • Shock sensitive material (e.g., crystalline ethyl ether, perchlorate in canisters) • High explosives or unexploded ordnance • Propane tanks	Phase 2 Phase 2a Phase 2b Phase 4a Phase 4b Phase 4c Onsite transportation Mobile laboratory and DIF activities
External Events • Natural phenomena • Other external events	• Earthquake • Lightning • Heavy snowfall • High winds • Heavy rain/flood • Tornado • Freezing temperatures • Vehicles moving on nearby roadway • Aircraft crash • Wildland fire • Water/sewer line • Water tower	Phase 2 Phase 2a Phase 2b Phase 3 Phase 4a Phase 4b Phase 4c Onsite transportation Mobile laboratory and DIF activities

Table 3.2-1 (continued)

HAZARD TYPE	HAZARDOUS MATERIAL/ENERGY SOURCE	APPLICABLE PHASE/ACTIVITY
Flammability and Fires • Presence of fuel – solid, liquid, gas • Presence of strong oxidizer – oxygen, peroxide, etc. • Presence of strong ignition force – welding torch, heater, etc. • Presence of pyrophoric materials	• Equipment/vehicle fuel (e.g., gasoline, propane) • Cutting torch; welding torch • Pyrophoric materials • Flammable waste in trenches/pits • Flammable waste stored/staged above ground	Phase 2 Phase 2a Phase 2b Phase 4a Phase 4b Phase 4c Onsite transportation Mobile laboratory and DIF activities
Heat and Temperature • Source of heat - non-electrical • Hot surface burns • Very cold surface burns • Increased gas pressure caused by heat • Increased flammability caused by heat • Increased volatility caused by heat • Increased activity caused by heat	• Equipment/vehicle exhaust • Incompatible materials (e.g., materials that react to water, air, metal, etc.) in trenches/pits • Incompatible materials (e.g., materials that react to water, air, metal, etc.) processed/ staged/stored above ground	Phase 2 Phase 2a Phase 2b Phase 4a Phase 4b Phase 4c Onsite transportation Mobile laboratory and DIF activities
Kinetic Energy • Moving equipment • Surface disturbances	• Heavy equipment in motion • Operation of sampling equipment (e.g., drum spikes, hot taps) • Operation of cutting equipment	Phase 2 Phase 2a Phase 2b Phase 4a Phase 4b Phase 4c Onsite transportation Mobile laboratory and DIF activities
Leak of material • Flammable • Toxic • Corrosive • Slippery • Radioactive	• Low integrity containers in trenches/pits • Low integrity containers stored/staged above ground • Waste transfer hose	Phase 2 Phase 2a Phase 2b Phase 4a Phase 4b Mobile laboratory and DIF activities
Mechanical • Sharp edges or points • Rotating equipment • Reciprocating equipment • Pinch points • Weights to be lifted • Stability/toppling tendency • Ejected parts or fragments	• Broken glass containers • Rotating equipment (e.g., auger)	Phase 2 Phase 2a Phase 2b Phase 4a Phase 4b Onsite transportation Mobile laboratory and DIF activities
Potential Energy • Elevated work surfaces • Lifts, scaffolds, ladders • Stacked material • Heavy masses over weak ground areas	• Heavy equipment staged or operating over weak ground area • Heavy equipment operating in and around trenches • Worker working over weak ground area	Phase 2 Phase 2a Phase 2b Phase 4a Phase 4b Phase 4c Onsite transportation

Table 3.2-1 (continued)

HAZARD TYPE	HAZARDOUS MATERIAL/ENERGY SOURCE	APPLICABLE PHASE/ACTIVITY
• Equipment booms and lifts	• Worker working in and around trenches • Worker handling radiological or chemical materials • Ladders, scaffolding, etc.	Mobile laboratory and DIF activities
Pressure • Compressed gas • Compressed air tool • Pressurized system exhaust • Objects propelled by pressure • Water hammer • Flex hose whipping	• High pressure cylinders • Fume hood	Phase 2 Phase 2a Phase 2b Phase 4a Phase 4b Mobile laboratory and DIF activities
Radiation • Ionizing radiation • Ultraviolet light • High intensity visible light • Infrared radiation • Electromagnetic radiation • Laser radiation	• Diffuse, volume-contaminated radioactive waste in trenches/pits • Diffuse, volume-contaminated radioactive waste processed/staged/ stored above ground • Surface-contaminated landfill debris • Concentrated radioactive sources/material in containers • Fissile material	Phase 2 Phase 2a Phase 2b Phase 4a Phase 4b Onsite transportation Mobile laboratory and DIF activities
Static • Container rupture • Over pressurization • Negative pressure effects	• Acids (hydrogen gas buildup) • TRU waste (hydrogen gas buildup)	Phase 2 Phase 2a Phase 2b Phase 4a Phase 4b Mobile laboratory and DIF activities
Toxicity • Gas or liquid (asphyxiant, irritant, systemic poison, carcinogen, mutagen) • Combination product • Combustion product	• Diffuse, volume-contaminated chemical waste in trenches/pits • Diffuse, volume-contaminated chemical waste processed/staged/ stored above ground • Surface-contaminated landfill debris • Concentrated chemical sources/material in containers	Phase 2 Phase 2a Phase 2b Phase 4a Phase 4b Onsite transportation Mobile laboratory and DIF activities
Vibration • Vibrating tools • High noise level source • Metal fatigue • Flow or jet vibration • Supersonics	• Vibrating equipment (e.g., excavator, compactor) • Moving transportation vehicles	Phase 2 Phase 2a Phase 2b Phase 4a Phase 4b Phase 4c Onsite transportation

In addition to the hazardous materials/energy sources identified in Table 3.2-1, Appendix C provides a list of the contaminants of concern that are anticipated to be found in the burial trenches/pits during the MDA B IRR Program. SMEs generated this list after a review of historical plutonium processing, historical documents and memos, and recent sampling data. This list identifies a wide variety of acids, reactive and shock-sensitive materials, radionuclides, and other hazardous materials/substances. Due to the rigorous plutonium recovery processes of the 1940s, the likelihood that a significant accumulation and activity of plutonium is encountered is small. However, a large percentage of the waste material placed in the trenches did have elevated levels of surface radiological contamination. Although Appendix C contains a substantial list, it should not be considered all encompassing of the potential hazardous materials/substances that may be encountered during the MDA B IRR Program.

3.3 Hazard Categorization

Analysts based the initial categorization of MDA B on the inventory reported in a 1971 memorandum from Meyer (Meyer 1971). According to the Meyer inventory, the maximum plutonium-239 inventory in MDA B is estimated to be 100 g. In accordance with the categorization methodology described in DOE-STD-1027-92, Change Notice 1 (DOE 1997), analysts categorized MDA B as an HC3 site with the understanding that the inventory would not be intentionally disturbed and that the cover material would remain intact. As previously stated, DOE (Steele 2003) concurred with this categorization for S&M activities falling under the scope of the NES S&M DSA (LANL November 2004).

DOE-STD-1027-92, Change Notice 1 (DOE 1997), requires a final hazard categorization be performed based on the unmitigated release of available hazardous material. This standard states, “For the purposes of hazard categorization, ‘unmitigated’ is meant to consider material quantity, form, location, dispersibility and interaction with available energy sources, but not to consider safety features (e.g., ventilation system, fire suppression, etc.) which will prevent or mitigate a release.” The phases and activities planned for MDA B IRR are designed to intentionally expose and disturb the inventory of MDA B, thereby greatly increasing the dispersibility of the buried material and the potential for interaction with energy sources over that which would occur during S&M activities alone. Given the uncertainty in both the total inventory and the degree to which it is dispersed throughout the MDA B site, as well as the close proximity of the public (approximately 20 m/66 ft), analysts conservatively assumed that an unmitigated release would have the potential for significant onsite consequences (i.e., 1 rem or more in the range of 100 m/328 ft) that could also affect the nearby public. Therefore, the final hazard categorization for MDA B during IRR is HC2.

3.4 Hazard-Barrier Analysis

To ensure the safety of the public, workers, and the environment during MDA B IRR Program phases and activities, analysts identified barriers that will contribute to the prevention and/or mitigation of the hazards that were identified during the hazard identification process. The term “barrier” is used to describe systems, components, structures, procedures, and human actions. It is roughly equivalent to the term “control.” Barriers may provide physical separation between hazards and potential receptors or administratively control hazards associated with tasks.

Tables 3.4-1 and 3.4-2 summarize the barriers identified for the MDA B IRR Program phases and activities. These include both engineering controls (ECs) and administrative controls (ACs). To compensate for potential human and mechanical failures, defense-in-depth for the MDA B IRR Program is based on several layers of protection with successive barriers (ECs and ACs) to prevent or mitigate the release of hazardous materials/substances.

Program commitments (e.g., radiation protection, maintenance, quality assurance) are recognized as being important to safety for the MDA B IRR Program. Table 3.4-3 provides the safety management program (SMP) commitments for the MDA B IRR Program. The discipline imposed by SMPs is an integral part of defense-in-depth.

Table 3.4-1
Engineering Controls

Barrier #	Barrier	Preventive or Mitigative	Safety Function
EC-1	Work Area Enclosure	P, M	The work area enclosure will reduce the potential for chemical reactions by protecting water reactive materials in an open trench from rain, snow, and other precipitation. The work area enclosure will also provide containment in the event of a chemical and/or radiological spill or release.
EC-2	Ventilation/Filtration System (in work area enclosure)	M	The ventilation/filtration system will supply fresh air to the work area enclosure to refresh/remove/replace the existing atmosphere and filter and clean contaminated air before it is released to the outside environment.
EC-3	Mobile Laboratory/DIF Structure	M	The mobile laboratory/DIF structures will provide containment in the event of a chemical and/or radiological spill or release.
EC-4	Ventilation/Filtration System (in mobile laboratory/DIF)	M	The ventilation/filtration system will supply fresh air to the mobile laboratory/DIF to refresh/remove/ replace the existing atmosphere and filter and clean contaminated air before it is released to the outside environment.
EC-5	Protective Enclosures/ Barriers (e.g., fume hood, glovebox, blast shield, etc.)	P	The protective enclosures/barriers will isolate chemical fumes/vapors and radioactive particulates during identification activities.
EC-6	Post-Excavation Containment (e.g., overpacking, cylinder coffin, blast box, plastic sheeting, etc.)	P	The post-excavation containment will provide an additional barrier to the spill and/or release of chemical or radiological material. Overpacking, cylinder coffins, blast boxes, etc., will protect original waste containers against insult/impact. Plastic sheeting will provide confinement for non-containerized waste such as contaminated overburden and large pieces of contaminated concrete or metal equipment.
EC-7	Configuration of Burial (e.g., burial depth, inventory distribution)	P, M	The configuration of burial will provide containment of inventory not exposed by an open trench or test pit. It will additionally minimize the amount of inventory that may be involved in an accident.

Table 3.4-1 (continued)

Barrier #	Barrier	Preventive or Mitigative	Safety Function
EC-8	Impact Barriers (e.g., bollards, Jersey barriers, etc.)	P	Impact barriers will prevent vehicles and equipment from inadvertently impacting structures, or processing, staging, and storage areas.
EC-9	Cargo Securement Devices and Systems (e.g., tie-downs, D-rings, etc.)	P	Cargo securement devices and systems will ensure packages, containing hazardous materials/substances, do not move around, topple over, or fall from the onsite transport vehicle.
EC-10	Air Monitoring Systems	M	Air monitoring systems will alert workers (and subsequently, the public) in the event that chemical or radioactive airborne concentrations exceed established thresholds.

Table 3.4-2
Administrative Controls

Barrier #	Barrier	Preventive or Mitigative	Safety Function
AC-1	Excavation Control Plan (pre-excavation)	M	The Excavation Control Plan will identify the maximum quantities of chemical and radiological materials that may be exposed in an open trench at any given time.
AC-2	Inventory Control Plan (post-excavation)	P, M	The Inventory Control Plan will identify the maximum quantities of chemical and radiological materials that may be processed/staged/stored above ground (i.e., in the enclosure and mobile laboratories/DIF) at any given time. The Inventory Control Plan will also identify the maximum quantities of material that may be transported onsite at any given time. Additionally, the Inventory Control Plan will specify segregation and packaging requirements for all materials processed/staged/stored above ground and transported onsite.
AC-3	Continuous Hazard Evaluation/Verification and Response Plan	P, M	The Continuous Hazard Evaluation/Verification and Response Plan will identify visual inspection and sampling requirements with hold points. The Continuous Hazard Evaluation/ Verification and Response Plan will also establish the appropriate worker responses to visual inspection and sampling results during all modes of operation, including emergencies.
AC-4	Fire Protection Program Plan	P	The Fire Protection Program Plan will identify requirements for fire prevention such as minimization of combustibles and activities requiring a fire watch.
AC-5	Air Monitoring and Response Plan	M	The Air Monitoring and Response Plan will establish the thresholds for air monitoring. The Air Monitoring and Response Plan will additionally establish the appropriate worker responses to air monitor results during all modes of operation, including emergencies.
AC-6	Access Control Plan	P, M	The Access Control Plan will identify the requirements necessary (e.g., fencing, signage, qualification requirements, etc.) to ensure that only authorized personnel and personnel with the required qualifications and training are present at the MDA B site.

Table 3.4-2 (continued)

Barrier #	Barrier	Preventive or Mitigative	Safety Function
AC-7	Continuous Surveillance and Maintenance Plan	P	The Continuous Surveillance and Maintenance Plan will identify the S&M requirements necessary to ensure the integrity of the configuration of burial (EC-8) for those areas of MDA B not immediately impacted (i.e., areas other than the area of the open trench or test pit) by IRR Program phases and activities.
AC-8	Vehicle/Equipment Control Plan	P, M	The Vehicle/Equipment Control Plan will provide the requirements necessary to ensure that transportation vehicles and equipment operate and move around the MDA B site in a safe manner. The Vehicle/Equipment Control Plan will additionally establish the procedures to be followed in the event of an onsite vehicle/equipment accident.
AC-9	Cargo Securement Plan	P	The Cargo Securement Plan will ensure that cargo securement devices and systems are selected and used correctly and effectively.

Table 3.4-3
Safety Management Programs

Barrier #	Barrier	Preventive or Mitigative	Safety Function
SMP-1	Abnormal Events Reporting Program	P	The Abnormal Events Reporting Program will ensure the evaluation of abnormal events that have occurred and the identification of additional controls to prevent those events from reoccurring.
SMP-2	Calibration Program	P	The Calibration Program will ensure that measuring equipment (e.g., dosimetry) is working properly.
SMP-3	Chemical Management Program	P	The Chemical Management Program will ensure that workers are appropriately trained and qualified to work with chemicals.
SMP-4	Conduct of Operations Program	P	The Conduct of Operations Program provides formal programs and procedures dictating high operating standards to ensure a high level of performance and safety.
SMP-5	Configuration Management Program	P	The Configuration Management Program will ensure that any changes to documentation or barriers are reviewed and approved.
SMP-6	Emergency Management and Response Program	M	The Emergency Management and Response Program will minimize the potential consequences of an accident to workers and the public.
SMP-7	Fire Protection Program	P	The Fire Protection Program will ensure workers are trained and knowledgeable in fire safety including the operation of fire extinguishers. This program will directly support AC-4.
SMP-8	Human Reliability Program	P	The Human Reliability Program will ensure that workers are reliable in the performance of their jobs by screening for drug and alcohol use/addictions and other conditions that may represent a safety concern.
SMP-9	Integrated Work Management Program	P	The Integrated Work Management Program will ensure work is planned and hazards are controlled.
SMP-10	Lockout/Tagout Program	P	The Lockout/Tagout Program will ensure appropriate safety precautions are observed when working with electrical equipment and machinery.
SMP-11	Maintenance Management Program	P	The Maintenance Management Program will ensure that all equipment (e.g., vehicles, heavy equipment, etc.) is in proper working order.

Table 3.4-3 (continued)

Barrier #	Barrier	Preventive or Mitigative	Safety Function
SMP-12	Medical Surveillance Program	P	The Medical Surveillance Program will ensure that workers do not receive chronic exposures over time to hazardous materials/substances above the regulated limits.
SMP-13	Packaging and Transportation Program	P	The Packaging and Transportation Program will ensure that quality, safety, and regulatory requirements are met during onsite transportation.
SMP-14	Personal Protective Equipment Program	P	The Personal Protective Equipment Program will ensure workers are adequately protected from exposure to hazardous materials/substances.
SMP-15	Quality Assurance Program	P	The Quality Assurance Program will ensure that quality requirements that address the needs of vehicles and equipment, packaging, personnel, and operations are maintained.
SMP-16	Radiation Protection Program	P	The Radiation Protection Program will ensure radiation exposure is maintained as low as reasonably achievable (ALARA) by defining specific training, exposure limits, monitoring, posting, and labeling requirements, etc.
SMP-17	Records Management Program	P	The Records Management Program will ensure that important records (e.g., personnel exposure records) are maintained.
SMP-18	Safety Concern Program	P	The Safety Concern Program will ensure that workers report any uncontrolled or previously unidentified hazards.
SMP-19	Training and Qualification Program	P	The Training and Qualification Program will ensure that accidents resulting from human error, procedure violations, and ignorance are minimized.
SMP-20	Unreviewed Safety Question Program	P	The Unreviewed Safety Question Program will ensure that identified controls remain effective and that any additional controls necessary to the safety basis of the MDA B IRR Program are identified.

Analysts designated structures, systems, and components (SSCs) that are major contributors to defense-in-depth and/or worker safety as safety-significant (SS) SSCs. Any features which provide the outer or predominant means of mitigating the uncontrolled release of hazardous materials (e.g., ventilation system directing airflow to High Efficiency Particulate Air [HEPA] filters, overall building structure) and any preventive features that are designed to preclude highly energetic events that potentially threaten multiple layers of defense-in-depth or essentially defeat any one layer were considered for SS designation.

Additionally, analysts followed the guidance of DOE Standard 1186-2004 (DOE 2004) to select ACs for elevation to the status of specific ACs (SACs). SACs are those ACs “selected to provide preventive and/or mitigative functions for specific potential accident scenarios, and which, also have safety importance equivalent to engineered controls that would be classified as Safety Class (SC) or Safety Significant (SS) if the engineered controls were available and selected.”

SS SSCs include

- the work area enclosure (EC-1),
- the ventilation/filtration system (in the work area enclosure) (EC-2),
- the mobile laboratory/DIF structure (EC-3),
- the ventilation/filtration system (in the mobile laboratory/DIF) (EC-4),
- protective enclosures/barriers (EC-5),
- post-excavation containment (EC-6),
- configuration of burial (EC-7),
- impact barriers (EC-8),
- cargo securement devices and systems (EC-9), and
- air monitoring systems (EC-10).

SACs include

- the Excavation Control Plan (AC-1),
- the Inventory Control Plan (AC-2),
- the Continuous Hazard Evaluation/Verification and Response Plan (AC-3), and
- the Fire Protection Program Plan (AC-4).

3.4.1 Engineering Controls

3.4.1.1 Work Area Enclosure

The work area enclosure will be a temporary, mobile structure that will contain facilities for trench/test pit investigation and segregating, declassifying, identifying, packaging, and managing excavated materials. The enclosure is primarily intended to isolate field activities from adjacent businesses and the surrounding environment. The work area enclosure will

- provide an environment that allows work to be performed during inclement weather (rain, snow, high winds),
- prevent the direct exposure of excavated material and the open excavation to adverse weather conditions,
- provide some measure of site security and control, and
- provide containment in the event of a chemical and/or radiological spill or release.

The work area enclosure is both a preventive and mitigative control. The work area enclosure will prevent chemical reactions by protecting water reactive materials from rain, snow, and other precipitation. Fire, explosion, and poison gas are possible results of chemical reactions. The work area enclosure will additionally provide containment in the event of an accident to prevent exposures to the public. The work area enclosure will be a major contributor to defense-in-depth to protect the public and to worker safety. Therefore, the work area enclosure is a SS SSC and a TSR passive design feature (DF). The contractor chosen to perform the tasks identified by this DSA will design and/or procure the work area enclosure and provide the necessary drawings and specifications.

3.4.1.2 Ventilation/Filtration System in the Work Area Enclosure

The work area enclosure will contain a ventilation/filtration system. The ventilation/filtration system will be HEPA-filtered to remove radioactive particulates from the air. Chemical scrubbers will also be employed. This ventilation/filtration system will be utilized to move contaminated air away from the work areas to prevent worker inhalation exposure and filter and clean contaminated air before it is released to the outside environment.

The ventilation/filtration system is a mitigative control. The ventilation/filtration system will minimize the potential for worker inhalation exposure and will minimize the release of radioactive particulates and chemical fumes, dusts, and vapors to the outside environment and to the public. The ventilation/filtration system will be a major contributor to defense-in-depth to protect the public and to worker safety. Therefore, the ventilation/filtration system is a SS SSC. The ventilation/filtration system will require a TSR limiting condition for operation (LCO) and a surveillance requirement (SR) to ensure its proper operation. The contractor chosen to perform the tasks identified by this DSA will select an appropriate ventilation/filtration system for use within the work area enclosure and will identify the limiting conditions under which it will be required to operate.

3.4.1.3 Mobile Laboratory/DIF Structure

The mobile laboratories and DIF will be temporary structures for the characterization and definitive identification of hazardous materials/substances that cannot be adequately characterized within the work area enclosure. The mobile laboratory and DIF structures will be mitigative barriers. The mobile laboratory and DIF structures will provide containment of hazardous material/substance spills or releases in the event of an accident. The mobile laboratory and DIF structures will be major contributors to defense-in-depth to protect the public and to worker safety during mobile laboratory and DIF activities. Therefore, the mobile laboratory/DIF structure is a SS SSC and a TSR passive DF. The contractor chosen to perform the tasks identified by this DSA will design and/or procure the mobile laboratories and DIF and provide the necessary drawings and specifications.

3.4.1.4 Ventilation/Filtration System in the Mobile Laboratory/DIF

The mobile laboratory/DIF will contain a ventilation/filtration system. The ventilation/filtration system will be HEPA-filtered to remove radioactive particulates from the air. Chemical scrubbers will also be employed. This ventilation/filtration system will be utilized to move contaminated air away from the work areas to prevent worker inhalation exposure and filter and clean contaminated air before it is released to the outside environment.

The mobile laboratory/DIF ventilation/filtration system is a mitigative barrier. The ventilation/filtration system will minimize the potential for worker inhalation exposure and will minimize the release of radioactive particulates and chemical fumes, dusts, and vapors to the outside environment and to the public. The ventilation/filtration system will be a major contributor to defense-in-depth to protect the public and to worker safety. Therefore, the mobile laboratory/DIF ventilation/filtration system is a SS SSC. The ventilation/filtration system will require a TSR LCO and SR to ensure its proper operation. The contractor chosen to perform the tasks identified by this DSA will select the appropriate ventilation/filtration systems for use within the mobile laboratories and DIF and will identify the limiting conditions under which they will be required to operate.

3.4.1.5 Protective Enclosures/Barriers

Protective enclosures will include barriers such as gloveboxes, fume hoods, and blast shields. Protective enclosures such as gloveboxes and fume hoods will be used to minimize the potential exposure to workers and the public from hazardous gases, dusts, mists, and vapors. Protective barriers such as blast shields will be used primarily for worker protection.

Protective enclosures/barriers provide a preventive safety function. Protective enclosures/barriers will be major contributors to defense-in-depth to protect the public and to worker safety during mobile laboratory and DIF activities. Therefore, protective enclosures/barriers are SS SSCs. Protective enclosures/barriers will require TSR LCOs and SRs to ensure they are operating properly.

3.4.1.6 Post-Excavation Containment

Original waste containers include the containers in which the waste material was originally buried such as

- 55-gallon drums,
- glass carboys,
- glass bottles,
- glass jars,
- cylinders, and
- lecture bottles.

It is likely that some of the original waste containers may be degraded. Post-excavation containment will include overpacking or other protective containerization or cover to protect the original waste container from insult and provide a secondary barrier between the hazardous materials/substances and the public, workers, and the environment. Post-excavation containment may include but not necessarily be limited to

- overpacking,
- cylinder coffins,
- blast boxes, and
- plastic sheeting.

Post-excavation containment is a preventive barrier. In the event that containerized hazardous materials/substances processed/stored/staged/transported above ground are threatened by an external energy source such as an explosion, fire, or impact hazard (e.g., impact by moving equipment), this containment will protect the original waste container from insult/impact, thereby providing an additional barrier to the spill or release of hazardous materials/substances. Plastic sheeting or other cover will protect the non-containerized waste (e.g., contaminated soil) from dispersal and prevent contaminant migration. The contractor chosen to perform the tasks identified by this DSA will identify the specific containment or enclosure that will be used for excavated hazardous materials/substances. Post-excavation containment will be a major contributor to defense-in-depth to protect the public and to worker safety. Therefore, post-excavation containment is a SS SSC and a TSR passive DF.

3.4.1.7 Configuration of Burial

Configuration of burial containment includes the depth at which inventory is buried and the distribution of inventory across MDA B. Configuration of burial containment ensures that MDA B inventory that is not immediately involved in trenching or test pit placement is not disturbed by IRR Program phases and activities in progress in other areas of MDA B or by other events external to MDA B. Additionally, this containment will provide a barrier to the inadvertent release of hazardous materials/substances during the evaluation and alternatives assessment phase (Phase 3). Configuration of burial containment is characterized by burial depth and inventory distribution.

The depth of burial provides protection to waste from surface activities and other external forces. Most of the waste in MDA B is contained well below the surface. MDA B has some cover material above the waste. These covers will provide an additional barrier to the inadvertent release of material.

Distribution (rather than concentration) of the inventory primarily serves as a barrier to the release of significant amounts of radiological material or hazardous chemicals. At MDA B, inventory is distributed throughout pits and trenches over approximately six acres, mitigating the amount of material that could be released in the event that the MDA B cover material is breached in any one location.

Configuration of burial is both a preventive and mitigative barrier. It prevents the disturbance of buried inventory. Additionally, by limiting the inventory involved to that inventory exposed in the open trench and processed/stored/staged/transported above ground, configuration of burial provides mitigation in the event of an accident during trenching or test pit placement. Configuration of burial will be a major contributor to defense-in-depth to protect the public and to worker safety. Therefore, configuration of burial is a SS SSC and a TSR passive DF.

3.4.1.8 Impact Barriers

Field personnel will position impact barriers around the work area enclosure, storage and processing areas within the work area enclosure, mobile laboratories, and the DIF to prevent vehicles from inadvertently impacting structures and/or containers. Impact barriers will include barriers such as bollards, Jersey barriers, and perimeter fencing.

Impact barriers are a preventive barrier. Impact barriers will be a major contributor to defense-in-depth to protect the public and to worker safety during MDA B onsite transportation activities. Therefore, impact barriers are SS SSCs and TSR passive DFs. An AC will be required to ensure impact barriers are appropriately placed and maintained. The contractor chosen to perform the tasks identified by this DSA will select the impact barriers to be used during MDA B IRR Program phases and activities and will designate their location and maintenance requirements.

3.4.1.9 Cargo Securement Devices and Systems

To prevent lateral, forward, backward, and vertical movement, field personnel will secure containers to onsite transport vehicles using cargo securement devices and systems in compliance with 49 CFR 393, Subpart I, “Protection against Shifting or Falling Cargo.“ The performance requirements for cargo securement devices and systems as specified in 49 CFR 393.102 of this subpart are:

- withstand 0.8 g deceleration in the forward direction,
- withstand 0.5 g acceleration in the rearward direction,
- withstand 0.5 g acceleration in a lateral direction, and
- provide downward force equivalent to at least 20 percent of the weight of the article of cargo if the article is not fully contained within the structure of the vehicle.

Cargo securement devices that will be used for onsite transportation include tie-downs and D-rings. Field personnel will visually inspect all cargo securement devices and systems, including vehicle structures and anchor points, prior to each use. All cargo securement devices and systems will be designed, installed, and maintained to ensure that the maximum forces acting on the devices or systems do not exceed the working load limit for the devices under the conditions described above.

The combination of cargo securement devices and systems is a preventive barrier. Cargo securement devices and systems will prevent containers from shifting during transport or falling from the transport vehicle. Shifting or falling containers could result in a damaged container and a spill or release of a hazardous material/substance. The combination of cargo securement devices and systems will be a major contributor to defense-in-depth to protect the public and will contribute to worker safety during MDA B onsite transportation activities. Therefore, the combination of cargo securement devices and systems is a SS SSC. A TSR LCO and SR will be required to ensure that cargo securement devices and systems meet the performance requirements as described above. A Cargo Securement Plan (as described in the next section) will also be implemented to ensure cargo securement devices are selected as appropriate to the load being transported, meet the minimum performance requirements, are inspected prior to each use, and used correctly and effectively. The contractor chosen to perform the tasks identified by this DSA will specify the exact cargo securement devices and systems that will be used for onsite transportation activities and will ensure that workers are trained in the selection and use of those cargo securement devices and systems.

3.4.1.10 Air Monitoring Systems

Air monitoring systems will include a combination of radiation and non-radiation air monitors and samplers equipped with alarms located both within and outside of the work area enclosure and mobile laboratories/DIF. Air monitors and samplers will provide for radiological, non-radiological, airborne particulates (dust), and other work area sampling as appropriate.

The air monitoring systems are mitigative barriers. The air monitoring systems will alert workers to unsafe conditions and potential offsite releases. The air monitoring systems will be major contributors to defense-in-depth to protect the public and to worker safety. Therefore, the air monitoring systems are SS SSCs. TSR LCOs and SRs will be required to ensure the proper operation of the air monitoring systems. An Air Monitoring and Response Plan (as described in the next section) will also be implemented to ensure locations and monitoring requirements are appropriately identified and maintained. The contractor chosen to perform the tasks identified by this DSA will identify the number and types of air monitors that will be used and will identify the limiting conditions under which they will be required to operate.

3.4.2 Administrative Controls

3.4.2.1 Excavation Control Plan

The contractor chosen to perform the tasks identified by this DSA will develop an Excavation Control Plan. The Excavation Control Plan will provide guidance on the quantities of waste that may be exposed in a trench at a given time. This limit on the quantities of exposed waste will be based on the types of hazardous materials/substances that are encountered as trench contents are exposed.

In addition to the limit on the quantities of exposed waste, the Excavation Control Plan will provide guidance on the types and quantities of hazardous materials/substances (e.g., low hazard, high hazard, compactable, non-compactable, etc.) that will be removed from the trenches during each phase and the hazardous materials/substances that will be placed back into the trenches prior to backfilling. No new (i.e., not previously buried in MDA B) hazardous materials/substances will be added to any trench for disposal prior to backfill.

The Excavation Control Plan is a mitigative barrier. The Excavation Control Plan will be a major contributor to defense-in-depth to protect the public and to worker safety. Therefore, the development of the Excavation Control Plan is a TSR directive action SAC.

3.4.2.2 Inventory Control Plan

The contractor chosen to perform the tasks identified by this DSA will develop an Inventory Control Plan. The Inventory Control Plan will include the various potential waste classifications and the anticipated volumes of each; packaging and staging requirements; and the sampling protocol for all hazardous materials/substances designated for offsite disposal and retention/replacement in trenches. The Inventory Control Plan will also include waste segregation/combination restrictions. Sampling protocol will include HazCat screening. The HazCat screening process will provide the basic information needed for segregating waste materials by physical form (solid, liquid, or gas) and hazard class (radioactive, reactive, corrosive, or flammable). HazCat screening will ensure the segregation/combination of hazardous materials/substances in waste staging and storage areas does not violate the waste segregation/combination restrictions.

The Inventory Control Plan will specify the material/inventory limits for hazardous materials/substances processed/staged/stored within the work area enclosure, mobile laboratories/DIF, and any exterior (to the enclosure) onsite storage areas. Additionally, material/inventory limits and segregation requirements will be identified for onsite transportation.

Requirements for the protection of excavated material (i.e., identification of the proper containment or enclosure of excavated material) will also be included in the Inventory Control Plan.

The Inventory Control Plan will provide both preventive and mitigative safety functions. The Inventory Control Plan will be a major contributor to defense-in-depth to protect the public and to worker safety. Therefore, the development of the Inventory Control Plan is a TSR directive action SAC.

3.4.2.3 Continuous Hazard Evaluation/Verification and Response Plan

The contractor chosen to perform the tasks identified by this DSA will develop a Continuous Hazard Evaluation/Verification and Response Plan. The Continuous Hazard Evaluation/Verification and Response Plan will describe the visual inspection and sampling requirements necessary to ensure that the types and quantities of hazardous materials/substances exposed within the trenches are within the safety basis established by this DSA. Additionally, the Continuous Hazard Evaluation/Verification and Response Plan will ensure that actual or potential IDLH or other dangerous conditions do not exist within the trenches.

It is anticipated that visual inspections of trenches and test pits and sampling of the exposed material will be initiated immediately following the removal of overburden. Visual inspections and sampling will continue as specified by the Continuous Hazard Evaluation/Verification and Response Plan. The Continuous Hazard Evaluation/Verification and Response Plan will specify conditions that will require hold points prior to proceeding with a task. The Continuous Hazard Evaluation/Verification and Response Plan will also provide guidance on the appropriate responses to inspection and sampling results for both emergency and non-emergency situations. For example, an open trench may be backfilled and the controls, necessary to safely remove the hazardous material/substance from the trench, reevaluated in the event that the limit on the quantities of exposed waste cannot be reasonably controlled (e.g., a single container is discovered with a quantity of a hazardous material/substance exceeding the set limit for that material/substance). The Continuous Hazard Evaluation/Verification and Response Plan will additionally describe actions to be taken in the event an external event threatens operations at MDA B (e.g., an approaching wildfire).

The Continuous Hazard Evaluation/Verification and Response Plan is both a preventive and mitigative barrier. The Continuous Hazard Evaluation/Verification and Response Plan will be a major contributor to defense-in-depth to protect the public and to worker safety. Therefore, the development of the Continuous Hazard Evaluation/Verification and Response Plan is a TSR directive action SAC.

3.4.2.4 Fire Protection Program Plan

The contractor chosen to perform the tasks identified by this DSA will develop a Fire Protection Program Plan. The Fire Protection Program Plan will identify the requirements for fire prevention during MDA B IRR Program phases and activities. These requirements will include activities and tasks requiring a fire watch, combustible control limits, and other safety precautions necessary to prevent the initiation and spread of a fire.

The Fire Protection Program Plan is a preventive barrier. The Fire Protection Program Plan will be a major contributor to defense-in-depth to protect the public and to worker safety. Therefore, the development of the Fire Protection Program Plan is a TSR directive action SAC.

3.4.2.5 Air Monitoring and Response Plan

The contractor chosen to perform the tasks identified by this DSA will develop an Air Monitoring and Response Plan for the MDA B IRR Program. This plan will establish thresholds for radiological, non-radiological, dust, and other sampling as appropriate both internal and external to the work area enclosure and mobile laboratories/DIF. These requirements will include the specific number and locations of air monitors, and dose and concentration limits. Additionally, the Air Monitoring and Response Plan will include development of appropriate responses to air monitor results for both emergency and non-emergency situations. The Air Monitoring and Response Plan will provide defense-in-depth to protect the public and contribute to worker safety. Therefore, the development of the Air Monitoring and Response Plan is a TSR AC.

3.4.2.6 Access Control Plan

The contractor chosen to perform the tasks identified by this DSA will develop an Access Control Plan. The purpose of the Access Control Plan will be to ensure only essential personnel are present during MDA B IRR Program phases and activities. The Access Control Plan will include

- perimeter fencing and signage to ensure a member of the public or other unauthorized person does not enter the MDA B site;
- verification that worker qualification and training requirements have been met prior to granting a worker access to the MDA B site, the work area enclosure, the mobile laboratories or DIF, or any other limited access areas; and
- removal of non-essential personnel from high-hazard areas.

The Access Control Plan is both a preventive and mitigative barrier. The Access Control Plan will provide defense-in-depth to protect the public and contribute to worker safety during MDA B IRR Program phases and activities. Therefore, the development of the Access Control Plan is a TSR AC.

3.4.2.7 Continuous Surveillance and Maintenance Plan

The contractor chosen to perform the tasks identified by this DSA will develop a Continuous S&M Plan. The Continuous S&M Plan will include many of the elements of the NES S&M Program as described in the “Documented Safety Analysis for Surveillance and Maintenance of Nuclear Environmental Sites at Los Alamos National Laboratory” (LANL November 2004). The intent of the Continuous S&M Plan will be to continue to ensure the integrity of the MDA B site in areas that are not immediately involved in trenching and test pit placement tasks and also to ensure the integrity of the entire site during the evaluation and alternatives assessment phase (Phase 3). The Continuous S&M Plan will include elements such as

- vegetation maintenance,
- erosion control and cover maintenance,
- sampling and surveying,
- geological mapping, and
- visual inspections.

Vegetation maintenance will include routine trimming, mowing, and removal of shrubbery, trees, and other plant life. Vegetation maintenance will minimize the likelihood that a fire will initiate/propagate across the MDA B site and ensure that there is adequate and appropriate vegetation to minimize erosion.

Erosion control and cover maintenance will provide for the maintenance of systems designed to control the amount and location of runoff and infiltration near and on MDA B and for the maintenance of the cover layer. Cover augmentation or other small repairs in response to erosion or biological actions, such as burrows, may also be included.

Radiological and chemical sampling and surveying will continue to be performed to ensure that hazardous materials/substances have not migrated or been released. The Continuous S&M Plan will specify the frequency and type of sampling and survey measures that will be conducted during MDA B IRR Program phases.

Geological mapping will include general surveying, geologic mapping, and visual observation techniques to assess and document current geologic status and the effects of erosion or geologic events on NES surface or subsurface characteristics.

Periodic visual inspections of MDA B will be conducted to identify problematic conditions including vegetation, erosion, burrowing or other biological agents, or access control issues and general condition of the cover. Inspections will ensure that the secondary containment for buried hazardous materials/substances (as described under the Inventory Isolation barrier) is in a condition that allows it to provide its intended function. The Continuous S&M Plan will specify the frequency and criteria for visual inspections during MDA B IRR Program phases and activities.

The Continuous S&M Plan is a preventive barrier. The Continuous S&M Plan will provide defense-in-depth to protect the public and contribute to worker safety during MDA B IRR Program phases and activities. Therefore, the development of the Continuous S&M Plan is a TSR AC.

3.4.2.8 Vehicle/Equipment Control Plan

The contractor chosen to perform the tasks identified by this DSA will develop a Vehicle/Equipment Control Plan for MDA B onsite transportation activities, as well as activities involving the maintenance of heavy equipment (e.g., refueling). The Vehicle/Equipment Control Plan will identify locations on or near MDA B for the following:

- transport routes,
- loading/unloading areas,
- parking areas,
- refueling areas, and
- personal vehicle areas.

Additionally, the Vehicle/Equipment Control Plan will include a traffic limit, a speed limit, a restriction on transportation during inclement weather, and an Emergency Response and Management Plan.

Only designated transport routes will be used for MDA B onsite transportation. The contractor will select the transport routes that minimize the potential for an accident and for landfill cave-in. Only designated loading/unloading areas will be used during MDA B onsite transportation. Loading/unloading areas will be identified and designed to ensure transport vehicles can be safety loaded and unloaded without the potential for a landfill cave-in.

Transport vehicles and equipment will be parked only in designated parking areas. The contractor will designate parking areas where the ground is solid and away from structures and storage areas to minimize the potential for landfill cave-in and to minimize any interaction between parked vehicles and structures that may contain hazardous materials/substances. Refueling operations will take place only in designated refueling areas. The contractor will designate refueling areas at a distance from MDA B structures to minimize the potential that a fire initiated in the refueling area will involve hazardous materials/substances processed/staged/stored above ground or exposed in an open trench.

Personal vehicle access and parking areas will be designated by the contractor. The contractor will designate personal vehicle areas that minimize the potential for a landfill cave-in. Personal vehicle areas will also be located at a distance from MDA B structures to ensure that personal vehicle accidents do not impact hazardous materials/substances staged/stored above ground or exposed in an open trench.

The Vehicle/Equipment Control Plan will specify a limit (traffic limit) on the number of vehicles and equipment traversing the site at any given time. This limit will take into consideration the potential for multiple vehicle accidents, as well as the potential for landfill cave-in. The Vehicle/Equipment Control Plan will also specify a speed limit for onsite transportation. The contractor will select an appropriate speed limit that will minimize the potential for an accident, as well as challenges to hazardous material/substance containers and cargo securement devices. Setting and observing a safe site speed limit will increase the driver's ability to negotiate turns or maneuver around obstacles on the transportation route, shorten the distance necessary for the vehicle to stop, and decrease the distance the vehicle travels while the driver reacts to a hazard.

Onsite transportation will not be conducted during rain, hail, sleet, snow, fog, high winds, extreme temperatures, or other similar inclement weather conditions or when such conditions are predicted to be imminent. Additionally, onsite transportation will not be conducted when transportation routes are wet, icy, slick, or otherwise hazardous as a result of inclement weather. The Vehicle/Equipment Control Plan will describe the exact conditions during which inclement weather restrictions will be in place.

The Vehicle/Equipment Control Plan will provide guidance on the emergency responses to be taken in the event of a transportation accident. Ensuring that workers are prepared in the event of an accident will minimize the consequences to the workers and the public.

The Vehicle/Equipment Control Plan is both a preventive and mitigative barrier. The Vehicle/Equipment Control Plan will provide defense-in-depth to protect the public and contribute to worker safety. Therefore, the development of the Vehicle/Equipment Control Plan is a TSR AC.

3.4.2.9 Cargo Securement Plan

The contractor chosen to perform the tasks identified by this DSA will develop a Cargo Securement Plan. The Cargo Securement Plan will ensure cargo securement devices are selected as appropriate to the load being transported, meet the minimum performance requirements, are inspected prior to each use, and used correctly and effectively. The Cargo Securement Plan will identify the cargo securement devices and systems (configurations) appropriate for each type of load anticipated during MDA B IRR and the inspection requirements necessary to ensure that cargo securement devices and systems are used correctly and effectively.

The Cargo Securement Plan is a preventive barrier. The Cargo Securement Plan will provide defense-in-depth to protect the public and contribute to worker safety. Therefore, the development of the Cargo Securement Plan is a TSR AC.

3.4.3 Safety Management Programs

SMPs are designed to ensure that a facility/activity is operated/conducted in a manner that adequately protects the public, workers, and the environment. LANL SMPs will be relied upon to provide additional defense-in-depth to MDA B IRR Program phases and activities and will further ensure the safety of the public, workers, and the environment. LANL SMPs are TSR programmatic ACs.

3.4.3.1 Abnormal Events Reporting Program

An abnormal event is a real-time event that adversely affects workers, the public, property, or the environment. Examples include

- vehicle accident/incident resulting in damage to the vehicles involved and/or personnel injury;
- occupational injury/illness;
- fire/explosion;
- radiological or hazardous material/substance spill;
- loss of process ventilation that results in a spread of radiological or hazardous contamination;
- natural phenomena (flooding, severe weather, forest fire);
- procedural/regulatory violation (violations of DOT regulations); and
- property damage that is not security-related (damage that results in a claim against the Laboratory, damage caused by fire, contaminated personal clothing, DOE-recordable levels).

The LANL Abnormal Events Reporting Program will be implemented for the MDA B IRR Program. This program will ensure that injuries or illnesses, environmental incidents, radiological incidents, property damage, and any other reportable occurrences are reported according to the required method set forth by LANL.

3.4.3.2 Calibration Program

LANL's Calibration Program is essential to activities that depend on accurate measurements. LANL is responsible for ensuring the stated accuracy of any measured data used for the following purposes:

- monitoring or controlling safe conditions to prevent hazards to personnel or the environment,
- reports or publications,
- establishing specifications,
- acceptance testing of purchased items,
- final testing of products or services provided to customers within or outside the Laboratory,
- monitoring or controlling process parameters,

- evaluating or testing weapons material or systems, and
- verifying the accuracy of measuring and test equipment.

The LANL Calibration Program will be implemented to ensure the proper control, use, and calibration of tools and equipment necessary for the MDA B IRR Program. The Calibration Program will particularly ensure the safety of workers and the public through the proper calibration of measuring and test equipment used to manage and control radiation doses.

3.4.3.3 Chemical Management Program

The purpose of LANL's Chemical Management Program is to protect worker health and safety, prevent pollution, assist Emergency Management and Response (EM&R), protect the environment, and minimize waste by controlling chemical activities. LANL's Chemical Management Program ensures that only workers qualified through education, training, and experience work with chemicals. A Chemical Management Program in accordance with the LANL-wide program will be implemented for the MDA B IRR Program and will be made up of the following elements:

- a Hazard Communication (HAZCOM) Plan;
- chemical procurement;
- the current chemical inventory in the automated chemical inventory system (ACIS);
- a carcinogen management program;
- labels and signs;
- material safety data sheets (MSDSs);
- exposure control;
- safe chemical storage that meets regulatory storage limits, segregation, and shelf life;
- an MDA B-specific emergency response plan and spill control;
- the safe transport of chemicals;
- waste minimization and disposal; and
- worker qualification and training.

3.4.3.4 Conduct of Operations Program

By identifying the risks to operations and developing and implementing the controls needed to perform the work safely and securely, the LANL Conduct of Operations Program ensures that conduct of operations is integrated into the Laboratory's processes for accepting and performing work. The Conduct of Operations Program ensures that the depth of detail required and the magnitude of resources expended for operations are commensurate with each facility's programmatic importance and potential environment, safety, health, and security impact.

3.4.3.5 Configuration Management Program

Configuration management (CM) is an integrated management program that establishes consistency among design requirements, physical configuration, and facility documentation, and maintains this consistency throughout the life of the facility as changes occur. The LANL CM Program consists of CM functions associated with program management, design requirements, document control, change control, and assessments.

The LANL CM Program will be implemented for the MDA B IRR Program and will ensure that changes to the technical baseline are properly identified, developed, assessed, approved, scheduled, implemented, and documented through the use of a formal process. This program will additionally ensure the use of a systematic, rigorous process to document, review, and approve changes to the barriers that are relied upon to protect the public, workers, and environment.

3.4.3.6 Emergency Management and Response Program

The LANL Emergency Management Plan incorporates into one document a description of the entire process designed to plan for, respond to, and mitigate the potential consequences of an emergency. This plan, coupled with the Building Emergency Planning Program and site-specific emergency procedures, states the requirements, procedures, and information needed to ensure that any emergency at LANL is mitigated as expeditiously and effectively as possible. Implementation of the LANL Emergency Management Plan establishes an emergency management program that accomplishes the following:

- assigns responsibilities,
- guides in categorization and classification of an emergency,
- states necessary notifications for emergency response personnel and the public,
- outlines the assessment of LANL and offsite hazardous materials conditions during or following an emergency,
- outlines an effective course of action to protect the public and LANL personnel in the event of an emergency,
- addresses the implementation of protective actions,
- guides mitigation of hazardous materials consequences, and
- outlines necessary training for emergency response personnel.

Division leaders, program managers, project leaders, facility managers, group leaders, and office leaders must plan for emergencies, provide the necessary emergency training to ensure that employees and the public are protected, and take the actions necessary to mitigate the emergency until relieved by authorized personnel. The EM&R Group is responsible for assisting LANL managers in that effort by administering a comprehensive emergency management program.

3.4.3.7 Fire Protection Program

The LANL Fire Protection Program minimizes potential losses from the following fire-related events:

- injury or loss of life;
- a fire that causes an unacceptable onsite or offsite release of hazardous or radiological material;
- vital programs suffering unacceptable interruptions as a result of fire and related hazards;
- property losses from fire and related events exceeding defined limits established by LANL; and
- critical processes, controls, and safety class systems being damaged as a result of fire and related events.

Adherence to the LANL Fire Protection Program will ensure fire safety during the MDA B IRR Program. Under the LANL Fire Protection Program, provisions will be made for ensuring the implementation of MDA B-related fire protection activities identified by the Fire Protection Program Plan, such as worker fire prevention and safety training; combustible controls; fire watch; and fire extinguisher inspection, testing, and maintenance.

3.4.3.8 Human Reliability Program

The LANL Human Reliability Program (HRP) ensures that all individuals working in positions affording unescorted access to certain materials, facilities, and programs are certified to meet the highest standards of reliability and physical and mental suitability. LANL's HRP is designed to meet the objective of protecting the national security through a system of continuous evaluation of individuals working in positions that afford unescorted access to certain materials, facilities, and programs. The purpose of this continuous evaluation is to identify in a timely manner individuals whose judgment may be impaired by physical and/or emotional disorders, the use of illegal drugs or the abuse of legal drugs or other substances, the abuse of alcohol, or any other condition or circumstance that may represent a reliability, safety, and/or security concern.

3.4.3.9 Integrated Work Management Program

The LANL Integrated Work Management (IWM) Program defines requirements and processes for doing work in a safe, secure, environmentally responsible manner. It defines the requirements for the implementation of the five-step process associated with Integrated Safety Management (ISM) and Integrated Safeguards and Security Management (ISSM) and directly supports the LANL Environmental Management System at the activity level. The core functions of ISM and ISSM include the following tasks:

- define the work,
- identify and analyze hazards,
- develop and implement controls,
- perform the work, and
- ensure performance.

While implementing the five-step ISM process, IWM emphasizes the following criteria:

- management and worker accountability;
- applying the worker's knowledge and experience;
- providing integrated, worker-friendly documentation that includes defined work tasks/steps that are linked to specific hazards and unambiguous controls;
- identifying a single person-in-charge for each work activity;
- providing independent oversight and facility coordination;
- formally validating, releasing, and closing out work activities; and
- feedback and continuous improvement.

The most important aspects of this process are the direct involvement of workers in controlling the risks, and the accountability of responsible division leaders and of responsible line management for safety, security, and environmental protection. As the level of risk posed by the hazards and work complexity increase, IWM requires a more rigorous process and documentation. For moderate- and high-hazard and complex activities, the work process, hazards, and controls must be documented in an Integrated Work Document (IWD). The IWD consists of the following four parts:

- activity-specific information,
- work-area information,
- validation and release information (followed by work execution), and
- close-out information.

An IWM Program will be implemented for the MDA B IRR Program and will serve as a preventive barrier by ensuring that appropriate controls are in place and that work is authorized so that no increase in risk to the workers, public, or environment is created. Additionally, this program will ensure the use of a systematic, rigorous process to document, review, and approve changes to the barriers that are relied upon to protect the public, workers, and environment.

3.4.3.10 Lockout/Tagout Program

The LANL Lockout/Tagout Program defines the required procedures for affixing lockout/tagout devices to energy-isolating devices, and to otherwise disable machines or equipment, in order to prevent unexpected energization, start-up, or release of stored energy and in order to prevent injury to employees. The LANL Lockout/Tagout Program will be implemented for the MDA B IRR Program and will consist of procedures to control potentially hazardous energy and materials and personnel training. This program will ensure that potentially hazardous energy or toxic material sources are isolated and rendered inoperative during servicing or maintenance or in any instance where unexpected energizing, startup, or release of stored energy or toxic material can cause injury.

3.4.3.11 Maintenance Management Program

The following six elements form the core of an effective Maintenance Management Program at LANL:

- inventory and grade (graded approach),
- maintenance procedures,
- training and qualification,
- scheduling,
- equipment/system status, and
- equipment history.

This program will ensure the identification and maintenance of vehicles, equipment, and other laboratory property that have the potential to adversely affect public safety, worker safety, environmental protection, and the programmatic mission at LANL.

The LANL Maintenance Management Program will ensure the proper implementation of maintenance and work control requirements during the MDA B IRR Program. By ensuring that vehicles and equipment are functioning properly, the potential for an accident initiated by faulty vehicles or equipment will be reduced.

3.4.3.12 Medical Surveillance Program

The LANL Medical Surveillance Program will be in place to ensure applicable replacement, job-transfer, termination, and regulatory driven medical surveillance and/or certification evaluations are performed. Additionally, occupational medicine staff team with other ES&H disciplines to perform field support, worksite evaluations, assessment of job demands and potential hazards, which ensures adequate worker health and safety assessment during these evaluations.

3.4.3.13 Packaging and Transportation Program

LANL's Packaging and Transportation Program defines the requirements for controlling onsite and offsite packaging and transportation activities to be implemented in order to ensure that quality, safety, and regulatory requirements are met. The LANL Packaging and Transportation Program will be implemented for MDA B onsite transportation activities.

3.4.3.14 Personal Protective Equipment Program

The LANL Personal Protective Equipment (PPE) Program addresses the requirements for PPE hazard assessment, selection, training, use, maintenance, storage, and disposal. The use of PPE is required in Laboratory work areas in which hazards are not effectively controlled by other means, are unknown, or are controlled but require additional protection. PPE provides for specialized protection for the respiratory system, eyes, face, feet, ears, skin, and head, as well as for the entire body. PPE is the last line of protection in the hierarchy of controls.

The LANL PPE Program will be implemented for the MDA B IRR Program. The PPE Program will address the following elements:

- PPE selection based upon site hazards;
- PPE use and limitations of the equipment;

- work mission duration;
- PPE maintenance and storage;
- PPE decontamination and disposal;
- PPE training and proper fitting;
- PPE donning and doffing procedures;
- PPE inspection procedures prior to, during, and after use;
- evaluation of the effectiveness of the PPE program; and
- limitations during temperature extremes, heat stress, and other appropriate medical considerations.

Workers will be trained in the selection, use, and maintenance of PPE.

3.4.3.15 Quality Assurance Program

LANL's Institutional Quality Management Program (IQMP) assigns roles, responsibilities, authorities and accountabilities; defines policies and requirements; provides for the performance and assessment of work; and ensures the identification and application of improvement initiatives. Through the implementation of the IQMP, LANL accomplishes the following:

- enhances the formality of operations;
- reduces work-related risk and hazards to the public and workers;
- improves responsibility and accountability for material, process, and product control;
- improves work-control processes through the integration of quality and safety principles in a single work-control process that uses consensus codes and standards ;
- provides guidance for tailoring and simplifying the approach to meet requirements;
- institutionalizes the Integrated Safeguards and Security Management (ISSM) System;
- communicates an integrated corporate approach to business systems management;
- minimizes rework and improves efficiency and effectiveness in work productivity;
- provides the means to ensure continued ability to meet customer needs and institutional goals; and
- increases facility availability to support national science and stockpile stewardship missions.

A Quality Assurance Program will be implemented for the MDA B IRR Program in support of the LANL IQMP to achieve and improve quality through the identification of problems and the recommendation and initiation of improvements during MDA B IRR Program phases and activities. This program will ensure that the MDA B IRR Program maintains quality requirements that address the needs of sampling, surveying, mapping, excavating, personnel, and other applicable activities.

3.4.3.16 Radiation Protection Program

The LANL Radiation Protection Program will be implemented during the MDA B IRR Program for radiological survey issues related directly to worker safety and to unrestricted release as described in 10 CFR 835. The LANL Radiation Protection Program ensures that employees, contractors, subcontractors (for example, maintenance subcontractors), visiting scientists, DOE or Department of Defense (DoD) personnel, members of the public, and any other personnel who will be working at MDA B, conduct their work in such a way that radiation doses resulting from their work are kept ALARA. The LANL Radiation Protection Program includes the following elements that are combined to accomplish the ALARA principle and to ensure personnel health and safety:

- Areas with potential radiological hazards are identified and designated with postings.
- Radioactive contamination is managed and controlled to minimize personnel exposure and to limit inadvertent transfer beyond area boundaries.
- External and internal radiation doses to personnel are monitored and ensured not to exceed annual or lifetime limits.
- Instrumentation used to make radiation measurements is calibrated and maintained to ensure accurate results.
- Areas and activities requiring PPE are identified.
- Personnel are given training in radiation protection.

3.4.3.17 Records Management Program

Records include information created and received in the course of conducting LANL programs and business. Records management serves to promote the creation, capture, use, and transfer of records and knowledge. It also serves to preserve and protect the Laboratory's archival and historical documents and information. Further, the management of records reduces the legal risk to the Laboratory when approved retention schedules are implemented. LANL’s Records Management Program is designed to follow good business practices to ensure the protection of corporate information assets.

The LANL Records Management Program will be implemented for the MDA B IRR Program and will ensure that records created in the normal course of business are maintained and protected from unauthorized destruction or removal. The records that will be important to safety during the MDA B IRR Program include personnel records that document radiation doses, documentation of identified hazards, inventory tracking data, and technical baseline documentation.

3.4.3.18 Safety Concern Program

The Safety Concern Program is intended to be a no-fault partnership between workers and managers at LANL to identify and resolve safety concerns. A safety concern is an environment-, safety-, or health-related issue that a Laboratory worker believes should be reviewed or corrected. The LANL Safety Concern Program ensures that safety issues are identified and corrected.

3.4.3.19 Training and Qualification Program

Specific training requirements have been established by LANL for all workers. Training and qualification of workers, based upon an identification of the knowledge, skills, and abilities required to independently perform work is an important mechanism used to control hazards. Required institutional, facility-specific, and job-specific training for performing their assigned jobs shall be provided to all workers.

The LANL Training and Qualification Program will be implemented for the MDA B IRR Program. This program will ensure that LANL's institutional training requirements are met and will identify job- and task-specific training necessary for MDA B IRR workers to complete their work safely and effectively, thus minimizing the potential for accidents resulting in a hazardous material release. Elements that will be covered in the training of all workers for the MDA B IRR Program include the following:

- names of personnel and alternates responsible for site safety and health;
- safety, health, and other hazards present on the site;
- use of PPE;
- Work practices by which the worker can minimize risks from hazards;
- safe use of engineering controls and equipment on the site;
- medical surveillance requirements, including recognition of symptoms and signs which might indicate overexposure to hazards;
- decontamination procedures;
- the emergency response plan;
- confined space entry procedures; and
- spill containment procedures.

3.4.3.20 Unreviewed Safety Question Program

The unreviewed safety question (USQ) process facilitates the ability to make changes to support day-to-day operations. It also provides a mechanism for keeping the safety basis current by reviewing potential USQs, reporting USQs to DOE, and obtaining approval from DOE prior to taking any action that involves a USQ. The USQ process is required for

- all temporary or permanent physical changes at a facility;
- all temporary or permanent changes to procedures at a facility;
- all activities, operations, tests, or experiments that are new to a facility; and
- discoveries of potential inadequacies in the existing DSA.

The USQ process not only applies to changes within the boundary of a facility, but also to changes outside the boundary, when those changes have the potential to affect the safety of the operations within the boundaries.

The LANL USQ Program will be implemented for the MDA B IRR Program and will ensure that any changes to MDA B planned activities are analyzed against the DSA with respect to frequency, consequences, and safety margin to determine if the change falls within the existing safety envelope or if it requires approval through the USQ process. The LANL USQ program will thereby ensure that controls remain effective and that any additional controls necessary to the safety basis of the MDA B IRR Program are identified.

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Appendix A

Acronyms/Abbreviations and Glossary

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A-1.0 ACRONYMS AND ABBREVIATIONS

AC	administrative control
ACIS	Automated Chemical Inventory System
AEA	Atomic Energy Act
AGL	above ground level
ALARA	as low as reasonably achievable
AOC	area of contamination
ASTM	American Society for Testing and Materials
CAM	continuous air monitoring
CCTV	closed-circuit television system
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CM	configuration management
DF	design feature
DIF	Definitive Identification Facility
DoD	Department of Defense
DOE	Department of Energy
DOT	Department of Transportation
DP	Delta Prime
DSA	documented safety analysis
EC	engineering control
EM&R	emergency management and response
EPA	Environmental Protection Agency
ER	environmental restoration
ERMP	Emergency Response and Management Plan
ES&H	environment, safety, and health
FID	flame ionization detector
GC	gas chromatograph
GTCC	greater than Class C
HazCat	hazard characterization
HAZCOM	hazard communication
HC	hazard category
HE	high explosive
HEPA	high-efficiency particulate air
HH	high-hazard
HHW	high-hazard waste
HRP	Human Reliability Program

IDLH	immediately dangerous to life and health
IQMP	Institutional Quality Management Program
IRR	investigation, remediation, and restoration
ISM	Integrated Safety Management
ISSM	Integrated Safeguards and Security Management
IWD	integrated work document
IWM	Integrated Work Management
LANL	Los Alamos National Laboratory
LCO	limiting condition for operation
LHBWC	low-hazard bulk waste compactable
LHBWN	low-hazard bulk waste non-compactable
LLRW	low-level radioactive waste
MDA	material disposal area
MLLRW	mixed low-level radioactive waste
MSDS	material safety data sheet
NES	nuclear environmental site
NESHAPS	National Emission Standards for Hazardous Air Pollutants
NMAC	New Mexico Administrative Code
NMED	New Mexico Environment Department
NNSA	National Nuclear Security Administration
NWIS	Nuclear Waste and Infrastructure Services
OSHA	Occupational Safety and Health Administration
PCB	polychlorinated biphenyl
PID	photoionization detector
PPE	personal protective equipment
QMP	Quality Management Plan
RCRA	Resource Conservation and Recovery Act
RFI	RCRA facility investigation
S&M	surveillance and maintenance
SAC	specific administrative control
SAL	screening action level
SHSM	Site Health and Safety Manager
SIH	standard industrial hazard
SS	safety-significant
SSHASP	Site-Specific Health and Safety Plan
SSL	sight screening level
SME	subject matter expert

SMP	safety management program
SOP	standard operating procedure
SR	surveillance requirement
SVOC	semivolatile organic compound
SWMU	solid waste management unit
SWPPP	Storm Water Pollution Prevention Plan
TA	technical area
TAL	target analyte list (EPA)
TERP	Temporary Elevation and Restoration Plan
TIIP	Trenching Investigation Implementation Plan
TRU	transuranic
TSCA	Toxic Substances Control Act
TSD	treatment, storage, and disposal
TSDF	treatment, storage, and disposal facility
TSR	technical safety requirement
TSS	temporary site stabilization
USQ	unreviewed safety question
UTR	University (of California) Technical Representative
VOC	volatile organic compound
WAC	waste acceptance criteria
WMP	Waste Management Plan
XRF	x-ray fluorescence

A-2.0 GLOSSARY

area of contamination (AOC) – The approved site boundary within which wastes may be observed, sampled, staged, and returned to the subsurface investigative trenches without initiating RCRA Subtitle C hazardous waste management requirements. (The EPA interprets the RCRA to allow certain discrete areas of generally dispersed contamination to be considered RCRA units. Therefore, consolidation of material within an AOC and treatment of material, in situ, within an AOC does not create a point of hazardous waste generation for purposes of the RCRA.)

field screening sample – A sample that may be collected and analyzed onsite, in the enclosure or support facilities, and may be used for health and safety analysis, preliminary waste assay and segregation, and temporary handling and storage control.

hazardous material/substance – Includes any substance designated or reflected in 29 CFR 1910.120, to which exposure may result in adverse affects to the worker, public, or environment including : (1) any substance defined under section 101(14) of CERCLA; (2) any biological agent and other disease-causing agent that after release into the environment and upon exposure, ingestion, inhalation, or assimilation into any person, either directly from the environment or indirectly by ingestion through food chains, will or may reasonably be anticipated to cause death, disease, behavioral abnormalities, cancer, genetic mutation, physiological malfunctions (including malfunctions in reproduction), or physical deformations in such persons or their offspring; (3) any substance listed by the DOT as hazardous materials under 49 CFR 172.101 and appendices; and (4) hazardous waste (i.e., a waste or combination of wastes as defined in 40 CFR 261.3 or substances defined as hazardous waste in 49 CFR 171.8).

high-hazard waste (HHW) – Waste that, based on its physical/chemical properties and potential impacts to health and safety, is to be sampled, processed, packaged, and transported for treatment and/or disposal when encountered in any phase of the MDA B IRR Program. Components of high-hazard waste include, but are not limited to

- any container of unknown material content when encountered in a trench or excavation;
- spent chemical or solvent wastes or product chemicals in intact or partially intact containers;
- reactive, flammable, corrosive, and/or shock sensitive chemicals in containers;
- all liquid RCRA hazardous wastes, as defined in 40 CFR 261 and adopted in 20.4.1.200 NMAC;
- GTCC LLRW, that exceeds the quantitative Class C limits presented in 10 CFR 61;
- TRU waste, as defined in DOE Order 435.1;
- bulk material (environmental media or debris) that when uncovered, creates a work environment resulting in an atmospheric concentration of any toxic, corrosive, or asphyxiant substance that poses an immediate threat to life or would cause irreversible or delayed adverse health effects or would interfere with an individual's ability to escape from a dangerous atmosphere;
- bulk material (environmental media or debris) that when uncovered, results in dose rates constituting a “high radiation area” as defined by 10 CFR 835.2;
- any bulk material that when subject to movement in and from the trench results in a "high airborne radiation area" as defined by 10 CFR 830.2;
- MLLRW exceeding any of the aforementioned bulk material chemical criteria and containing both hazardous waste and source, special nuclear, or by-product material subject to the AEA of 1954;

- TSCA waste including friable asbestos identified as New Mexico Special Waste or concentrated (containerized or pooled liquid form) PCB containing materials; and
- other special materials identified by the SHSM and approved by the LANL technical representative.

hold point – A predetermined step specified in work planning documents that requires specific actions or hazard controls prior to continuing work (e.g., characterization activities or radiological controls).

low-hazard bulk waste compactable or placeable (LHBWC) – Includes bulk wastes of low relative health risk that may be readily replaced and/or compacted in an excavated trench including, but not limited to:

- bulk material (environmental media or debris) exhibiting above-background concentrations of hazardous chemical constituents or radionuclides, but not exceeding any of the thresholds for identification as HHW;
- items with fixed and/or removable surface radiological contamination exceeding 10 CFR 835 unrestricted release limits, but not resulting in radiological conditions exceeding any of the thresholds for identification as HHW;
- non-friable asbestos;
- MLLRW not exceeding any of the HHW bulk material chemical criteria and containing both hazardous waste and source, special nuclear, or by-product material subject to the AEA of 1954; and
- other special materials identified by the SHSM and approved by the LANL technical representative.

low-hazard bulk waste non-compactable or non-placeable (LHBWN) – Includes bulk wastes of low relative health risk that are not readily replaced and/or compacted in an excavated trench including, but not limited to:

- bulk material (environmental media or debris) exhibiting above-background concentrations of hazardous chemical constituents or radionuclides, but not exceeding any of the thresholds for identification as HHW;
- items with fixed and/or removable surface radiological contamination exceeding 10 CFR 835 unrestricted release limits, but not resulting in radiological conditions exceeding any of the thresholds for identification as HHW;
- non-friable asbestos;
- MLLRW not exceeding any of the HHW bulk material chemical criteria and containing both hazardous waste and source, special nuclear, or by-product material subject to the AEA of 1954; and
- other special materials identified by the SHSM and approved by the LANL technical representative.

overburden – Any material that may be present over the contents of the MDA B trenches, but is not contained within. May include but is not limited to, soils, miscellaneous fill, gravel, or stone or concrete rip rap. The overburden may or may not be contaminated.

release – Any spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping, or disposing of hazardous waste or hazardous constituents into the environment (including the abandonment or discarding of barrels, containers, and other closed receptacles that contain any hazardous wastes or hazardous constituents).

safety-significant structure, system, and components (SS SSCs) - Structures, systems, and components which are not designated as safety-class SSCs but whose preventive or mitigative function is a major contributor to defense in depth and/or worker safety as determined from safety analyses. (As a general rule of thumb, safety-significant SSC designations based on worker safety are limited to those systems, structures, or components whose failure is estimated to result in a prompt worker fatality or serious injuries or significant radiological or chemical exposures to workers. The term, serious injuries, as used in this definition, refers to medical treatment for immediately life-threatening or permanently disabling injuries [e.g., loss of eye, loss of limb]).

unrestricted release criteria – Concentrations of residual chemical and radiological constituents, when weighted against one another, present an acceptable residual risk. Attainment of these concentrations is necessary prior to any permanent backfill, stabilization, and restoration operations.

verification sample – A sample transferred offsite for laboratory analyses and related to material left in place at the close of trench investigation (i.e., tuff), contaminated material returned to the trench for interim storage, and/or material packaged and transported offsite for waste disposal. Verification samples are used to demonstrate compliance with unrestricted release criteria.

Appendix B

Hazard-Barrier Matrix

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B-1.0 INTRODUCTION

Table B-1 provides a breakdown of barriers associated with preventing and/or mitigating each hazard scenario postulated for MDA B IRR. Analysts postulated hazard scenarios only for those hazards that could result in a radiological and/or chemical spill or release during MDA B IRR Program phases and activities. Standard industrial hazards (SIHs) were not evaluated but will be controlled according to 29 CFR 1910.120 as implemented through LANL's safety management programs (SMPs).

The column, Safety Management Programs, is selected when one or more of the following SMPs contributes to the prevention and/or mitigation of the postulated hazard scenario:

- Abnormal Events Reporting Program
- Calibration Program
- Chemical Management Program
- Conduct of Operation Program
- Configuration Management Program
- Emergency Management Program
- Fire Protection Program
- Human Reliability Program
- Integrated Work Management Program
- Lockout/Tagout Program
- Maintenance Management Program
- Medical Surveillance Program
- Packaging and Transportation Program
- Personal Protective Equipment Program
- Quality Assurance Program
- Radiation Protection Program
- Records Management Program
- Safety Concern Program
- Training and Qualification Program
- Unreviewed Safety Question Program

Table B-1
Hazard-Barrier Matrix

Scenario Description (Hazard Type, What-If, Outcome)	Engineering Controls										Administrative Controls										
	Work Area Enclosure (EC-1)	Ventilation/Filtration (EC-2)	Mobile Laboratory/DIF Structure (EC-3)	Ventilation/Filtration (EC-4)	Prot. Enclosures/ Barriers (EC-5)	Post-Excavation Cont. (EC-6)	Conf. of Burial (EC-7)	Impact Barriers (EC-8)	Cargo Sec. Devices and Sys. (EC-9)	Air Monitoring Sys. (EC-10)	Excavation Control Plan (AC-1)	Inventory Control Plan (AC-2)	Cont. Haz. Eval./Verif. & Res. Plan (AC-3)	Fire Protection Program Plan (AC-4)	Air Monitoring and Response Plan (AC-5)	Access Control Plan (AC-6)	Continuous S&M Plan (AC-7)	Vehicle/Equipment Control Plan (AC-8)	Cargo Securement Plan (AC-9)	Safety Management Programs
(1) <u>Hazard Type:</u> Chemical Reaction <u>What-If:</u> Packaging fails during handling within the work area enclosure due to rust, corrosion, or degradation. <u>Outcome:</u> Radiological and/or chemical waste is spilled.	✓	✓				✓				✓		✓			✓	✓				✓

Table B-1 (continued)

Scenario Description (Hazard Type, What-If, Outcome)	Engineering Controls										Administrative Controls									
	Work Area Enclosure (EC-1)	Ventilation/Filtration (EC-2)	Mobile Laboratory/DIF Structure (EC-3)	Ventilation/Filtration (EC-4)	Prot. Enclosures/ Barriers (EC-5)	Post-Excavation Cont. (EC-6)	Conf. of Burial (EC-7)	Impact Barriers (EC-8)	Cargo Sec. Devices and Sys. (EC-9)	Air Monitoring Sys. (EC-10)	Excavation Control Plan (AC-1)	Inventory Control Plan (AC-2)	Cont. Haz. Eval./Verif. & Res. Plan (AC-3)	Fire Protection Program Plan (AC-4)	Air Monitoring and Response Plan (AC-5)	Access Control Plan (AC-6)	Continuous S&M Plan (AC-7)	Vehicle/Equipment Control Plan (AC-8)	Cargo Securement Plan (AC-9)	Safety Management Programs
(2) <u>Hazard Type:</u> Chemical Reaction; Explosion; Flammability and Fires <u>What-If:</u> Water is mistakenly introduced by worker for emergency or other purposes into open trench containing reactive hazardous materials. <u>Outcome:</u> Exothermic reaction results in a fire and/or explosion within the open trench with a radiological and/or chemical release.	✓	✓								✓	✓		✓	✓	✓	✓				✓

Table B-1 (continued)

Scenario Description (Hazard Type, What-If, Outcome)	Engineering Controls										Administrative Controls									
	Work Area Enclosure (EC-1)	Ventilation/Filtration (EC-2)	Mobile Laboratory/DIF Structure (EC-3)	Ventilation/Filtration (EC-4)	Prot. Enclosures/ Barriers (EC-5)	Post-Excavation Cont. (EC-6)	Conf. of Burial (EC-7)	Impact Barriers (EC-8)	Cargo Sec. Devices and Sys. (EC-9)	Air Monitoring Sys. (EC-10)	Excavation Control Plan (AC-1)	Inventory Control Plan (AC-2)	Cont. Haz. Eval./Verif. & Res. Plan (AC-3)	Fire Protection Program Plan (AC-4)	Air Monitoring and Response Plan (AC-5)	Access Control Plan (AC-6)	Continuous S&M Plan (AC-7)	Vehicle/Equipment Control Plan (AC-8)	Cargo Securement Plan (AC-9)	Safety Management Programs
(3) Hazard Type: Chemical Reaction; Explosion; Flammability and Fires What-If: Chemical reaction occurs between reactive hazardous materials within transport vehicle during onsite transport due to moving vehicle losing control (as the result of human error) and impacting an object or another vehicle. Outcome: Exothermic reaction results in a fire and/or explosion with the potential for involving radiological and/or chemical waste in open trenches, staged/stored above ground, or buried waste.						✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓

Table B-1 (continued)

Scenario Description (Hazard Type, What-If, Outcome)	Engineering Controls										Administrative Controls									
	Work Area Enclosure (EC-1)	Ventilation/Filtration (EC-2)	Mobile Laboratory/DIF Structure (EC-3)	Ventilation/Filtration (EC-4)	Prot. Enclosures/ Barriers (EC-5)	Post-Excavation Cont. (EC-6)	Conf. of Burial (EC-7)	Impact Barriers (EC-8)	Cargo Sec. Devices and Sys. (EC-9)	Air Monitoring Sys. (EC-10)	Excavation Control Plan (AC-1)	Inventory Control Plan (AC-2)	Cont. Haz. Eval./Verif. & Res. Plan (AC-3)	Fire Protection Program Plan (AC-4)	Air Monitoring and Response Plan (AC-5)	Access Control Plan (AC-6)	Continuous S&M Plan (AC-7)	Vehicle/Equipment Control Plan (AC-8)	Cargo Securement Plan (AC-9)	Safety Management Programs
(4) <u>Hazard Type:</u> Chemical Reaction; Explosion; Flammability and Fires <u>What-If:</u> Incorrect chemical neutralization formula is used during the chemical stabilization process in the DIF or other mobile laboratory. <u>Outcome:</u> Exothermic reaction results in a fire and/or explosion with the potential for involving other radiological and/or chemical waste located in the same laboratory.			✓	✓	✓	✓				✓		✓		✓	✓	✓				✓

Table B-1 (continued)

Scenario Description (Hazard Type, What-If, Outcome)	Engineering Controls										Administrative Controls									
	Work Area Enclosure (EC-1)	Ventilation/Filtration (EC-2)	Mobile Laboratory/DIF Structure (EC-3)	Ventilation/Filtration (EC-4)	Prot. Enclosures/ Barriers (EC-5)	Post-Excavation Cont. (EC-6)	Conf. of Burial (EC-7)	Impact Barriers (EC-8)	Cargo Sec. Devices and Sys. (EC-9)	Air Monitoring Sys. (EC-10)	Excavation Control Plan (AC-1)	Inventory Control Plan (AC-2)	Cont. Haz. Eval./Verif. & Res. Plan (AC-3)	Fire Protection Program Plan (AC-4)	Air Monitoring and Response Plan (AC-5)	Access Control Plan (AC-6)	Continuous S&M Plan (AC-7)	Vehicle/Equipment Control Plan (AC-8)	Cargo Securement Plan (AC-9)	Safety Management Programs
(5) Hazard Type: Chemical Reaction; Explosion; Flammability and Fires What-If: Incompatible reactive hazardous materials inadvertently come into contact with each other in the DIF or other mobile laboratory. Outcome: Exothermic reaction results in a fire and/or explosion with the potential for involving other radiological and/or chemical waste located in the same laboratory.			✓	✓	✓	✓				✓		✓		✓	✓	✓				✓

Table B-1 (continued)

Scenario Description (Hazard Type, What-If, Outcome)	Engineering Controls										Administrative Controls									
	Work Area Enclosure (EC-1)	Ventilation/Filtration (EC-2)	Mobile Laboratory/DIF Structure (EC-3)	Ventilation/Filtration (EC-4)	Prot. Enclosures/ Barriers (EC-5)	Post-Excavation Cont. (EC-6)	Conf. of Burial (EC-7)	Impact Barriers (EC-8)	Cargo Sec. Devices and Sys. (EC-9)	Air Monitoring Sys. (EC-10)	Excavation Control Plan (AC-1)	Inventory Control Plan (AC-2)	Cont. Haz. Eval./Verif. & Res. Plan (AC-3)	Fire Protection Program Plan (AC-4)	Air Monitoring and Response Plan (AC-5)	Access Control Plan (AC-6)	Continuous S&M Plan (AC-7)	Vehicle/Equipment Control Plan (AC-8)	Cargo Securement Plan (AC-9)	Safety Management Programs
(6) <u>Hazard Type:</u> Deceleration <u>What-If:</u> Collision occurs, as a result of human error, between forklift carrying waste container(s) and other equipment or objects within work area enclosure. <u>Outcome:</u> Waste container(s) fall from forklift, failing container(s), and spilling radiological and/or chemical waste.	✓	✓				✓				✓		✓			✓	✓				✓

Table B-1 (continued)

Scenario Description (Hazard Type, What-If, Outcome)	Engineering Controls										Administrative Controls									
	Work Area Enclosure (EC-1)	Ventilation/Filtration (EC-2)	Mobile Laboratory/DIF Structure (EC-3)	Ventilation/Filtration (EC-4)	Prot. Enclosures/ Barriers (EC-5)	Post-Excavation Cont. (EC-6)	Conf. of Burial (EC-7)	Impact Barriers (EC-8)	Cargo Sec. Devices and Sys. (EC-9)	Air Monitoring Sys. (EC-10)	Excavation Control Plan (AC-1)	Inventory Control Plan (AC-2)	Cont. Haz. Eval./Verif. & Res. Plan (AC-3)	Fire Protection Program Plan (AC-4)	Air Monitoring and Response Plan (AC-5)	Access Control Plan (AC-6)	Continuous S&M Plan (AC-7)	Vehicle/Equipment Control Plan (AC-8)	Cargo Securement Plan (AC-9)	Safety Management Programs
(7) <u>Hazard Type:</u> Deceleration; Flammability and Fires <u>What-If:</u> Collision occurs, as a result of human error, between forklift carrying waste container(s) and other equipment within work area enclosure. <u>Outcome:</u> Waste container(s) fall from forklift, failing container(s), and spilling radiological and/or chemical waste. Fire is initiated as a result of collision (e.g., sparks ignite fuel) and engulfs spilled material.	✓	✓				✓				✓		✓		✓	✓	✓				✓

Table B-1 (continued)

Scenario Description (Hazard Type, What-If, Outcome)	Engineering Controls										Administrative Controls									
	Work Area Enclosure (EC-1)	Ventilation/Filtration (EC-2)	Mobile Laboratory/DIF Structure (EC-3)	Ventilation/Filtration (EC-4)	Prot. Enclosures/ Barriers (EC-5)	Post-Excavation Cont. (EC-6)	Conf. of Burial (EC-7)	Impact Barriers (EC-8)	Cargo Sec. Devices and Sys. (EC-9)	Air Monitoring Sys. (EC-10)	Excavation Control Plan (AC-1)	Inventory Control Plan (AC-2)	Cont. Haz. Eval./Verif. & Res. Plan (AC-3)	Fire Protection Program Plan (AC-4)	Air Monitoring and Response Plan (AC-5)	Access Control Plan (AC-6)	Continuous S&M Plan (AC-7)	Vehicle/Equipment Control Plan (AC-8)	Cargo Securement Plan (AC-9)	Safety Management Programs
(8) Hazard Type: Deceleration What-If: Moving vehicle or equipment loses control, due to driver error, and impacts waste containers being processed/staged/ stored within work area enclosure. Outcome: Waste containers are ruptured. Radiological and/or chemical waste is spilled.	✓	✓				✓		✓		✓		✓			✓	✓		✓		✓

Table B-1 (continued)

Scenario Description (Hazard Type, What-If, Outcome)	Engineering Controls										Administrative Controls									
	Work Area Enclosure (EC-1)	Ventilation/Filtration (EC-2)	Mobile Laboratory/DIF Structure (EC-3)	Ventilation/Filtration (EC-4)	Prot. Enclosures/ Barriers (EC-5)	Post-Excavation Cont. (EC-6)	Conf. of Burial (EC-7)	Impact Barriers (EC-8)	Cargo Sec. Devices and Sys. (EC-9)	Air Monitoring Sys. (EC-10)	Excavation Control Plan (AC-1)	Inventory Control Plan (AC-2)	Cont. Haz. Eval./Verif. & Res. Plan (AC-3)	Fire Protection Program Plan (AC-4)	Air Monitoring and Response Plan (AC-5)	Access Control Plan (AC-6)	Continuous S&M Plan (AC-7)	Vehicle/Equipment Control Plan (AC-8)	Cargo Securement Plan (AC-9)	Safety Management Programs
(9) <u>Hazard Type:</u> Deceleration; Flammability and Fires <u>What-If:</u> Moving vehicle or equipment loses control, due to driver error, and impacts waste containers being processed/staged/ stored within work area enclosure. <u>Outcome:</u> Waste containers are ruptured. Radiological and/or chemical waste is spilled. Subsequent fire engulfs spilled material.	✓	✓				✓		✓		✓		✓		✓	✓	✓		✓		✓

Table B-1 (continued)

Scenario Description (Hazard Type, What-If, Outcome)	Engineering Controls										Administrative Controls									
	Work Area Enclosure (EC-1)	Ventilation/Filtration (EC-2)	Mobile Laboratory/DIF Structure (EC-3)	Ventilation/Filtration (EC-4)	Prot. Enclosures/ Barriers (EC-5)	Post-Excavation Cont. (EC-6)	Conf. of Burial (EC-7)	Impact Barriers (EC-8)	Cargo Sec. Devices and Sys. (EC-9)	Air Monitoring Sys. (EC-10)	Excavation Control Plan (AC-1)	Inventory Control Plan (AC-2)	Cont. Haz. Eval./Verif. & Res. Plan (AC-3)	Fire Protection Program Plan (AC-4)	Air Monitoring and Response Plan (AC-5)	Access Control Plan (AC-6)	Continuous S&M Plan (AC-7)	Vehicle/Equipment Control Plan (AC-8)	Cargo Securement Plan (AC-9)	Safety Management Programs
(10) <u>Hazard Type:</u> Deceleration <u>What-If:</u> Onsite collision occurs, as the result of driver error, between moving vehicle carrying waste containers and equipment or other vehicle. <u>Outcome:</u> Waste containers are ruptured. Radiological and/or chemical waste is spilled.						✓			✓	✓		✓			✓	✓		✓	✓	✓

Table B-1 (continued)

Scenario Description (Hazard Type, What-If, Outcome)	Engineering Controls										Administrative Controls									
	Work Area Enclosure (EC-1)	Ventilation/Filtration (EC-2)	Mobile Laboratory/DIF Structure (EC-3)	Ventilation/Filtration (EC-4)	Prot. Enclosures/ Barriers (EC-5)	Post-Excavation Cont. (EC-6)	Conf. of Burial (EC-7)	Impact Barriers (EC-8)	Cargo Sec. Devices and Sys. (EC-9)	Air Monitoring Sys. (EC-10)	Excavation Control Plan (AC-1)	Inventory Control Plan (AC-2)	Cont. Haz. Eval./Verif. & Res. Plan (AC-3)	Fire Protection Program Plan (AC-4)	Air Monitoring and Response Plan (AC-5)	Access Control Plan (AC-6)	Continuous S&M Plan (AC-7)	Vehicle/Equipment Control Plan (AC-8)	Cargo Securement Plan (AC-9)	Safety Management Programs
(11) Hazard Type: Deceleration; Flammability and Fires What-If: Moving vehicle carrying waste containers is involved in an accident, as the result of driver error. Outcome: Waste containers are ruptured. Radiological and/or chemical waste is spilled. Subsequent fire engulfs containers.						✓				✓		✓		✓	✓	✓		✓		✓

Table B-1 (continued)

Scenario Description (Hazard Type, What-If, Outcome)	Engineering Controls										Administrative Controls									
	Work Area Enclosure (EC-1)	Ventilation/Filtration (EC-2)	Mobile Laboratory/DIF Structure (EC-3)	Ventilation/Filtration (EC-4)	Prot. Enclosures/ Barriers (EC-5)	Post-Excavation Cont. (EC-6)	Conf. of Burial (EC-7)	Impact Barriers (EC-8)	Cargo Sec. Devices and Sys. (EC-9)	Air Monitoring Sys. (EC-10)	Excavation Control Plan (AC-1)	Inventory Control Plan (AC-2)	Cont. Haz. Eval./Verif. & Res. Plan (AC-3)	Fire Protection Program Plan (AC-4)	Air Monitoring and Response Plan (AC-5)	Access Control Plan (AC-6)	Continuous S&M Plan (AC-7)	Vehicle/Equipment Control Plan (AC-8)	Cargo Securement Plan (AC-9)	Safety Management Programs
(12) <u>Hazard Type:</u> Deceleration <u>What-If:</u> Onsite moving vehicle loses control as the result of driver error and impacts work area enclosure structure. <u>Outcome:</u> Containment is breached. Airborne contamination within work area enclosure is released to the outside environment.								✓		✓	✓	✓	✓		✓			✓		✓

Table B-1 (continued)

Scenario Description (Hazard Type, What-If, Outcome)	Engineering Controls										Administrative Controls									
	Work Area Enclosure (EC-1)	Ventilation/Filtration (EC-2)	Mobile Laboratory/DIF Structure (EC-3)	Ventilation/Filtration (EC-4)	Prot. Enclosures/ Barriers (EC-5)	Post-Excavation Cont. (EC-6)	Conf. of Burial (EC-7)	Impact Barriers (EC-8)	Cargo Sec. Devices and Sys. (EC-9)	Air Monitoring Sys. (EC-10)	Excavation Control Plan (AC-1)	Inventory Control Plan (AC-2)	Cont. Haz. Eval./Verif. & Res. Plan (AC-3)	Fire Protection Program Plan (AC-4)	Air Monitoring and Response Plan (AC-5)	Access Control Plan (AC-6)	Continuous S&M Plan (AC-7)	Vehicle/Equipment Control Plan (AC-8)	Cargo Securement Plan (AC-9)	Safety Management Programs
(13) <u>Hazard Type:</u> Deceleration <u>What-If:</u> Brake failure or other vehicle malfunction causes moving vehicle or equipment to lose control and impact waste containers being processed/staged/ stored within work area enclosure. <u>Outcome:</u> Waste containers are ruptured. Radiological and/or chemical waste is spilled.	✓	✓				✓		✓		✓		✓			✓	✓		✓		✓

Table B-1 (continued)

Scenario Description (Hazard Type, What-If, Outcome)	Engineering Controls										Administrative Controls									
	Work Area Enclosure (EC-1)	Ventilation/Filtration (EC-2)	Mobile Laboratory/DIF Structure (EC-3)	Ventilation/Filtration (EC-4)	Prot. Enclosures/ Barriers (EC-5)	Post-Excavation Cont. (EC-6)	Conf. of Burial (EC-7)	Impact Barriers (EC-8)	Cargo Sec. Devices and Sys. (EC-9)	Air Monitoring Sys. (EC-10)	Excavation Control Plan (AC-1)	Inventory Control Plan (AC-2)	Cont. Haz. Eval./Verif. & Res. Plan (AC-3)	Fire Protection Program Plan (AC-4)	Air Monitoring and Response Plan (AC-5)	Access Control Plan (AC-6)	Continuous S&M Plan (AC-7)	Vehicle/Equipment Control Plan (AC-8)	Cargo Securement Plan (AC-9)	Safety Management Programs
(14) Hazard Type: Deceleration; Flammability and Fires What-If: Brake failure or other vehicle malfunction causes moving vehicle or equipment to lose control and impact waste containers being processed/staged/ stored within work area enclosure. Outcome: Waste containers are ruptured. Radiological and/or chemical waste is spilled. Subsequent fire engulfs containers.	✓	✓				✓		✓		✓		✓		✓	✓	✓		✓		✓

Table B-1 (continued)

Scenario Description (Hazard Type, What-If, Outcome)	Engineering Controls										Administrative Controls									
	Work Area Enclosure (EC-1)	Ventilation/Filtration (EC-2)	Mobile Laboratory/DIF Structure (EC-3)	Ventilation/Filtration (EC-4)	Prot. Enclosures/ Barriers (EC-5)	Post-Excavation Cont. (EC-6)	Conf. of Burial (EC-7)	Impact Barriers (EC-8)	Cargo Sec. Devices and Sys. (EC-9)	Air Monitoring Sys. (EC-10)	Excavation Control Plan (AC-1)	Inventory Control Plan (AC-2)	Cont. Haz. Eval./Verif. & Res. Plan (AC-3)	Fire Protection Program Plan (AC-4)	Air Monitoring and Response Plan (AC-5)	Access Control Plan (AC-6)	Continuous S&M Plan (AC-7)	Vehicle/Equipment Control Plan (AC-8)	Cargo Securement Plan (AC-9)	Safety Management Programs
(15) <u>Hazard Type:</u> Deceleration <u>What-If:</u> Onsite collision occurs, as the result of brake failure or other mechanical defect, between moving vehicle carrying waste containers and equipment or other vehicle. <u>Outcome:</u> Waste containers are ruptured. Radiological and/or chemical waste is spilled.						✓			✓	✓		✓			✓	✓		✓	✓	✓

Table B-1 (continued)

Scenario Description (Hazard Type, What-If, Outcome)	Engineering Controls										Administrative Controls									
	Work Area Enclosure (EC-1)	Ventilation/Filtration (EC-2)	Mobile Laboratory/DIF Structure (EC-3)	Ventilation/Filtration (EC-4)	Prot. Enclosures/ Barriers (EC-5)	Post-Excavation Cont. (EC-6)	Conf. of Burial (EC-7)	Impact Barriers (EC-8)	Cargo Sec. Devices and Sys. (EC-9)	Air Monitoring Sys. (EC-10)	Excavation Control Plan (AC-1)	Inventory Control Plan (AC-2)	Cont. Haz. Eval./Verif. & Res. Plan (AC-3)	Fire Protection Program Plan (AC-4)	Air Monitoring and Response Plan (AC-5)	Access Control Plan (AC-6)	Continuous S&M Plan (AC-7)	Vehicle/Equipment Control Plan (AC-8)	Cargo Securement Plan (AC-9)	Safety Management Programs
(16) Hazard Type: Deceleration; Flammability and Fires What-If: Moving vehicle carrying waste containers is involved in an accident as the result of brake failure or other mechanical defect. Outcome: Waste containers are ruptured. Radiological and/or chemical waste is spilled. Subsequent fire engulfs containers.						✓				✓		✓		✓	✓	✓		✓		✓

Table B-1 (continued)

Scenario Description (Hazard Type, What-If, Outcome)	Engineering Controls										Administrative Controls									
	Work Area Enclosure (EC-1)	Ventilation/Filtration (EC-2)	Mobile Laboratory/DIF Structure (EC-3)	Ventilation/Filtration (EC-4)	Prot. Enclosures/ Barriers (EC-5)	Post-Excavation Cont. (EC-6)	Conf. of Burial (EC-7)	Impact Barriers (EC-8)	Cargo Sec. Devices and Sys. (EC-9)	Air Monitoring Sys. (EC-10)	Excavation Control Plan (AC-1)	Inventory Control Plan (AC-2)	Cont. Haz. Eval./Verif. & Res. Plan (AC-3)	Fire Protection Program Plan (AC-4)	Air Monitoring and Response Plan (AC-5)	Access Control Plan (AC-6)	Continuous S&M Plan (AC-7)	Vehicle/Equipment Control Plan (AC-8)	Cargo Securement Plan (AC-9)	Safety Management Programs
(17) Hazard Type: Electrical What-If: Electrical component of equipment or vehicle overheats or sparks and ignites vegetation or other combustible within work area enclosure. Outcome: Fire has the potential for involving radiological and/or chemical waste in open trenches, staged/stored above ground, and buried waste.	✓	✓				✓	✓			✓	✓	✓		✓	✓	✓	✓			✓

Table B-1 (continued)

Scenario Description (Hazard Type, What-If, Outcome)	Engineering Controls										Administrative Controls									
	Work Area Enclosure (EC-1)	Ventilation/Filtration (EC-2)	Mobile Laboratory/DIF Structure (EC-3)	Ventilation/Filtration (EC-4)	Prot. Enclosures/ Barriers (EC-5)	Post-Excavation Cont. (EC-6)	Conf. of Burial (EC-7)	Impact Barriers (EC-8)	Cargo Sec. Devices and Sys. (EC-9)	Air Monitoring Sys. (EC-10)	Excavation Control Plan (AC-1)	Inventory Control Plan (AC-2)	Cont. Haz. Eval./Verif. & Res. Plan (AC-3)	Fire Protection Program Plan (AC-4)	Air Monitoring and Response Plan (AC-5)	Access Control Plan (AC-6)	Continuous S&M Plan (AC-7)	Vehicle/Equipment Control Plan (AC-8)	Cargo Securement Plan (AC-9)	Safety Management Programs
(18) <u>Hazard Type:</u> Electrical; Explosion <u>What-If:</u> Electrical component of equipment or vehicle explodes within work area enclosure. <u>Outcome:</u> Debris from explosion damages waste containers stored above ground. Resultant fire has the potential for involving radiological and/or chemical waste in open trenches, staged/stored above ground, and buried waste.	✓	✓				✓	✓			✓	✓	✓		✓	✓	✓	✓			✓

Table B-1 (continued)

Scenario Description (Hazard Type, What-If, Outcome)	Engineering Controls										Administrative Controls									
	Work Area Enclosure (EC-1)	Ventilation/Filtration (EC-2)	Mobile Laboratory/DIF Structure (EC-3)	Ventilation/Filtration (EC-4)	Prot. Enclosures/ Barriers (EC-5)	Post-Excavation Cont. (EC-6)	Conf. of Burial (EC-7)	Impact Barriers (EC-8)	Cargo Sec. Devices and Sys. (EC-9)	Air Monitoring Sys. (EC-10)	Excavation Control Plan (AC-1)	Inventory Control Plan (AC-2)	Cont. Haz. Eval./Verif. & Res. Plan (AC-3)	Fire Protection Program Plan (AC-4)	Air Monitoring and Response Plan (AC-5)	Access Control Plan (AC-6)	Continuous S&M Plan (AC-7)	Vehicle/Equipment Control Plan (AC-8)	Cargo Securement Plan (AC-9)	Safety Management Programs
(19) <u>Hazard Type:</u> Electrical <u>What-If:</u> Electrical component of equipment sparks and ignites combustible within DIF or other mobile laboratory. <u>Outcome:</u> Subsequent fire has the potential to involve radiological and/or chemical waste located in the same laboratory.			✓	✓	✓	✓				✓		✓		✓	✓	✓				✓

Table B-1 (continued)

Scenario Description (Hazard Type, What-If, Outcome)	Engineering Controls										Administrative Controls									
	Work Area Enclosure (EC-1)	Ventilation/Filtration (EC-2)	Mobile Laboratory/DIF Structure (EC-3)	Ventilation/Filtration (EC-4)	Prot. Enclosures/ Barriers (EC-5)	Post-Excavation Cont. (EC-6)	Conf. of Burial (EC-7)	Impact Barriers (EC-8)	Cargo Sec. Devices and Sys. (EC-9)	Air Monitoring Sys. (EC-10)	Excavation Control Plan (AC-1)	Inventory Control Plan (AC-2)	Cont. Haz. Eval./Verif. & Res. Plan (AC-3)	Fire Protection Program Plan (AC-4)	Air Monitoring and Response Plan (AC-5)	Access Control Plan (AC-6)	Continuous S&M Plan (AC-7)	Vehicle/Equipment Control Plan (AC-8)	Cargo Securement Plan (AC-9)	Safety Management Programs
(20) <u>Hazard Type:</u> Explosion <u>What-If:</u> Shock sensitive material, high explosives, or unexploded ordnance explode in open trench. <u>Outcome:</u> Explosion and resulting fire engulf contents of open trench with a radiological and/or chemical release.	✓	✓								✓	✓		✓	✓	✓	✓				✓

Table B-1 (continued)

Scenario Description (Hazard Type, What-If, Outcome)	Engineering Controls										Administrative Controls									
	Work Area Enclosure (EC-1)	Ventilation/Filtration (EC-2)	Mobile Laboratory/DIF Structure (EC-3)	Ventilation/Filtration (EC-4)	Prot. Enclosures/ Barriers (EC-5)	Post-Excavation Cont. (EC-6)	Conf. of Burial (EC-7)	Impact Barriers (EC-8)	Cargo Sec. Devices and Sys. (EC-9)	Air Monitoring Sys. (EC-10)	Excavation Control Plan (AC-1)	Inventory Control Plan (AC-2)	Cont. Haz. Eval./Verif. & Res. Plan (AC-3)	Fire Protection Program Plan (AC-4)	Air Monitoring and Response Plan (AC-5)	Access Control Plan (AC-6)	Continuous S&M Plan (AC-7)	Vehicle/Equipment Control Plan (AC-8)	Cargo Securement Plan (AC-9)	Safety Management Programs
(21) <u>Hazard Type:</u> Explosion <u>What-If:</u> Shock sensitive material, high explosives, or unexploded ordnance explode underground in burial pit that is not involved in current trenching. <u>Outcome:</u> Buried waste containers are damaged. Cover material is disturbed. Uncontained radiological and/or chemical waste is exposed.							✓			✓				✓	✓	✓	✓			✓

Table B-1 (continued)

Scenario Description (Hazard Type, What-If, Outcome)	Engineering Controls										Administrative Controls									
	Work Area Enclosure (EC-1)	Ventilation/Filtration (EC-2)	Mobile Laboratory/DIF Structure (EC-3)	Ventilation/Filtration (EC-4)	Prot. Enclosures/ Barriers (EC-5)	Post-Excavation Cont. (EC-6)	Conf. of Burial (EC-7)	Impact Barriers (EC-8)	Cargo Sec. Devices and Sys. (EC-9)	Air Monitoring Sys. (EC-10)	Excavation Control Plan (AC-1)	Inventory Control Plan (AC-2)	Cont. Haz. Eval./Verif. & Res. Plan (AC-3)	Fire Protection Program Plan (AC-4)	Air Monitoring and Response Plan (AC-5)	Access Control Plan (AC-6)	Continuous S&M Plan (AC-7)	Vehicle/Equipment Control Plan (AC-8)	Cargo Securement Plan (AC-9)	Safety Management Programs
(22) <u>Hazard Type:</u> Explosion <u>What-If:</u> Moving vehicle, carrying shock sensitive material, high explosives, or unexploded ordnance, is involved in an accident due to driver error or other causes. <u>Outcome:</u> Explosion and subsequent fire result with the potential for involving radiological and/or chemical waste staged/stored above ground or buried waste.						✓	✓			✓		✓		✓	✓	✓	✓	✓		✓

Table B-1 (continued)

Scenario Description (Hazard Type, What-If, Outcome)	Engineering Controls										Administrative Controls									
	Work Area Enclosure (EC-1)	Ventilation/Filtration (EC-2)	Mobile Laboratory/DIF Structure (EC-3)	Ventilation/Filtration (EC-4)	Prot. Enclosures/ Barriers (EC-5)	Post-Excavation Cont. (EC-6)	Conf. of Burial (EC-7)	Impact Barriers (EC-8)	Cargo Sec. Devices and Sys. (EC-9)	Air Monitoring Sys. (EC-10)	Excavation Control Plan (AC-1)	Inventory Control Plan (AC-2)	Cont. Haz. Eval./Verif. & Res. Plan (AC-3)	Fire Protection Program Plan (AC-4)	Air Monitoring and Response Plan (AC-5)	Access Control Plan (AC-6)	Continuous S&M Plan (AC-7)	Vehicle/Equipment Control Plan (AC-8)	Cargo Securement Plan (AC-9)	Safety Management Programs
(23) Hazard Type: External Events; Explosion What-If: An offsite nearby natural gas line ruptures/explodes due to earthquake, aircraft crash, or other causes. Outcome: Debris and subsequent fire impact the exterior storage area and work area enclosure. Exterior storage area is engulfed in fire. Fire has the potential for involving radiological and/or chemical waste in open trenches, staged/stored above ground, and buried waste.						✓	✓			✓	✓	✓		✓	✓	✓	✓			✓

Table B-1 (continued)

Scenario Description (Hazard Type, What-If, Outcome)	Engineering Controls										Administrative Controls									
	Work Area Enclosure (EC-1)	Ventilation/Filtration (EC-2)	Mobile Laboratory/DIF Structure (EC-3)	Ventilation/Filtration (EC-4)	Prot. Enclosures/ Barriers (EC-5)	Post-Excavation Cont. (EC-6)	Conf. of Burial (EC-7)	Impact Barriers (EC-8)	Cargo Sec. Devices and Sys. (EC-9)	Air Monitoring Sys. (EC-10)	Excavation Control Plan (AC-1)	Inventory Control Plan (AC-2)	Cont. Haz. Eval./Verif. & Res. Plan (AC-3)	Fire Protection Program Plan (AC-4)	Air Monitoring and Response Plan (AC-5)	Access Control Plan (AC-6)	Continuous S&M Plan (AC-7)	Vehicle/Equipment Control Plan (AC-8)	Cargo Securement Plan (AC-9)	Safety Management Programs
(24) Hazard Type: External Events What-If: Aircraft crashes into work area enclosure. Outcome: Waste containers fail and contents are spilled. Subsequent fire has the potential for involving radiological and/or chemical waste in open trenches or staged/stored above ground.						✓				✓	✓	✓		✓	✓	✓				✓

Table B-1 (continued)

Scenario Description (Hazard Type, What-If, Outcome)	Engineering Controls										Administrative Controls									
	Work Area Enclosure (EC-1)	Ventilation/Filtration (EC-2)	Mobile Laboratory/DIF Structure (EC-3)	Ventilation/Filtration (EC-4)	Prot. Enclosures/ Barriers (EC-5)	Post-Excavation Cont. (EC-6)	Conf. of Burial (EC-7)	Impact Barriers (EC-8)	Cargo Sec. Devices and Sys. (EC-9)	Air Monitoring Sys. (EC-10)	Excavation Control Plan (AC-1)	Inventory Control Plan (AC-2)	Cont. Haz. Eval./Verif. & Res. Plan (AC-3)	Fire Protection Program Plan (AC-4)	Air Monitoring and Response Plan (AC-5)	Access Control Plan (AC-6)	Continuous S&M Plan (AC-7)	Vehicle/Equipment Control Plan (AC-8)	Cargo Securement Plan (AC-9)	Safety Management Programs
(25) Hazard Type: External Events What-If: Aircraft crashes into MDA B (outside work area enclosure). Outcome: Cover material over burial pits is disturbed and some previously buried waste containers are exposed. Subsequent fire has the potential for involving the work area enclosure, as well as all exterior areas.						✓	✓			✓	✓	✓		✓	✓	✓	✓			✓

Table B-1 (continued)

Scenario Description (Hazard Type, What-If, Outcome)	Engineering Controls										Administrative Controls									
	Work Area Enclosure (EC-1)	Ventilation/Filtration (EC-2)	Mobile Laboratory/DIF Structure (EC-3)	Ventilation/Filtration (EC-4)	Prot. Enclosures/ Barriers (EC-5)	Post-Excavation Cont. (EC-6)	Conf. of Burial (EC-7)	Impact Barriers (EC-8)	Cargo Sec. Devices and Sys. (EC-9)	Air Monitoring Sys. (EC-10)	Excavation Control Plan (AC-1)	Inventory Control Plan (AC-2)	Cont. Haz. Eval./Verif. & Res. Plan (AC-3)	Fire Protection Program Plan (AC-4)	Air Monitoring and Response Plan (AC-5)	Access Control Plan (AC-6)	Continuous S&M Plan (AC-7)	Vehicle/Equipment Control Plan (AC-8)	Cargo Securement Plan (AC-9)	Safety Management Programs
(26) <u>Hazard Type:</u> External Events <u>What-If:</u> Earthquake induces fissures in landfill. <u>Outcome:</u> Cover material no longer provides complete containment. Buried waste containers are damaged. A fire potentially results and engulfs exposed waste.							✓			✓				✓	✓	✓	✓			✓

Table B-1 (continued)

Scenario Description (Hazard Type, What-If, Outcome)	Engineering Controls										Administrative Controls									
	Work Area Enclosure (EC-1)	Ventilation/Filtration (EC-2)	Mobile Laboratory/DIF Structure (EC-3)	Ventilation/Filtration (EC-4)	Prot. Enclosures/ Barriers (EC-5)	Post-Excavation Cont. (EC-6)	Conf. of Burial (EC-7)	Impact Barriers (EC-8)	Cargo Sec. Devices and Sys. (EC-9)	Air Monitoring Sys. (EC-10)	Excavation Control Plan (AC-1)	Inventory Control Plan (AC-2)	Cont. Haz. Eval./Verif. & Res. Plan (AC-3)	Fire Protection Program Plan (AC-4)	Air Monitoring and Response Plan (AC-5)	Access Control Plan (AC-6)	Continuous S&M Plan (AC-7)	Vehicle/Equipment Control Plan (AC-8)	Cargo Securement Plan (AC-9)	Safety Management Programs
(27) Hazard Type: External Events; Potential Energy What-If: Tornado, earthquake, or high winds topple stacked waste containers stored in work area enclosure. Outcome: Contents of waste containers are spilled. A fire potentially results and engulfs spilled material.	✓	✓				✓				✓		✓		✓	✓	✓				✓

Table B-1 (continued)

Scenario Description (Hazard Type, What-If, Outcome)	Engineering Controls										Administrative Controls									
	Work Area Enclosure (EC-1)	Ventilation/Filtration (EC-2)	Mobile Laboratory/DIF Structure (EC-3)	Ventilation/Filtration (EC-4)	Prot. Enclosures/ Barriers (EC-5)	Post-Excavation Cont. (EC-6)	Conf. of Burial (EC-7)	Impact Barriers (EC-8)	Cargo Sec. Devices and Sys. (EC-9)	Air Monitoring Sys. (EC-10)	Excavation Control Plan (AC-1)	Inventory Control Plan (AC-2)	Cont. Haz. Eval./Verif. & Res. Plan (AC-3)	Fire Protection Program Plan (AC-4)	Air Monitoring and Response Plan (AC-5)	Access Control Plan (AC-6)	Continuous S&M Plan (AC-7)	Vehicle/Equipment Control Plan (AC-8)	Cargo Securement Plan (AC-9)	Safety Management Programs
(28) <u>Hazard Type:</u> External Events <u>What-If:</u> Tornado, earthquake, or high winds collapses work area enclosure. <u>Outcome:</u> Waste containers fail and contents are spilled. A fire potentially results and engulfs spilled material.						✓				✓		✓		✓	✓	✓				✓
(29) <u>Hazard Type:</u> External Events <u>What-If:</u> Tornado, earthquake, or high winds damage work area enclosure structure. <u>Outcome:</u> Containment is breached. Airborne contamination within work area enclosure is released to the outside environment.										✓	✓	✓	✓		✓					✓

Table B-1 (continued)

Scenario Description (Hazard Type, What-If, Outcome)	Engineering Controls										Administrative Controls									
	Work Area Enclosure (EC-1)	Ventilation/Filtration (EC-2)	Mobile Laboratory/DIF Structure (EC-3)	Ventilation/Filtration (EC-4)	Prot. Enclosures/ Barriers (EC-5)	Post-Excavation Cont. (EC-6)	Conf. of Burial (EC-7)	Impact Barriers (EC-8)	Cargo Sec. Devices and Sys. (EC-9)	Air Monitoring Sys. (EC-10)	Excavation Control Plan (AC-1)	Inventory Control Plan (AC-2)	Cont. Haz. Eval./Verif. & Res. Plan (AC-3)	Fire Protection Program Plan (AC-4)	Air Monitoring and Response Plan (AC-5)	Access Control Plan (AC-6)	Continuous S&M Plan (AC-7)	Vehicle/Equipment Control Plan (AC-8)	Cargo Securement Plan (AC-9)	Safety Management Programs
(30) Hazard Type: External Events What-If: Tornado, earthquake, or high winds cause power pole with live electric line to fall onto work area enclosure. Outcome: Resulting fire has the potential for involving radiological and/or chemical waste in open trenches, staged/stored above ground, and buried waste.						✓	✓			✓	✓	✓		✓	✓	✓	✓			✓

Table B-1 (continued)

Scenario Description (Hazard Type, What-If, Outcome)	Engineering Controls										Administrative Controls									
	Work Area Enclosure (EC-1)	Ventilation/Filtration (EC-2)	Mobile Laboratory/DIF Structure (EC-3)	Ventilation/Filtration (EC-4)	Prot. Enclosures/ Barriers (EC-5)	Post-Excavation Cont. (EC-6)	Conf. of Burial (EC-7)	Impact Barriers (EC-8)	Cargo Sec. Devices and Sys. (EC-9)	Air Monitoring Sys. (EC-10)	Excavation Control Plan (AC-1)	Inventory Control Plan (AC-2)	Cont. Haz. Eval./Verif. & Res. Plan (AC-3)	Fire Protection Program Plan (AC-4)	Air Monitoring and Response Plan (AC-5)	Access Control Plan (AC-6)	Continuous S&M Plan (AC-7)	Vehicle/Equipment Control Plan (AC-8)	Cargo Securement Plan (AC-9)	Safety Management Programs
(31) Hazard Type: External Events What-If: Earthquake induced fire involves protective covering of non-containerized waste stored within work area enclosure. Outcome: Contamination on large equipment and overburden becomes airborne.	✓	✓								✓		✓		✓	✓	✓				✓

Table B-1 (continued)

Scenario Description (Hazard Type, What-If, Outcome)	Engineering Controls										Administrative Controls									
	Work Area Enclosure (EC-1)	Ventilation/Filtration (EC-2)	Mobile Laboratory/DIF Structure (EC-3)	Ventilation/Filtration (EC-4)	Prot. Enclosures/ Barriers (EC-5)	Post-Excavation Cont. (EC-6)	Conf. of Burial (EC-7)	Impact Barriers (EC-8)	Cargo Sec. Devices and Sys. (EC-9)	Air Monitoring Sys. (EC-10)	Excavation Control Plan (AC-1)	Inventory Control Plan (AC-2)	Cont. Haz. Eval./Verif. & Res. Plan (AC-3)	Fire Protection Program Plan (AC-4)	Air Monitoring and Response Plan (AC-5)	Access Control Plan (AC-6)	Continuous S&M Plan (AC-7)	Vehicle/Equipment Control Plan (AC-8)	Cargo Securement Plan (AC-9)	Safety Management Programs
(32) Hazard Type: External Events What-If: Tornado or high winds loft contaminated overburden stored within work area enclosure. Outcome: Contaminated overburden is dispersed and contamination becomes airborne.	✓	✓				✓				✓		✓			✓	✓				✓

Table B-1 (continued)

Scenario Description (Hazard Type, What-If, Outcome)	Engineering Controls										Administrative Controls									
	Work Area Enclosure (EC-1)	Ventilation/Filtration (EC-2)	Mobile Laboratory/DIF Structure (EC-3)	Ventilation/Filtration (EC-4)	Prot. Enclosures/ Barriers (EC-5)	Post-Excavation Cont. (EC-6)	Conf. of Burial (EC-7)	Impact Barriers (EC-8)	Cargo Sec. Devices and Sys. (EC-9)	Air Monitoring Sys. (EC-10)	Excavation Control Plan (AC-1)	Inventory Control Plan (AC-2)	Cont. Haz. Eval./Verif. & Res. Plan (AC-3)	Fire Protection Program Plan (AC-4)	Air Monitoring and Response Plan (AC-5)	Access Control Plan (AC-6)	Continuous S&M Plan (AC-7)	Vehicle/Equipment Control Plan (AC-8)	Cargo Securement Plan (AC-9)	Safety Management Programs
(33) <u>Hazard Type:</u> External Events; Chemical Reaction; Explosion; Flammability and Fires <u>What-If:</u> Heavy rains cause flooding of open trench containing reactive hazardous materials. <u>Outcome:</u> Exothermic reaction results in a fire and/or explosion within the open trench with a radiological and/or chemical release.	✓	✓								✓	✓		✓	✓	✓	✓				✓

Table B-1 (continued)

Scenario Description (Hazard Type, What-If, Outcome)	Engineering Controls										Administrative Controls									
	Work Area Enclosure (EC-1)	Ventilation/Filtration (EC-2)	Mobile Laboratory/DIF Structure (EC-3)	Ventilation/Filtration (EC-4)	Prot. Enclosures/ Barriers (EC-5)	Post-Excavation Cont. (EC-6)	Conf. of Burial (EC-7)	Impact Barriers (EC-8)	Cargo Sec. Devices and Sys. (EC-9)	Air Monitoring Sys. (EC-10)	Excavation Control Plan (AC-1)	Inventory Control Plan (AC-2)	Cont. Haz. Eval./Verif. & Res. Plan (AC-3)	Fire Protection Program Plan (AC-4)	Air Monitoring and Response Plan (AC-5)	Access Control Plan (AC-6)	Continuous S&M Plan (AC-7)	Vehicle/Equipment Control Plan (AC-8)	Cargo Securement Plan (AC-9)	Safety Management Programs
(34) Hazard Type: External Events What-If: Heavy rains/flooding disperse the stockpile of contaminated overburden stored within the work area enclosure. Outcome: Contamination spreads to clean areas of MDA B and has the potential to spread outside of the MDA B fence line.	✓	✓				✓						✓								✓

Table B-1 (continued)

Scenario Description (Hazard Type, What-If, Outcome)	Engineering Controls										Administrative Controls									
	Work Area Enclosure (EC-1)	Ventilation/Filtration (EC-2)	Mobile Laboratory/DIF Structure (EC-3)	Ventilation/Filtration (EC-4)	Prot. Enclosures/ Barriers (EC-5)	Post-Excavation Cont. (EC-6)	Conf. of Burial (EC-7)	Impact Barriers (EC-8)	Cargo Sec. Devices and Sys. (EC-9)	Air Monitoring Sys. (EC-10)	Excavation Control Plan (AC-1)	Inventory Control Plan (AC-2)	Cont. Haz. Eval./Verif. & Res. Plan (AC-3)	Fire Protection Program Plan (AC-4)	Air Monitoring and Response Plan (AC-5)	Access Control Plan (AC-6)	Continuous S&M Plan (AC-7)	Vehicle/Equipment Control Plan (AC-8)	Cargo Securement Plan (AC-9)	Safety Management Programs
(35) Hazard Type: External Events What-If: Heavy rains/flooding loosen cover material and expose buried waste. Outcome: Contamination is transported to the surface of MDA B with the potential to spread outside of the MDA B fence line.							✓										✓			✓
(36) Hazard Type: External Events What-If: Snow and ice accumulate on the roof of the work area enclosure. Outcome: The work area enclosure collapses. Waste packages fail and contents are spilled.						✓				✓		✓			✓	✓				✓

Table B-1 (continued)

Scenario Description (Hazard Type, What-If, Outcome)	Engineering Controls										Administrative Controls									
	Work Area Enclosure (EC-1)	Ventilation/Filtration (EC-2)	Mobile Laboratory/DIF Structure (EC-3)	Ventilation/Filtration (EC-4)	Prot. Enclosures/ Barriers (EC-5)	Post-Excavation Cont. (EC-6)	Conf. of Burial (EC-7)	Impact Barriers (EC-8)	Cargo Sec. Devices and Sys. (EC-9)	Air Monitoring Sys. (EC-10)	Excavation Control Plan (AC-1)	Inventory Control Plan (AC-2)	Cont. Haz. Eval./Verif. & Res. Plan (AC-3)	Fire Protection Program Plan (AC-4)	Air Monitoring and Response Plan (AC-5)	Access Control Plan (AC-6)	Continuous S&M Plan (AC-7)	Vehicle/Equipment Control Plan (AC-8)	Cargo Securement Plan (AC-9)	Safety Management Programs
(37) <u>Hazard Type:</u> External Events; Chemical Reaction; Explosion; Flammability and Fires <u>What-If:</u> Water/sewer line or water tank/tower is ruptured due to earthquake, aircraft crash, freezing temperatures, or other cause. <u>Outcome:</u> MDA B floods causing flooding of open trench and storage areas that contain reactive hazardous materials. Exothermic reaction results in a fire and/or explosion with the potential for involving radiological and/or chemical waste in open trenches, staged/stored above ground, or buried waste.	✓	✓				✓	✓			✓	✓	✓		✓	✓	✓	✓			✓

Table B-1 (continued)

Scenario Description (Hazard Type, What-If, Outcome)	Engineering Controls										Administrative Controls									
	Work Area Enclosure (EC-1)	Ventilation/Filtration (EC-2)	Mobile Laboratory/DIF Structure (EC-3)	Ventilation/Filtration (EC-4)	Prot. Enclosures/ Barriers (EC-5)	Post-Excavation Cont. (EC-6)	Conf. of Burial (EC-7)	Impact Barriers (EC-8)	Cargo Sec. Devices and Sys. (EC-9)	Air Monitoring Sys. (EC-10)	Excavation Control Plan (AC-1)	Inventory Control Plan (AC-2)	Cont. Haz. Eval./Verif. & Res. Plan (AC-3)	Fire Protection Program Plan (AC-4)	Air Monitoring and Response Plan (AC-5)	Access Control Plan (AC-6)	Continuous S&M Plan (AC-7)	Vehicle/Equipment Control Plan (AC-8)	Cargo Securement Plan (AC-9)	Safety Management Programs
(38) Hazard Type: External Events What-If: Wildland fire is induced by lightning or other cause. Outcome: Fire spreads to MDA B with the potential to involve all areas of MDA B.						✓	✓			✓	✓	✓	✓	✓	✓	✓	✓			✓
(39) Hazard Type: External Events What-If: A vehicle accident occurs on DP Road with a subsequent fire. Outcome: Fire spreads to MDA B with the potential to involve all areas of MDA B.						✓	✓			✓	✓	✓	✓	✓	✓	✓	✓			✓

Table B-1 (continued)

Scenario Description (Hazard Type, What-If, Outcome)	Engineering Controls										Administrative Controls									
	Work Area Enclosure (EC-1)	Ventilation/Filtration (EC-2)	Mobile Laboratory/DIF Structure (EC-3)	Ventilation/Filtration (EC-4)	Prot. Enclosures/ Barriers (EC-5)	Post-Excavation Cont. (EC-6)	Conf. of Burial (EC-7)	Impact Barriers (EC-8)	Cargo Sec. Devices and Sys. (EC-9)	Air Monitoring Sys. (EC-10)	Excavation Control Plan (AC-1)	Inventory Control Plan (AC-2)	Cont. Haz. Eval./Verif. & Res. Plan (AC-3)	Fire Protection Program Plan (AC-4)	Air Monitoring and Response Plan (AC-5)	Access Control Plan (AC-6)	Continuous S&M Plan (AC-7)	Vehicle/Equipment Control Plan (AC-8)	Cargo Securement Plan (AC-9)	Safety Management Programs
(40) <u>Hazard Type:</u> External Events <u>What-If:</u> Earthquake causes onsite transport vehicle carrying waste containers to lose control and crash. <u>Outcome:</u> Containers are ruptured. Radiological and/or chemical waste is spilled.						✓			✓	✓		✓			✓	✓		✓	✓	✓
(41) <u>Hazard Type:</u> External Events <u>What-If:</u> Lightning strikes onsite transport vehicle carrying waste containers. <u>Outcome:</u> Resulting fire engulfs containers with a radiological and/or chemical release.						✓				✓		✓		✓	✓	✓		✓		✓

Table B-1 (continued)

Scenario Description (Hazard Type, What-If, Outcome)	Engineering Controls										Administrative Controls									
	Work Area Enclosure (EC-1)	Ventilation/Filtration (EC-2)	Mobile Laboratory/DIF Structure (EC-3)	Ventilation/Filtration (EC-4)	Prot. Enclosures/ Barriers (EC-5)	Post-Excavation Cont. (EC-6)	Conf. of Burial (EC-7)	Impact Barriers (EC-8)	Cargo Sec. Devices and Sys. (EC-9)	Air Monitoring Sys. (EC-10)	Excavation Control Plan (AC-1)	Inventory Control Plan (AC-2)	Cont. Haz. Eval./Verif. & Res. Plan (AC-3)	Fire Protection Program Plan (AC-4)	Air Monitoring and Response Plan (AC-5)	Access Control Plan (AC-6)	Continuous S&M Plan (AC-7)	Vehicle/Equipment Control Plan (AC-8)	Cargo Securement Plan (AC-9)	Safety Management Programs
(42) Hazard Type: External Events What-If: Heavy rain causes onsite transport vehicle carrying waste containers to lose control and crash. Outcome: Containers are ruptured. Radiological and/or chemical waste is spilled.						✓			✓	✓		✓			✓	✓		✓	✓	✓
(43) Hazard Type: External Events What-If: Tornado or high winds cause onsite transport vehicle carrying waste containers to lose control and crash. Outcome: Containers are ruptured. Radiological and/or chemical waste is spilled.						✓			✓	✓		✓			✓	✓		✓	✓	✓

Table B-1 (continued)

Scenario Description (Hazard Type, What-If, Outcome)	Engineering Controls										Administrative Controls									
	Work Area Enclosure (EC-1)	Ventilation/Filtration (EC-2)	Mobile Laboratory/DIF Structure (EC-3)	Ventilation/Filtration (EC-4)	Prot. Enclosures/ Barriers (EC-5)	Post-Excavation Cont. (EC-6)	Conf. of Burial (EC-7)	Impact Barriers (EC-8)	Cargo Sec. Devices and Sys. (EC-9)	Air Monitoring Sys. (EC-10)	Excavation Control Plan (AC-1)	Inventory Control Plan (AC-2)	Cont. Haz. Eval./Verif. & Res. Plan (AC-3)	Fire Protection Program Plan (AC-4)	Air Monitoring and Response Plan (AC-5)	Access Control Plan (AC-6)	Continuous S&M Plan (AC-7)	Vehicle/Equipment Control Plan (AC-8)	Cargo Securement Plan (AC-9)	Safety Management Programs
(44) Hazard Type: External Events What-If: Freezing temperatures and heavy snow create icy driving conditions causing onsite transport vehicle carrying waste containers to lose control and crash. Outcome: Containers are ruptured. Radiological and/or chemical waste is spilled.						✓			✓	✓		✓			✓	✓		✓	✓	✓

Table B-1 (continued)

Scenario Description (Hazard Type, What-If, Outcome)	Engineering Controls										Administrative Controls									
	Work Area Enclosure (EC-1)	Ventilation/Filtration (EC-2)	Mobile Laboratory/DIF Structure (EC-3)	Ventilation/Filtration (EC-4)	Prot. Enclosures/ Barriers (EC-5)	Post-Excavation Cont. (EC-6)	Conf. of Burial (EC-7)	Impact Barriers (EC-8)	Cargo Sec. Devices and Sys. (EC-9)	Air Monitoring Sys. (EC-10)	Excavation Control Plan (AC-1)	Inventory Control Plan (AC-2)	Cont. Haz. Eval./Verif. & Res. Plan (AC-3)	Fire Protection Program Plan (AC-4)	Air Monitoring and Response Plan (AC-5)	Access Control Plan (AC-6)	Continuous S&M Plan (AC-7)	Vehicle/Equipment Control Plan (AC-8)	Cargo Securement Plan (AC-9)	Safety Management Programs
(45) Hazard Type: External Events; Potential Energy What-If: Tornado, earthquake, or high winds cause waste sample containers to fall from work bench within DIF or other mobile laboratory. Outcome: Containers are broken or ruptured. Radiological and/or chemical waste is spilled.			✓	✓		✓				✓		✓			✓	✓				✓

Table B-1 (continued)

Scenario Description (Hazard Type, What-If, Outcome)	Engineering Controls										Administrative Controls									
	Work Area Enclosure (EC-1)	Ventilation/Filtration (EC-2)	Mobile Laboratory/DIF Structure (EC-3)	Ventilation/Filtration (EC-4)	Prot. Enclosures/ Barriers (EC-5)	Post-Excavation Cont. (EC-6)	Conf. of Burial (EC-7)	Impact Barriers (EC-8)	Cargo Sec. Devices and Sys. (EC-9)	Air Monitoring Sys. (EC-10)	Excavation Control Plan (AC-1)	Inventory Control Plan (AC-2)	Cont. Haz. Eval./Verif. & Res. Plan (AC-3)	Fire Protection Program Plan (AC-4)	Air Monitoring and Response Plan (AC-5)	Access Control Plan (AC-6)	Continuous S&M Plan (AC-7)	Vehicle/Equipment Control Plan (AC-8)	Cargo Securement Plan (AC-9)	Safety Management Programs
(46) <u>Hazard Type:</u> External Events <u>What-If:</u> Tornado, earthquake, or high winds collapse DIF or other mobile laboratory. <u>Outcome:</u> Containers are broken or ruptured. Radiological and/or chemical waste is spilled.					✓	✓				✓		✓			✓	✓				✓

Table B-1 (continued)

Scenario Description (Hazard Type, What-If, Outcome)	Engineering Controls										Administrative Controls									
	Work Area Enclosure (EC-1)	Ventilation/Filtration (EC-2)	Mobile Laboratory/DIF Structure (EC-3)	Ventilation/Filtration (EC-4)	Prot. Enclosures/ Barriers (EC-5)	Post-Excavation Cont. (EC-6)	Conf. of Burial (EC-7)	Impact Barriers (EC-8)	Cargo Sec. Devices and Sys. (EC-9)	Air Monitoring Sys. (EC-10)	Excavation Control Plan (AC-1)	Inventory Control Plan (AC-2)	Cont. Haz. Eval./Verif. & Res. Plan (AC-3)	Fire Protection Program Plan (AC-4)	Air Monitoring and Response Plan (AC-5)	Access Control Plan (AC-6)	Continuous S&M Plan (AC-7)	Vehicle/Equipment Control Plan (AC-8)	Cargo Securement Plan (AC-9)	Safety Management Programs
(47) <u>Hazard Type:</u> External Events <u>What-If:</u> Snow and ice accumulate on the roof of the DIF or other mobile laboratory, causing the structure to collapse. <u>Outcome:</u> Containers are broken or ruptured. Radiological and/or chemical waste is spilled.					✓	✓				✓		✓			✓	✓				✓

Table B-1 (continued)

Scenario Description (Hazard Type, What-If, Outcome)	Engineering Controls										Administrative Controls									
	Work Area Enclosure (EC-1)	Ventilation/Filtration (EC-2)	Mobile Laboratory/DIF Structure (EC-3)	Ventilation/Filtration (EC-4)	Prot. Enclosures/ Barriers (EC-5)	Post-Excavation Cont. (EC-6)	Conf. of Burial (EC-7)	Impact Barriers (EC-8)	Cargo Sec. Devices and Sys. (EC-9)	Air Monitoring Sys. (EC-10)	Excavation Control Plan (AC-1)	Inventory Control Plan (AC-2)	Cont. Haz. Eval./Verif. & Res. Plan (AC-3)	Fire Protection Program Plan (AC-4)	Air Monitoring and Response Plan (AC-5)	Access Control Plan (AC-6)	Continuous S&M Plan (AC-7)	Vehicle/Equipment Control Plan (AC-8)	Cargo Securement Plan (AC-9)	Safety Management Programs
(48) Hazard Type: External Events What-If: Aircraft crashes into DIF or other mobile laboratory. Outcome: Subsequent fire has the potential to involve radiological and/or chemical waste located in the same laboratory.						✓				✓		✓		✓	✓	✓				✓
(49) Hazard Type: External Events What-If: Lightning strikes DIF or other mobile laboratory. Outcome: Subsequent fire has the potential to involve radiological and/or chemical waste located in the same laboratory.						✓				✓		✓		✓	✓	✓				✓

Table B-1 (continued)

Scenario Description (Hazard Type, What-If, Outcome)	Engineering Controls										Administrative Controls									
	Work Area Enclosure (EC-1)	Ventilation/Filtration (EC-2)	Mobile Laboratory/DIF Structure (EC-3)	Ventilation/Filtration (EC-4)	Prot. Enclosures/ Barriers (EC-5)	Post-Excavation Cont. (EC-6)	Conf. of Burial (EC-7)	Impact Barriers (EC-8)	Cargo Sec. Devices and Sys. (EC-9)	Air Monitoring Sys. (EC-10)	Excavation Control Plan (AC-1)	Inventory Control Plan (AC-2)	Cont. Haz. Eval./Verif. & Res. Plan (AC-3)	Fire Protection Program Plan (AC-4)	Air Monitoring and Response Plan (AC-5)	Access Control Plan (AC-6)	Continuous S&M Plan (AC-7)	Vehicle/Equipment Control Plan (AC-8)	Cargo Securement Plan (AC-9)	Safety Management Programs
(50) Hazard Type: External Events What-If: Wildfire spreads to MDA B during S&M. Outcome: Heat from fire mobilizes contamination on buried radiological and/or chemical waste.							✓			✓				✓	✓	✓	✓			✓

Table B-1 (continued)

Scenario Description (Hazard Type, What-If, Outcome)	Engineering Controls										Administrative Controls									
	Work Area Enclosure (EC-1)	Ventilation/Filtration (EC-2)	Mobile Laboratory/DIF Structure (EC-3)	Ventilation/Filtration (EC-4)	Prot. Enclosures/ Barriers (EC-5)	Post-Excavation Cont. (EC-6)	Conf. of Burial (EC-7)	Impact Barriers (EC-8)	Cargo Sec. Devices and Sys. (EC-9)	Air Monitoring Sys. (EC-10)	Excavation Control Plan (AC-1)	Inventory Control Plan (AC-2)	Cont. Haz. Eval./Verif. & Res. Plan (AC-3)	Fire Protection Program Plan (AC-4)	Air Monitoring and Response Plan (AC-5)	Access Control Plan (AC-6)	Continuous S&M Plan (AC-7)	Vehicle/Equipment Control Plan (AC-8)	Cargo Securement Plan (AC-9)	Safety Management Programs
(51) Hazard Type: Flammability and Fires What-If: Combustibles, such as cellulose materials, are inadvertently ignited within work area enclosure. Outcome: A fire results with the potential for involving radiological and/or chemical waste in open trenches, staged/stored above ground, or buried waste.	✓	✓				✓	✓			✓	✓	✓		✓	✓	✓	✓			✓

Table B-1 (continued)

Scenario Description (Hazard Type, What-If, Outcome)	Engineering Controls										Administrative Controls									
	Work Area Enclosure (EC-1)	Ventilation/Filtration (EC-2)	Mobile Laboratory/DIF Structure (EC-3)	Ventilation/Filtration (EC-4)	Prot. Enclosures/ Barriers (EC-5)	Post-Excavation Cont. (EC-6)	Conf. of Burial (EC-7)	Impact Barriers (EC-8)	Cargo Sec. Devices and Sys. (EC-9)	Air Monitoring Sys. (EC-10)	Excavation Control Plan (AC-1)	Inventory Control Plan (AC-2)	Cont. Haz. Eval./Verif. & Res. Plan (AC-3)	Fire Protection Program Plan (AC-4)	Air Monitoring and Response Plan (AC-5)	Access Control Plan (AC-6)	Continuous S&M Plan (AC-7)	Vehicle/Equipment Control Plan (AC-8)	Cargo Securement Plan (AC-9)	Safety Management Programs
(52) Hazard Type: Flammability and Fires What-If: Fuel of equipment or vehicle is ignited within work area enclosure. Outcome: A fire results with the potential for involving radiological and/or chemical waste in open trenches, staged/stored above ground, or buried waste.	✓	✓				✓	✓			✓	✓	✓		✓	✓	✓	✓	✓		✓

Table B-1 (continued)

Scenario Description (Hazard Type, What-If, Outcome)	Engineering Controls										Administrative Controls									
	Work Area Enclosure (EC-1)	Ventilation/Filtration (EC-2)	Mobile Laboratory/DIF Structure (EC-3)	Ventilation/Filtration (EC-4)	Prot. Enclosures/ Barriers (EC-5)	Post-Excavation Cont. (EC-6)	Conf. of Burial (EC-7)	Impact Barriers (EC-8)	Cargo Sec. Devices and Sys. (EC-9)	Air Monitoring Sys. (EC-10)	Excavation Control Plan (AC-1)	Inventory Control Plan (AC-2)	Cont. Haz. Eval./Verif. & Res. Plan (AC-3)	Fire Protection Program Plan (AC-4)	Air Monitoring and Response Plan (AC-5)	Access Control Plan (AC-6)	Continuous S&M Plan (AC-7)	Vehicle/Equipment Control Plan (AC-8)	Cargo Securement Plan (AC-9)	Safety Management Programs
(53) <u>Hazard Type:</u> Flammability and Fires <u>What-If:</u> Pyrophoric material spontaneously combusts within work area enclosure. <u>Outcome:</u> A fire results with the potential for involving radiological and/or chemical waste in open trenches, staged/stored above ground, or buried waste.	✓	✓				✓	✓			✓	✓	✓	✓	✓	✓	✓	✓			✓

Table B-1 (continued)

Scenario Description (Hazard Type, What-If, Outcome)	Engineering Controls										Administrative Controls									
	Work Area Enclosure (EC-1)	Ventilation/Filtration (EC-2)	Mobile Laboratory/DIF Structure (EC-3)	Ventilation/Filtration (EC-4)	Prot. Enclosures/ Barriers (EC-5)	Post-Excavation Cont. (EC-6)	Conf. of Burial (EC-7)	Impact Barriers (EC-8)	Cargo Sec. Devices and Sys. (EC-9)	Air Monitoring Sys. (EC-10)	Excavation Control Plan (AC-1)	Inventory Control Plan (AC-2)	Cont. Haz. Eval./Verif. & Res. Plan (AC-3)	Fire Protection Program Plan (AC-4)	Air Monitoring and Response Plan (AC-5)	Access Control Plan (AC-6)	Continuous S&M Plan (AC-7)	Vehicle/Equipment Control Plan (AC-8)	Cargo Securement Plan (AC-9)	Safety Management Programs
(54) Hazard Type: Flammability and Fires What-If: Workers initiate fire through the improper use of equipment or as the result of an unauthorized activity (e.g., smoking). Outcome: A fire results with the potential for involving radiological and/or chemical waste in open trenches, staged/stored above ground, or buried waste.	✓	✓				✓	✓			✓	✓	✓		✓	✓	✓	✓			✓

Table B-1 (continued)

Scenario Description (Hazard Type, What-If, Outcome)	Engineering Controls										Administrative Controls									
	Work Area Enclosure (EC-1)	Ventilation/Filtration (EC-2)	Mobile Laboratory/DIF Structure (EC-3)	Ventilation/Filtration (EC-4)	Prot. Enclosures/ Barriers (EC-5)	Post-Excavation Cont. (EC-6)	Conf. of Burial (EC-7)	Impact Barriers (EC-8)	Cargo Sec. Devices and Sys. (EC-9)	Air Monitoring Sys. (EC-10)	Excavation Control Plan (AC-1)	Inventory Control Plan (AC-2)	Cont. Haz. Eval./Verif. & Res. Plan (AC-3)	Fire Protection Program Plan (AC-4)	Air Monitoring and Response Plan (AC-5)	Access Control Plan (AC-6)	Continuous S&M Plan (AC-7)	Vehicle/Equipment Control Plan (AC-8)	Cargo Securement Plan (AC-9)	Safety Managment Programs
(55) <u>Hazard Type:</u> Flammability and Fires <u>What-If:</u> During refueling of vehicles and equipment, fuel spills onto the ground and ignites a fire. <u>Outcome:</u> A fire results with the potential for involving radiological and/or chemical waste in open trenches, staged/stored above ground, or buried waste.						✓	✓			✓	✓	✓		✓	✓	✓	✓	✓		✓

Table B-1 (continued)

Scenario Description (Hazard Type, What-If, Outcome)	Engineering Controls										Administrative Controls									
	Work Area Enclosure (EC-1)	Ventilation/Filtration (EC-2)	Mobile Laboratory/DIF Structure (EC-3)	Ventilation/Filtration (EC-4)	Prot. Enclosures/ Barriers (EC-5)	Post-Excavation Cont. (EC-6)	Conf. of Burial (EC-7)	Impact Barriers (EC-8)	Cargo Sec. Devices and Sys. (EC-9)	Air Monitoring Sys. (EC-10)	Excavation Control Plan (AC-1)	Inventory Control Plan (AC-2)	Cont. Haz. Eval./Verif. & Res. Plan (AC-3)	Fire Protection Program Plan (AC-4)	Air Monitoring and Response Plan (AC-5)	Access Control Plan (AC-6)	Continuous S&M Plan (AC-7)	Vehicle/Equipment Control Plan (AC-8)	Cargo Securement Plan (AC-9)	Safety Management Programs
(56) <u>Hazard Type:</u> Flammability and Fires <u>What-If:</u> Pyrophoric material spontaneously combusts within DIF or other mobile laboratory. <u>Outcome:</u> Subsequent fire has the potential to involve radiological and/or chemical waste located in the same laboratory.			✓	✓	✓	✓				✓		✓		✓	✓	✓				✓

Table B-1 (continued)

Scenario Description (Hazard Type, What-If, Outcome)	Engineering Controls										Administrative Controls									
	Work Area Enclosure (EC-1)	Ventilation/Filtration (EC-2)	Mobile Laboratory/DIF Structure (EC-3)	Ventilation/Filtration (EC-4)	Prot. Enclosures/ Barriers (EC-5)	Post-Excavation Cont. (EC-6)	Conf. of Burial (EC-7)	Impact Barriers (EC-8)	Cargo Sec. Devices and Sys. (EC-9)	Air Monitoring Sys. (EC-10)	Excavation Control Plan (AC-1)	Inventory Control Plan (AC-2)	Cont. Haz. Eval./Verif. & Res. Plan (AC-3)	Fire Protection Program Plan (AC-4)	Air Monitoring and Response Plan (AC-5)	Access Control Plan (AC-6)	Continuous S&M Plan (AC-7)	Vehicle/Equipment Control Plan (AC-8)	Cargo Securement Plan (AC-9)	Safety Management Programs
(57) Hazard Type: Heat and Temperature What-If: Equipment or vehicle exhaust ignites vegetation or other combustible within work area enclosure. Outcome: A fire results with the potential for involving radiological and/or chemical waste in open trenches, staged/stored above ground, or buried waste.	✓	✓				✓	✓			✓	✓	✓		✓	✓	✓	✓			✓

Table B-1 (continued)

Scenario Description (Hazard Type, What-If, Outcome)	Engineering Controls										Administrative Controls									
	Work Area Enclosure (EC-1)	Ventilation/Filtration (EC-2)	Mobile Laboratory/DIF Structure (EC-3)	Ventilation/Filtration (EC-4)	Prot. Enclosures/ Barriers (EC-5)	Post-Excavation Cont. (EC-6)	Conf. of Burial (EC-7)	Impact Barriers (EC-8)	Cargo Sec. Devices and Sys. (EC-9)	Air Monitoring Sys. (EC-10)	Excavation Control Plan (AC-1)	Inventory Control Plan (AC-2)	Cont. Haz. Eval./Verif. & Res. Plan (AC-3)	Fire Protection Program Plan (AC-4)	Air Monitoring and Response Plan (AC-5)	Access Control Plan (AC-6)	Continuous S&M Plan (AC-7)	Vehicle/Equipment Control Plan (AC-8)	Cargo Securement Plan (AC-9)	Safety Managment Programs
(58) <u>Hazard Type:</u> Heat and Temperature <u>What-If:</u> Equipment or vehicle exhaust ignites vegetation or other combustible external to work area enclosure. <u>Outcome:</u> Fire has the potential to involve radiological and/or chemical waste in open trenches, staged/stored above ground, or buried waste.						✓	✓			✓	✓	✓		✓	✓	✓	✓	✓		✓

Table B-1 (continued)

Scenario Description (Hazard Type, What-If, Outcome)	Engineering Controls										Administrative Controls									
	Work Area Enclosure (EC-1)	Ventilation/Filtration (EC-2)	Mobile Laboratory/DIF Structure (EC-3)	Ventilation/Filtration (EC-4)	Prot. Enclosures/ Barriers (EC-5)	Post-Excavation Cont. (EC-6)	Conf. of Burial (EC-7)	Impact Barriers (EC-8)	Cargo Sec. Devices and Sys. (EC-9)	Air Monitoring Sys. (EC-10)	Excavation Control Plan (AC-1)	Inventory Control Plan (AC-2)	Cont. Haz. Eval./Verif. & Res. Plan (AC-3)	Fire Protection Program Plan (AC-4)	Air Monitoring and Response Plan (AC-5)	Access Control Plan (AC-6)	Continuous S&M Plan (AC-7)	Vehicle/Equipment Control Plan (AC-8)	Cargo Securement Plan (AC-9)	Safety Management Programs
(59) <u>Hazard Type:</u> Kinetic Energy; Radiation <u>What-If:</u> Asphalt is found to be contaminated during cutting/breaking of asphalt within work area enclosure during removal of cover layer. <u>Outcome:</u> Contamination is dispersed and becomes airborne.	✓	✓								✓					✓	✓				✓

Table B-1 (continued)

Scenario Description (Hazard Type, What-If, Outcome)	Engineering Controls										Administrative Controls									
	Work Area Enclosure (EC-1)	Ventilation/Filtration (EC-2)	Mobile Laboratory/DIF Structure (EC-3)	Ventilation/Filtration (EC-4)	Prot. Enclosures/ Barriers (EC-5)	Post-Excavation Cont. (EC-6)	Conf. of Burial (EC-7)	Impact Barriers (EC-8)	Cargo Sec. Devices and Sys. (EC-9)	Air Monitoring Sys. (EC-10)	Excavation Control Plan (AC-1)	Inventory Control Plan (AC-2)	Cont. Haz. Eval./Verif. & Res. Plan (AC-3)	Fire Protection Program Plan (AC-4)	Air Monitoring and Response Plan (AC-5)	Access Control Plan (AC-6)	Continuous S&M Plan (AC-7)	Vehicle/Equipment Control Plan (AC-8)	Cargo Securement Plan (AC-9)	Safety Management Programs
(60) Hazard Type: Kinetic Energy; Chemical Reaction; Explosion; Flammability and Fires What-If: As the result of human error, equipment inadvertently ruptures a container or containers containing reactive hazardous materials within open trench. Outcome: Exothermic reaction results in a fire and/or explosion within the open trench with a radiological and/or chemical release.	✓	✓								✓	✓		✓	✓	✓	✓				✓

Table B-1 (continued)

Scenario Description (Hazard Type, What-If, Outcome)	Engineering Controls										Administrative Controls									
	Work Area Enclosure (EC-1)	Ventilation/Filtration (EC-2)	Mobile Laboratory/DIF Structure (EC-3)	Ventilation/Filtration (EC-4)	Prot. Enclosures/ Barriers (EC-5)	Post-Excavation Cont. (EC-6)	Conf. of Burial (EC-7)	Impact Barriers (EC-8)	Cargo Sec. Devices and Sys. (EC-9)	Air Monitoring Sys. (EC-10)	Excavation Control Plan (AC-1)	Inventory Control Plan (AC-2)	Cont. Haz. Eval./Verif. & Res. Plan (AC-3)	Fire Protection Program Plan (AC-4)	Air Monitoring and Response Plan (AC-5)	Access Control Plan (AC-6)	Continuous S&M Plan (AC-7)	Vehicle/Equipment Control Plan (AC-8)	Cargo Securement Plan (AC-9)	Safety Management Programs
(61) Hazard Type: Kinetic Energy; Explosion What-If: As the result of human error, equipment inadvertently ruptures a container or containers containing shock sensitive materials, high explosives, or unexploded ordnance within open trench. Outcome: Explosion results in a fire within the open trench with a radiological and/or chemical release.	✓	✓								✓	✓		✓	✓	✓	✓				✓

Table B-1 (continued)

Scenario Description (Hazard Type, What-If, Outcome)	Engineering Controls										Administrative Controls									
	Work Area Enclosure (EC-1)	Ventilation/Filtration (EC-2)	Mobile Laboratory/DIF Structure (EC-3)	Ventilation/Filtration (EC-4)	Prot. Enclosures/ Barriers (EC-5)	Post-Excavation Cont. (EC-6)	Conf. of Burial (EC-7)	Impact Barriers (EC-8)	Cargo Sec. Devices and Sys. (EC-9)	Air Monitoring Sys. (EC-10)	Excavation Control Plan (AC-1)	Inventory Control Plan (AC-2)	Cont. Haz. Eval./Verif. & Res. Plan (AC-3)	Fire Protection Program Plan (AC-4)	Air Monitoring and Response Plan (AC-5)	Access Control Plan (AC-6)	Continuous S&M Plan (AC-7)	Vehicle/Equipment Control Plan (AC-8)	Cargo Securement Plan (AC-9)	Safety Management Programs
(62) Hazard Type: Kinetic Energy What-If: As the result of human error, equipment inadvertently ruptures a container or containers (within an open trench) containing radiological and/or chemical waste. Outcome: Radiological and/or chemical waste is spilled within trench.	✓	✓								✓	✓		✓		✓	✓				✓

Table B-1 (continued)

Scenario Description (Hazard Type, What-If, Outcome)	Engineering Controls										Administrative Controls									
	Work Area Enclosure (EC-1)	Ventilation/Filtration (EC-2)	Mobile Laboratory/DIF Structure (EC-3)	Ventilation/Filtration (EC-4)	Prot. Enclosures/ Barriers (EC-5)	Post-Excavation Cont. (EC-6)	Conf. of Burial (EC-7)	Impact Barriers (EC-8)	Cargo Sec. Devices and Sys. (EC-9)	Air Monitoring Sys. (EC-10)	Excavation Control Plan (AC-1)	Inventory Control Plan (AC-2)	Cont. Haz. Eval./Verif. & Res. Plan (AC-3)	Fire Protection Program Plan (AC-4)	Air Monitoring and Response Plan (AC-5)	Access Control Plan (AC-6)	Continuous S&M Plan (AC-7)	Vehicle/Equipment Control Plan (AC-8)	Cargo Securement Plan (AC-9)	Safety Management Programs
(63) Hazard Type: Kinetic Energy; Potential Energy What-If: As the result of human error, equipment inadvertently runs into stacked containers containing radiological and/or chemical waste (staged/stored within the work area enclosure), toppling containers. Outcome: Radiological and/or chemical waste is spilled.	✓	✓				✓		✓		✓		✓			✓	✓				✓

Table B-1 (continued)

Scenario Description (Hazard Type, What-If, Outcome)	Engineering Controls										Administrative Controls									
	Work Area Enclosure (EC-1)	Ventilation/Filtration (EC-2)	Mobile Laboratory/DIF Structure (EC-3)	Ventilation/Filtration (EC-4)	Prot. Enclosures/ Barriers (EC-5)	Post-Excavation Cont. (EC-6)	Conf. of Burial (EC-7)	Impact Barriers (EC-8)	Cargo Sec. Devices and Sys. (EC-9)	Air Monitoring Sys. (EC-10)	Excavation Control Plan (AC-1)	Inventory Control Plan (AC-2)	Cont. Haz. Eval./Verif. & Res. Plan (AC-3)	Fire Protection Program Plan (AC-4)	Air Monitoring and Response Plan (AC-5)	Access Control Plan (AC-6)	Continuous S&M Plan (AC-7)	Vehicle/Equipment Control Plan (AC-8)	Cargo Securement Plan (AC-9)	Safety Management Programs
(64) Hazard Type: Kinetic Energy What-If: During excavation of trench, radiological material distributed in the soil is re-suspended. Outcome: Radiological material becomes airborne.	✓	✓								✓	✓		✓		✓	✓				✓
(65) Hazard Type: Kinetic Energy What-If: As the result of human error, forklift pierces container containing radiological and/or chemical waste within work area enclosure. Outcome: Radiological and/or chemical waste is spilled.	✓	✓				✓				✓		✓			✓	✓				✓

Table B-1 (continued)

Scenario Description (Hazard Type, What-If, Outcome)	Engineering Controls										Administrative Controls									
	Work Area Enclosure (EC-1)	Ventilation/Filtration (EC-2)	Mobile Laboratory/DIF Structure (EC-3)	Ventilation/Filtration (EC-4)	Prot. Enclosures/ Barriers (EC-5)	Post-Excavation Cont. (EC-6)	Conf. of Burial (EC-7)	Impact Barriers (EC-8)	Cargo Sec. Devices and Sys. (EC-9)	Air Monitoring Sys. (EC-10)	Excavation Control Plan (AC-1)	Inventory Control Plan (AC-2)	Cont. Haz. Eval./Verif. & Res. Plan (AC-3)	Fire Protection Program Plan (AC-4)	Air Monitoring and Response Plan (AC-5)	Access Control Plan (AC-6)	Continuous S&M Plan (AC-7)	Vehicle/Equipment Control Plan (AC-8)	Cargo Securement Plan (AC-9)	Safety Management Programs
(66) <u>Hazard Type:</u> Kinetic Energy; Chemical Reaction; Explosion; Flammability and Fires <u>What-If:</u> As the result of human error, forklift pierces container within work area enclosure containing reactive hazardous materials. <u>Outcome:</u> Exothermic reaction results in a fire and/or explosion with the potential for involving radiological and/or chemical waste in open trenches, staged/stored above ground, or buried waste.	✓	✓				✓	✓			✓	✓	✓		✓	✓	✓	✓			✓

Table B-1 (continued)

Scenario Description (Hazard Type, What-If, Outcome)	Engineering Controls										Administrative Controls									
	Work Area Enclosure (EC-1)	Ventilation/Filtration (EC-2)	Mobile Laboratory/DIF Structure (EC-3)	Ventilation/Filtration (EC-4)	Prot. Enclosures/ Barriers (EC-5)	Post-Excavation Cont. (EC-6)	Conf. of Burial (EC-7)	Impact Barriers (EC-8)	Cargo Sec. Devices and Sys. (EC-9)	Air Monitoring Sys. (EC-10)	Excavation Control Plan (AC-1)	Inventory Control Plan (AC-2)	Cont. Haz. Eval./Verif. & Res. Plan (AC-3)	Fire Protection Program Plan (AC-4)	Air Monitoring and Response Plan (AC-5)	Access Control Plan (AC-6)	Continuous S&M Plan (AC-7)	Vehicle/Equipment Control Plan (AC-8)	Cargo Securement Plan (AC-9)	Safety Management Programs
(67) <u>Hazard Type:</u> Leak of Material <u>What-If:</u> During exposure of contents of trench, containers containing radiological and/or chemical waste are discovered to be broken and leaking. <u>Outcome:</u> Radiological and/or chemical waste is spilled.	✓	✓								✓	✓		✓		✓	✓				✓

Table B-1 (continued)

Scenario Description (Hazard Type, What-If, Outcome)	Engineering Controls										Administrative Controls									
	Work Area Enclosure (EC-1)	Ventilation/Filtration (EC-2)	Mobile Laboratory/DIF Structure (EC-3)	Ventilation/Filtration (EC-4)	Prot. Enclosures/ Barriers (EC-5)	Post-Excavation Cont. (EC-6)	Conf. of Burial (EC-7)	Impact Barriers (EC-8)	Cargo Sec. Devices and Sys. (EC-9)	Air Monitoring Sys. (EC-10)	Excavation Control Plan (AC-1)	Inventory Control Plan (AC-2)	Cont. Haz. Eval./Verif. & Res. Plan (AC-3)	Fire Protection Program Plan (AC-4)	Air Monitoring and Response Plan (AC-5)	Access Control Plan (AC-6)	Continuous S&M Plan (AC-7)	Vehicle/Equipment Control Plan (AC-8)	Cargo Securement Plan (AC-9)	Safety Management Programs
(68) <u>Hazard Type:</u> Leak of Material; Chemical Reaction; Explosion; Flammability and Fires <u>What-If:</u> During exposure of contents of trench, containers containing reactive hazardous materials are discovered to be broken and leaking. <u>Outcome:</u> Exothermic reaction results in a fire and/or explosion within the open trench with a radiological and/or chemical release.	✓	✓								✓	✓		✓	✓	✓	✓				✓

Table B-1 (continued)

Scenario Description (Hazard Type, What-If, Outcome)	Engineering Controls										Administrative Controls									
	Work Area Enclosure (EC-1)	Ventilation/Filtration (EC-2)	Mobile Laboratory/DIF Structure (EC-3)	Ventilation/Filtration (EC-4)	Prot. Enclosures/ Barriers (EC-5)	Post-Excavation Cont. (EC-6)	Conf. of Burial (EC-7)	Impact Barriers (EC-8)	Cargo Sec. Devices and Sys. (EC-9)	Air Monitoring Sys. (EC-10)	Excavation Control Plan (AC-1)	Inventory Control Plan (AC-2)	Cont. Haz. Eval./Verif. & Res. Plan (AC-3)	Fire Protection Program Plan (AC-4)	Air Monitoring and Response Plan (AC-5)	Access Control Plan (AC-6)	Continuous S&M Plan (AC-7)	Vehicle/Equipment Control Plan (AC-8)	Cargo Securement Plan (AC-9)	Safety Management Programs
(69) Hazard Type: Leak of Material What-If: Waste transfer hose leaks during operations. Outcome: Radiological and/or chemical waste is spilled.	✓	✓								✓	✓		✓		✓	✓				✓
(70) Hazard Type: Leak of Material What-If: Gas cylinder is leaking from valve assembly during processing in work area enclosure. Outcome: Contents of cylinder are released.	✓	✓								✓		✓			✓	✓				✓

Table B-1 (continued)

Scenario Description (Hazard Type, What-If, Outcome)	Engineering Controls										Administrative Controls									
	Work Area Enclosure (EC-1)	Ventilation/Filtration (EC-2)	Mobile Laboratory/DIF Structure (EC-3)	Ventilation/Filtration (EC-4)	Prot. Enclosures/ Barriers (EC-5)	Post-Excavation Cont. (EC-6)	Conf. of Burial (EC-7)	Impact Barriers (EC-8)	Cargo Sec. Devices and Sys. (EC-9)	Air Monitoring Sys. (EC-10)	Excavation Control Plan (AC-1)	Inventory Control Plan (AC-2)	Cont. Haz. Eval./Verif. & Res. Plan (AC-3)	Fire Protection Program Plan (AC-4)	Air Monitoring and Response Plan (AC-5)	Access Control Plan (AC-6)	Continuous S&M Plan (AC-7)	Vehicle/Equipment Control Plan (AC-8)	Cargo Securement Plan (AC-9)	Safety Management Programs
(71) Hazard Type: Leak of Material What-If: Ventilation/filtration system fails as the result of dust loading, wetting, material defect, loss of power, or other cause. Outcome: Airborne contamination within work area enclosure or mobile laboratory/DIF is release to the outside environment.										✓	✓	✓	✓		✓					✓

Table B-1 (continued)

Scenario Description (Hazard Type, What-If, Outcome)	Engineering Controls										Administrative Controls									
	Work Area Enclosure (EC-1)	Ventilation/Filtration (EC-2)	Mobile Laboratory/DIF Structure (EC-3)	Ventilation/Filtration (EC-4)	Prot. Enclosures/ Barriers (EC-5)	Post-Excavation Cont. (EC-6)	Conf. of Burial (EC-7)	Impact Barriers (EC-8)	Cargo Sec. Devices and Sys. (EC-9)	Air Monitoring Sys. (EC-10)	Excavation Control Plan (AC-1)	Inventory Control Plan (AC-2)	Cont. Haz. Eval./Verif. & Res. Plan (AC-3)	Fire Protection Program Plan (AC-4)	Air Monitoring and Response Plan (AC-5)	Access Control Plan (AC-6)	Continuous S&M Plan (AC-7)	Vehicle/Equipment Control Plan (AC-8)	Cargo Securement Plan (AC-9)	Safety Management Programs
(72) Hazard Type: Mechanical What-If: Work inadvertently cuts himself/herself with glass from a broken container. Outcome: Worker suffers exposure to radiological and/or chemical contaminant.																✓				✓
(73) Hazard Type: Potential Energy What-If: Waste container is inadvertently dropped back into trench during removal of container from trench due to equipment malfunction. Outcome: Radiological and/or chemical waste is spilled.	✓	✓								✓	✓		✓		✓	✓				✓

Table B-1 (continued)

Scenario Description (Hazard Type, What-If, Outcome)	Engineering Controls										Administrative Controls									
	Work Area Enclosure (EC-1)	Ventilation/Filtration (EC-2)	Mobile Laboratory/DIF Structure (EC-3)	Ventilation/Filtration (EC-4)	Prot. Enclosures/ Barriers (EC-5)	Post-Excavation Cont. (EC-6)	Conf. of Burial (EC-7)	Impact Barriers (EC-8)	Cargo Sec. Devices and Sys. (EC-9)	Air Monitoring Sys. (EC-10)	Excavation Control Plan (AC-1)	Inventory Control Plan (AC-2)	Cont. Haz. Eval./Verif. & Res. Plan (AC-3)	Fire Protection Program Plan (AC-4)	Air Monitoring and Response Plan (AC-5)	Access Control Plan (AC-6)	Continuous S&M Plan (AC-7)	Vehicle/Equipment Control Plan (AC-8)	Cargo Securement Plan (AC-9)	Safety Management Programs
(74) Hazard Type: Potential Energy What-If: Containers containing radiological and/or chemical waste fall from moving forklift within work area enclosure. Outcome: Radiological and/or chemical waste is spilled.	✓	✓				✓				✓		✓			✓	✓				✓
(75) Hazard Type: Potential Energy What-If: Equipment falls into excavation, sinkhole, or other void space in landfill. Outcome: Equipment is contaminated. Waste containers are ruptured. Radiological and/or chemical waste is spilled.							✓			✓					✓	✓	✓	✓		✓

Table B-1 (continued)

Scenario Description (Hazard Type, What-If, Outcome)	Engineering Controls										Administrative Controls									
	Work Area Enclosure (EC-1)	Ventilation/Filtration (EC-2)	Mobile Laboratory/DIF Structure (EC-3)	Ventilation/Filtration (EC-4)	Prot. Enclosures/ Barriers (EC-5)	Post-Excavation Cont. (EC-6)	Conf. of Burial (EC-7)	Impact Barriers (EC-8)	Cargo Sec. Devices and Sys. (EC-9)	Air Monitoring Sys. (EC-10)	Excavation Control Plan (AC-1)	Inventory Control Plan (AC-2)	Cont. Haz. Eval./Verif. & Res. Plan (AC-3)	Fire Protection Program Plan (AC-4)	Air Monitoring and Response Plan (AC-5)	Access Control Plan (AC-6)	Continuous S&M Plan (AC-7)	Vehicle/Equipment Control Plan (AC-8)	Cargo Securement Plan (AC-9)	Safety Management Programs
(76) <u>Hazard Type:</u> Potential Energy <u>What-If:</u> Worker falls into excavation, sinkhole, or other void space in landfill. <u>Outcome:</u> Worker is contaminated. Waste containers are ruptured. Radiological and/or chemical waste is spilled.							✓			✓					✓	✓	✓			✓
(77) <u>Hazard Type:</u> Potential Energy <u>What-If:</u> Worker inadvertently drops sample or other container being handled within work area enclosure. <u>Outcome:</u> Radiological and/or chemical waste is spilled.	✓	✓				✓				✓		✓			✓	✓				✓

Table B-1 (continued)

Scenario Description (Hazard Type, What-If, Outcome)	Engineering Controls										Administrative Controls									
	Work Area Enclosure (EC-1)	Ventilation/Filtration (EC-2)	Mobile Laboratory/DIF Structure (EC-3)	Ventilation/Filtration (EC-4)	Prot. Enclosures/ Barriers (EC-5)	Post-Excavation Cont. (EC-6)	Conf. of Burial (EC-7)	Impact Barriers (EC-8)	Cargo Sec. Devices and Sys. (EC-9)	Air Monitoring Sys. (EC-10)	Excavation Control Plan (AC-1)	Inventory Control Plan (AC-2)	Cont. Haz. Eval./Verif. & Res. Plan (AC-3)	Fire Protection Program Plan (AC-4)	Air Monitoring and Response Plan (AC-5)	Access Control Plan (AC-6)	Continuous S&M Plan (AC-7)	Vehicle/Equipment Control Plan (AC-8)	Cargo Securement Plan (AC-9)	Safety Management Programs
(78) Hazard Type: Potential Energy What-If: Waste containers fall from vehicle moving across MDA B site. Outcome: Radiological and/or chemical waste is spilled.						✓			✓	✓		✓			✓	✓		✓	✓	✓
(79) Hazard Type: Potential Energy What-If: Landfill cave-in occurs during loading or unloading of transport vehicle. Outcome: Transport vehicle is contaminated. Waste containers are ruptured. Radiological and/or chemical waste is spilled.							✓			✓					✓	✓	✓	✓		✓

Table B-1 (continued)

Scenario Description (Hazard Type, What-If, Outcome)	Engineering Controls										Administrative Controls									
	Work Area Enclosure (EC-1)	Ventilation/Filtration (EC-2)	Mobile Laboratory/DIF Structure (EC-3)	Ventilation/Filtration (EC-4)	Prot. Enclosures/ Barriers (EC-5)	Post-Excavation Cont. (EC-6)	Conf. of Burial (EC-7)	Impact Barriers (EC-8)	Cargo Sec. Devices and Sys. (EC-9)	Air Monitoring Sys. (EC-10)	Excavation Control Plan (AC-1)	Inventory Control Plan (AC-2)	Cont. Haz. Eval./Verif. & Res. Plan (AC-3)	Fire Protection Program Plan (AC-4)	Air Monitoring and Response Plan (AC-5)	Access Control Plan (AC-6)	Continuous S&M Plan (AC-7)	Vehicle/Equipment Control Plan (AC-8)	Cargo Securement Plan (AC-9)	Safety Management Programs
(80) <u>Hazard Type:</u> Potential Energy <u>What-If:</u> During loading/ unloading activities, a waste container is dropped. <u>Outcome:</u> Waste container is ruptured. Radiological and/or chemical waste is spilled.						✓				✓		✓			✓	✓				✓

Table B-1 (continued)

Scenario Description (Hazard Type, What-If, Outcome)	Engineering Controls										Administrative Controls									
	Work Area Enclosure (EC-1)	Ventilation/Filtration (EC-2)	Mobile Laboratory/DIF Structure (EC-3)	Ventilation/Filtration (EC-4)	Prot. Enclosures/ Barriers (EC-5)	Post-Excavation Cont. (EC-6)	Conf. of Burial (EC-7)	Impact Barriers (EC-8)	Cargo Sec. Devices and Sys. (EC-9)	Air Monitoring Sys. (EC-10)	Excavation Control Plan (AC-1)	Inventory Control Plan (AC-2)	Cont. Haz. Eval./Verif. & Res. Plan (AC-3)	Fire Protection Program Plan (AC-4)	Air Monitoring and Response Plan (AC-5)	Access Control Plan (AC-6)	Continuous S&M Plan (AC-7)	Vehicle/Equipment Control Plan (AC-8)	Cargo Securement Plan (AC-9)	Safety Management Programs
(81) <u>Hazard Type:</u> Potential Energy; Explosion <u>What-If:</u> Worker inadvertently drops (or knocks off elevated work surface) a sample container, containing shock sensitive material, a high explosive, or an unexploded ordnance, within the DIF or other mobile laboratory. <u>Outcome:</u> Explosion with a subsequent fire has the potential for involving radiological and/or chemical waste located in the same laboratory.			✓	✓	✓	✓				✓		✓		✓	✓	✓				✓

Table B-1 (continued)

Scenario Description (Hazard Type, What-If, Outcome)	Engineering Controls										Administrative Controls									
	Work Area Enclosure (EC-1)	Ventilation/Filtration (EC-2)	Mobile Laboratory/DIF Structure (EC-3)	Ventilation/Filtration (EC-4)	Prot. Enclosures/ Barriers (EC-5)	Post-Excavation Cont. (EC-6)	Conf. of Burial (EC-7)	Impact Barriers (EC-8)	Cargo Sec. Devices and Sys. (EC-9)	Air Monitoring Sys. (EC-10)	Excavation Control Plan (AC-1)	Inventory Control Plan (AC-2)	Cont. Haz. Eval./Verif. & Res. Plan (AC-3)	Fire Protection Program Plan (AC-4)	Air Monitoring and Response Plan (AC-5)	Access Control Plan (AC-6)	Continuous S&M Plan (AC-7)	Vehicle/Equipment Control Plan (AC-8)	Cargo Securement Plan (AC-9)	Safety Management Programs
(82) Hazard Type: Potential Energy What-If: Worker inadvertently drops (or knocks off elevated work surface) a waste sample container within DIF or other mobile laboratory. Outcome: Waste container is broken or ruptured. Radiological and/or chemical waste is spilled.			✓	✓						✓		✓			✓	✓				✓

Table B-1 (continued)

Scenario Description (Hazard Type, What-If, Outcome)	Engineering Controls										Administrative Controls									
	Work Area Enclosure (EC-1)	Ventilation/Filtration (EC-2)	Mobile Laboratory/DIF Structure (EC-3)	Ventilation/Filtration (EC-4)	Prot. Enclosures/ Barriers (EC-5)	Post-Excavation Cont. (EC-6)	Conf. of Burial (EC-7)	Impact Barriers (EC-8)	Cargo Sec. Devices and Sys. (EC-9)	Air Monitoring Sys. (EC-10)	Excavation Control Plan (AC-1)	Inventory Control Plan (AC-2)	Cont. Haz. Eval./Verif. & Res. Plan (AC-3)	Fire Protection Program Plan (AC-4)	Air Monitoring and Response Plan (AC-5)	Access Control Plan (AC-6)	Continuous S&M Plan (AC-7)	Vehicle/Equipment Control Plan (AC-8)	Cargo Securement Plan (AC-9)	Safety Management Programs
(83) <u>Hazard Type:</u> Potential Energy; Chemical Reaction; Explosion; Flammability and Fires <u>What-If:</u> Worker inadvertently drops (or knocks off elevated work surface) a sample container, containing reactive hazardous materials, within the DIF or other mobile laboratory. <u>Outcome:</u> Exothermic reaction results in a fire and/or explosion with the potential for involving radiological and/or chemical waste located in the same laboratory.			✓	✓	✓	✓				✓		✓		✓	✓	✓				✓

Table B-1 (continued)

Scenario Description (Hazard Type, What-If, Outcome)	Engineering Controls										Administrative Controls									
	Work Area Enclosure (EC-1)	Ventilation/Filtration (EC-2)	Mobile Laboratory/DIF Structure (EC-3)	Ventilation/Filtration (EC-4)	Prot. Enclosures/ Barriers (EC-5)	Post-Excavation Cont. (EC-6)	Conf. of Burial (EC-7)	Impact Barriers (EC-8)	Cargo Sec. Devices and Sys. (EC-9)	Air Monitoring Sys. (EC-10)	Excavation Control Plan (AC-1)	Inventory Control Plan (AC-2)	Cont. Haz. Eval./Verif. & Res. Plan (AC-3)	Fire Protection Program Plan (AC-4)	Air Monitoring and Response Plan (AC-5)	Access Control Plan (AC-6)	Continuous S&M Plan (AC-7)	Vehicle/Equipment Control Plan (AC-8)	Cargo Securement Plan (AC-9)	Safety Management Programs
(84) Hazard Type: Pressure What-If: A high pressure cylinder is ruptured or suffers a broken valve stem during handling or from other cause. Outcome: The cylinder becomes a missile and impacts and ruptures a waste container. Radiological and/or chemical waste is spilled.	✓	✓				✓				✓		✓			✓	✓				✓
(85) Hazard Type: Pressure What-If: Fume hood/glovebox malfunctions within the DIF or other mobile laboratory. Outcome: Exposed radiological and/or chemical waste is no longer contained.			✓	✓						✓		✓			✓	✓				✓

Table B-1 (continued)

Scenario Description (Hazard Type, What-If, Outcome)	Engineering Controls										Administrative Controls									
	Work Area Enclosure (EC-1)	Ventilation/Filtration (EC-2)	Mobile Laboratory/DIF Structure (EC-3)	Ventilation/Filtration (EC-4)	Prot. Enclosures/ Barriers (EC-5)	Post-Excavation Cont. (EC-6)	Conf. of Burial (EC-7)	Impact Barriers (EC-8)	Cargo Sec. Devices and Sys. (EC-9)	Air Monitoring Sys. (EC-10)	Excavation Control Plan (AC-1)	Inventory Control Plan (AC-2)	Cont. Haz. Eval./Verif. & Res. Plan (AC-3)	Fire Protection Program Plan (AC-4)	Air Monitoring and Response Plan (AC-5)	Access Control Plan (AC-6)	Continuous S&M Plan (AC-7)	Vehicle/Equipment Control Plan (AC-8)	Cargo Securement Plan (AC-9)	Safety Management Programs
(86) <u>Hazard Type:</u> Pressure <u>What-If:</u> A high pressure cylinder is ruptured or suffers a broken valve stem during handling or from other cause within the DIF or other mobile laboratory. <u>Outcome:</u> The cylinder becomes a missile and impacts and ruptures a waste container. Radiological and/or chemical waste is spilled.			✓	✓		✓				✓		✓			✓	✓				✓

Table B-1 (continued)

Scenario Description (Hazard Type, What-If, Outcome)	Engineering Controls										Administrative Controls									
	Work Area Enclosure (EC-1)	Ventilation/Filtration (EC-2)	Mobile Laboratory/DIF Structure (EC-3)	Ventilation/Filtration (EC-4)	Prot. Enclosures/ Barriers (EC-5)	Post-Excavation Cont. (EC-6)	Conf. of Burial (EC-7)	Impact Barriers (EC-8)	Cargo Sec. Devices and Sys. (EC-9)	Air Monitoring Sys. (EC-10)	Excavation Control Plan (AC-1)	Inventory Control Plan (AC-2)	Cont. Haz. Eval./Verif. & Res. Plan (AC-3)	Fire Protection Program Plan (AC-4)	Air Monitoring and Response Plan (AC-5)	Access Control Plan (AC-6)	Continuous S&M Plan (AC-7)	Vehicle/Equipment Control Plan (AC-8)	Cargo Securement Plan (AC-9)	Safety Management Programs
(87) <u>Hazard Type:</u> Radiation <u>What-If:</u> A worker violates a procedure (e.g., through improper monitoring, failure to follow procedure, or RWP) or a container is breached. <u>Outcome:</u> Worker suffers radiological overexposure.						✓						✓				✓				✓
(88) <u>Hazard Type:</u> Radiation <u>What-If:</u> PPE is damaged, not working properly, or is not worn properly during work with radiological waste. <u>Outcome:</u> Worker suffers radiological overexposure.																✓				✓

Table B-1 (continued)

Scenario Description (Hazard Type, What-If, Outcome)	Engineering Controls										Administrative Controls									
	Work Area Enclosure (EC-1)	Ventilation/Filtration (EC-2)	Mobile Laboratory/DIF Structure (EC-3)	Ventilation/Filtration (EC-4)	Prot. Enclosures/ Barriers (EC-5)	Post-Excavation Cont. (EC-6)	Conf. of Burial (EC-7)	Impact Barriers (EC-8)	Cargo Sec. Devices and Sys. (EC-9)	Air Monitoring Sys. (EC-10)	Excavation Control Plan (AC-1)	Inventory Control Plan (AC-2)	Cont. Haz. Eval./Verif. & Res. Plan (AC-3)	Fire Protection Program Plan (AC-4)	Air Monitoring and Response Plan (AC-5)	Access Control Plan (AC-6)	Continuous S&M Plan (AC-7)	Vehicle/Equipment Control Plan (AC-8)	Cargo Securement Plan (AC-9)	Safety Management Programs
(89) Hazard Type: Radiation What-If: A higher-than-expected radiation source is encountered during excavation. Outcome: Worker suffers radiological overexposure.										✓	✓		✓		✓	✓				✓

Table B-1 (continued)

Scenario Description (Hazard Type, What-If, Outcome)	Engineering Controls										Administrative Controls									
	Work Area Enclosure (EC-1)	Ventilation/Filtration (EC-2)	Mobile Laboratory/DIF Structure (EC-3)	Ventilation/Filtration (EC-4)	Prot. Enclosures/ Barriers (EC-5)	Post-Excavation Cont. (EC-6)	Conf. of Burial (EC-7)	Impact Barriers (EC-8)	Cargo Sec. Devices and Sys. (EC-9)	Air Monitoring Sys. (EC-10)	Excavation Control Plan (AC-1)	Inventory Control Plan (AC-2)	Cont. Haz. Eval./Verif. & Res. Plan (AC-3)	Fire Protection Program Plan (AC-4)	Air Monitoring and Response Plan (AC-5)	Access Control Plan (AC-6)	Continuous S&M Plan (AC-7)	Vehicle/Equipment Control Plan (AC-8)	Cargo Securement Plan (AC-9)	Safety Management Programs
(90) Hazard Type: Static; Pressure; Explosion What-If: Hydrogen gas buildup in a buried container containing TRU waste or acid causes the container to explode. Outcome: Cover material is disturbed. Buried waste containers are damaged. A fire potentially results and engulfs exposed waste with a radiological and/or chemical release.							✓			✓				✓	✓	✓	✓			✓

Table B-1 (continued)

Scenario Description (Hazard Type, What-If, Outcome)	Engineering Controls										Administrative Controls									
	Work Area Enclosure (EC-1)	Ventilation/Filtration (EC-2)	Mobile Laboratory/DIF Structure (EC-3)	Ventilation/Filtration (EC-4)	Prot. Enclosures/ Barriers (EC-5)	Post-Excavation Cont. (EC-6)	Conf. of Burial (EC-7)	Impact Barriers (EC-8)	Cargo Sec. Devices and Sys. (EC-9)	Air Monitoring Sys. (EC-10)	Excavation Control Plan (AC-1)	Inventory Control Plan (AC-2)	Cont. Haz. Eval./Verif. & Res. Plan (AC-3)	Fire Protection Program Plan (AC-4)	Air Monitoring and Response Plan (AC-5)	Access Control Plan (AC-6)	Continuous S&M Plan (AC-7)	Vehicle/Equipment Control Plan (AC-8)	Cargo Securement Plan (AC-9)	Safety Management Programs
(91) <u>Hazard Type:</u> Static; Pressure <u>What-If:</u> Hydrogen gas buildup in a container, containing TRU waste or acid staged/stored within the work area enclosure, causes the container to bulge and rupture. <u>Outcome:</u> Contents are ejected with a radiological and/or chemical release.	✓	✓				✓				✓		✓			✓	✓				✓

Table B-1 (continued)

Scenario Description (Hazard Type, What-If, Outcome)	Engineering Controls										Administrative Controls									
	Work Area Enclosure (EC-1)	Ventilation/Filtration (EC-2)	Mobile Laboratory/DIF Structure (EC-3)	Ventilation/Filtration (EC-4)	Prot. Enclosures/ Barriers (EC-5)	Post-Excavation Cont. (EC-6)	Conf. of Burial (EC-7)	Impact Barriers (EC-8)	Cargo Sec. Devices and Sys. (EC-9)	Air Monitoring Sys. (EC-10)	Excavation Control Plan (AC-1)	Inventory Control Plan (AC-2)	Cont. Haz. Eval./Verif. & Res. Plan (AC-3)	Fire Protection Program Plan (AC-4)	Air Monitoring and Response Plan (AC-5)	Access Control Plan (AC-6)	Continuous S&M Plan (AC-7)	Vehicle/Equipment Control Plan (AC-8)	Cargo Securement Plan (AC-9)	Safety Management Programs
(92) Hazard Type: Static; Pressure What-If: Hydrogen gas buildup in a container containing TRU waste or acid causes the container to bulge and rupture within the DIF or other mobile laboratory. Outcome: Contents are ejected with a radiological and/or chemical release.			✓	✓	✓	✓				✓		✓			✓	✓				✓
(93) Hazard Type: Toxicity What-If: PPE is damaged, not working properly, or is not worn properly during work with chemical waste. Outcome: Worker suffers overexposure to hazardous chemicals.																				✓

Table B-1 (continued)

Scenario Description (Hazard Type, What-If, Outcome)	Engineering Controls										Administrative Controls									
	Work Area Enclosure (EC-1)	Ventilation/Filtration (EC-2)	Mobile Laboratory/DIF Structure (EC-3)	Ventilation/Filtration (EC-4)	Prot. Enclosures/ Barriers (EC-5)	Post-Excavation Cont. (EC-6)	Conf. of Burial (EC-7)	Impact Barriers (EC-8)	Cargo Sec. Devices and Sys. (EC-9)	Air Monitoring Sys. (EC-10)	Excavation Control Plan (AC-1)	Inventory Control Plan (AC-2)	Cont. Haz. Eval./Verif. & Res. Plan (AC-3)	Fire Protection Program Plan (AC-4)	Air Monitoring and Response Plan (AC-5)	Access Control Plan (AC-6)	Continuous S&M Plan (AC-7)	Vehicle/Equipment Control Plan (AC-8)	Cargo Securement Plan (AC-9)	Safety Management Programs
(94) Hazard Type: Toxicity What-If: A hazardous chemical that was not expected is encountered in excavation. Outcome: Worker suffers overexposure to hazardous chemicals.										✓	✓		✓		✓	✓				✓
(95) Hazard Type: Vibration What-If: Vibration from excavator or other heavy equipment causes walls of excavation to cave in. Outcome: Containers in trench are ruptured and radiological and/or chemical waste is spilled.	✓	✓								✓	✓		✓		✓	✓				✓

Table B-1 (continued)

Scenario Description (Hazard Type, What-If, Outcome)	Engineering Controls										Administrative Controls									
	Work Area Enclosure (EC-1)	Ventilation/Filtration (EC-2)	Mobile Laboratory/DIF Structure (EC-3)	Ventilation/Filtration (EC-4)	Prot. Enclosures/ Barriers (EC-5)	Post-Excavation Cont. (EC-6)	Conf. of Burial (EC-7)	Impact Barriers (EC-8)	Cargo Sec. Devices and Sys. (EC-9)	Air Monitoring Sys. (EC-10)	Excavation Control Plan (AC-1)	Inventory Control Plan (AC-2)	Cont. Haz. Eval./Verif. & Res. Plan (AC-3)	Fire Protection Program Plan (AC-4)	Air Monitoring and Response Plan (AC-5)	Access Control Plan (AC-6)	Continuous S&M Plan (AC-7)	Vehicle/Equipment Control Plan (AC-8)	Cargo Securement Plan (AC-9)	Safety Management Programs
(96) <u>Hazard Type:</u> Vibration <u>What-If:</u> Vibration of moving vehicle carrying shock sensitive material, high explosives, or unexploded ordnance causes the material to explode. <u>Outcome:</u> Subsequent fire has the potential to involve radiological and/or chemical waste in open trenches, staged/stored above ground, or buried waste.						✓	✓			✓	✓	✓		✓	✓	✓	✓	✓		✓

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Appendix C

MDA B Contaminants of Concern

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Acetone

Aluminum Nitrate

Ammonium Hydroxide

Ammonium Nitrate

Anion Exchange Resin

Beryllium

Calcium (metal)

CC14 (Carbon Tetrachloride)

Corrosive Gases (Gas Cylinders)

Cyanide Plating Waste

Ethyl Ether

Fluoride

H_2SO_4 (Sulfuric Acid)

H_3PO_4 (Phosphoric Acid)

HBr (Hydrogen Bromide)

HCl (Hydrochloric Acid)

HF (Hydrofluoric Acid)

HI (Hydrogen Iodide)

HNO_3 (Nitric Acid)

Kerosene

Lead

Methane Generation

Mineral Oils

Miscellaneous Mixtures and Spent Chemicals

Other Organics

Oxalate

Oxalic Acid

Perchlorates

Sodium Acetate

Sodium Bromotrioxide

Sodium Hydroxide

Sodium Nitrate

Sulfur Dioxide

Thenoyl-tri-fluoroacetone

Zinc

Zirconium

Actinium-227

Americium-241

Common Fission Products – Cs-137, Sr-90

Neptunium-237

Plutonium-239

Plutonium-240

Plutonium-241

Plutonium-242

Thorium-232

Tritium (surface/near surface)

Uranium-234

Uranium-235

Uranium-238

Asbestos

Biological waste