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Phase II Investigation/Remediation Work Plan for Material Disposal Area A, Solid Waste Management Unit 21-014, at Technical Area 21, Revision 1

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Responsible project leader:

Bruce Wedgeworth	[signature]	Project Leader	Environmental Programs	9/29/09
Printed Name	Signature	Title	Organization	Date

Responsible LANS representative:

Michael J. Graham	[signature]	Associate Director	Environmental Programs	9/30/09
Printed Name	Signature	Title	Organization	Date

Responsible DOE representative:

David R. Gregory	[signature]	Project Director	DOE-LASO	9/30/09
Printed Name	Signature	Title	Organization	Date

EXECUTIVE SUMMARY

This Phase II investigation/remediation work plan (work plan) describes the methodology that will be used to excavate the contents of Material Disposal Area (MDA) A, Solid Waste Management Unit 21-014, at Technical Area 21 at Los Alamos National Laboratory (the Laboratory). This Phase II work plan also describes the sampling and analysis methodology to be used to investigate the waste during removal and confirmation sampling of the excavation bottom and sidewalls after waste removal. Included within the scope of this work plan is the complete removal of potential contaminant sources (in the form of buried waste) from the MDA A central pit, eastern trenches, and Plutonium Tanks (formerly known as the General's Tanks). All buried waste will be removed and disposed of at appropriate off-site disposal facilities, according to the characteristics of the waste. Soil and tuff in contact with waste will be excavated until analytical results from confirmation samples indicate that inorganic chemical, organic chemical, and radionuclide concentrations are below their respective industrial cleanup levels.

This work plan is being conducted under the requirements of the March 1, 2005, Compliance Order on Consent (Consent Order), implementing regulations, and U.S. Department of Energy (DOE) orders under the Atomic Energy Act. Waste removal activities for the contents of the Plutonium Tanks will include development of specific engineered controls for protection of the workers and the public from potential airborne radiological exposure in accordance with nuclear safety. Work activities for removal of the eastern trenches and central pit waste will also be planned and executed to minimize off-site releases. Materials removed from the excavation will be evaluated to ensure proper handling in accordance with all applicable Laboratory health and safety requirements. During field operations, quarterly status reports will be prepared to keep the New Mexico Environment Department informed of field conditions and the progress of activities. The first status report is due 90 d after the start of the field activities. Any deviations from this work plan will be documented in the status and investigation reports. A Phase II investigation report will be prepared upon completion of field activities and will summarize the investigation and removal actions. The report will also recommend future actions at the site, including, as appropriate, further monitoring of vapor-phase volatile organic compounds and tritium.

The Laboratory requests a change of the Consent Order schedule date for the MDA A remedy completion report from March 11, 2011, to December 21, 2013 (see Table 8.0-1), based on the extensive preparatory, remediation work, and safety issues described above, which must be properly addressed.

At MDA A, the current and reasonably foreseeable land use is industrial. As the owner of the site, DOE is committed to cleanup to at least industrial levels to allow continued use of the site for industrial purposes. At present, no commitment has been made concerning future development or transfer of the site for other than Laboratory industrial purposes. DOE recognizes, however, the advantage of cleanup to residential levels in terms of eliminating potential future land-use restrictions and a reduction in long-term monitoring costs if the site meets residential risk-screening criteria. DOE, therefore, has established a goal of meeting residential cleanup levels at MDA A if practicable.

An approved investigation report discussed the results of sampling and analyses of the nature and extent of contaminants released to the environment from the pits, trenches, and tanks. Results of risk-screening calculations for residential and industrial worker scenarios indicated acceptable levels of current-day risk.

CONTENTS

1.0 INTRODUCTION 1
1.1 General Site Information 1
1.2 Investigation Objectives 2

2.0 BACKGROUND 2
2.1 Operational History 2
2.1.1 Plutonium Tanks 3
2.1.2 Vertical Shafts 3
2.1.3 Eastern Disposal Trenches 3
2.1.4 Central Pit 3
2.1.5 Former Drum Storage Area 4
2.1.6 Surface Storage 4
2.1.7 Summary of Subsurface Utilities 4
2.2 Inventory Estimates 5
2.3 Results from Previous Investigations 6

3.0 SITE CONDITIONS 7
3.1 Surface Conditions 7
3.2 Subsurface Conditions 7
3.2.1 Stratigraphy 7
3.2.2 Groundwater 9

4.0 SCOPE OF ACTIVITIES 9
4.1 Scope of Activities for Eastern Trenches and Central Pit 10
4.1.1 Justification for Proposed Scope of Work 10
4.1.2 Regulatory Basis for Technical Approach 10
4.1.3 Health and Safety and Environmental Protection 12
4.1.4 Topsoil and Overburden Excavation 13
4.1.5 Excavation of Central Pit and Disposal Trenches 13
4.1.6 Segregation of Waste by Material Type 13
4.1.7 Waste Management 13
4.1.8 Confirmation Sampling 14
4.1.9 Surveying Locations and Features of Excavation 14
4.1.10 Site Restoration 15
4.2 Scope of Activities for Plutonium Tanks 15
4.2.1 Justification for Proposed Scope of Work 15
4.2.2 Regulatory Basis for Technical Approach 15
4.2.3 Health and Safety and Environmental Protection 15
4.2.4 Preliminary Screening Activities 17
4.2.5 Excavation of Plutonium Tanks 17
4.2.6 Segregation of Waste Material by Type 18
4.2.7 Waste Management 18
4.2.8 Confirmation Sampling 18
4.2.9 Surveying Locations and Features of Excavation 18
4.2.10 Site Restoration 18

5.0 INVESTIGATION METHODS 18
5.1 Topsoil and Overburden Sampling and Excavation Methods 18

5.2 Excavation Methods of the Central Pit and Eastern Trenches 19
5.2.1 Initial Screening Methods 20
5.2.2 Initial Waste-Segregation Methods 21
5.2.3 Final Waste-Segregation Methods 21
5.2.4 Confirmation Sampling Methods for Soil and Tuff 21
5.2.5 Geodetic Survey Methods 22
5.2.6 Site Restoration 22
5.2.7 Waste Management Methods 22
5.2.8 Equipment Decontamination Methods 23
5.3 Excavation/Removal Methods for the Plutonium Tanks 23
5.3.1 Initial Screening Methods 23
5.3.2 Characterization of Atmosphere and Tank Sludge 24
5.3.3 Removal of Topsoil, Overburden, and Concrete Pad 24
5.3.4 Removal of Tank Waste 24
5.3.5 Removal of Tanks 25
5.3.6 Dispositioning and Transporting Tanks 25
5.3.7 Equipment Decontamination 25
5.3.8 Site Restoration 26
5.3.9 Waste Management Methods 26

6.0 SOIL VAPOR-MONITORING AND SAMPLING PROGRAM 26

7.0 COST ESTIMATE 26

8.0 SCHEDULE 26

9.0 REFERENCES 27

Figures

Figure 1.0-1 TA-21 and MDA A with respect to Laboratory TAs 31
Figure 1.0-2 MDA A in relation to TA-21 and surrounding TAs, MDAs, and SWMUs 32
Figure 1.1-1 MDA A site plan (orthophotograph) 33
Figure 2.1-1 MDA A site plan showing the Plutonium Tanks, central pit, eastern trenches, and utility lines 34
Figure 3.2-1 Generalized stratigraphy of DP Mesa in the area of MDA A 35
Figure 3.2-2 Perched saturation zones/regional aquifer 36
Figure 4.1-1 Inspection trenches for the observational approach to pit and trench characterization ... 37
Figure 4.1-2 Confirmation sample locations 38

Tables

Table 2.0-1 Summary of Historical Activities at MDA A 39
Table 2.3-1 MDA A, Carcinogenic Screening Evaluation 43
Table 5.2-1 Proposed Confirmation Sampling 44
Table 8.0-1 Planned Milestones for Investigation and Remediation of MDA A 45

Appendixes

Appendix A Investigation-Derived Waste Management

Appendix B Cost Associated with Proposed Activities

Acronyms and Abbreviations

AK	acceptable knowledge
bgs	below ground surface
BH	borehole
CAM	continuous air monitor
Consent Order	Compliance Order on Consent
COPC	chemical of potential concern
D&D	decontamination and decommissioning
DOE	Department of Energy (U.S.)
DOT	Department of Transportation (U.S.)
DSA	documented safety analysis
EPA	Environmental Protection Agency (U.S.)
GPR	ground-penetrating radar
GPS	global positioning system
HI	hazard index
HIR	historical investigation report
IDLH	immediately dangerous to life and health
IDW	investigation-derived waste
IR	investigation report
ISM	Integrated Safety Management
LANL	Los Alamos National Laboratory
LLW	low-level radioactive waste
MDA	material disposal area
MLLW	mixed low-level waste
mrem/yr	millirem per year
n/a	not applicable
na	not available
NMED	New Mexico Environment Department
NNSA	National Nuclear Security Administration

PCB	polychlorinated biphenyl
QA/QC	quality assurance/quality control
RCRA	Resource Conservation and Recovery Act
RFI	RCRA facility investigation
SAL	screening action level
SAP	sampling and analysis plan
SOP	standard operating procedure
SSHASP	site-specific health and safety plan
SSL	soil screening level
SVOC	semivolatile organic compound
SWMU	solid waste management unit
TA	technical area
TAL	target analyte list (EPA)
TBD	to be determined
TCDD[2,3,7,8-]	2,3,7,8-tetrachlorodibenzodioxin
TCLP	toxicity characteristic leaching procedure
TRU	transuranic
TSD	treatment, storage, and disposal
TSTA	Tritium Systems Test Assembly
UCL	upper confidence limit
VOC	volatile organic compound
WAC	waste acceptance criteria
WCSF	waste characterization strategy form

1.0 INTRODUCTION

This Phase II investigation/remediation work plan (hereafter, work plan) documents the work to be conducted for removal of wastes from Material Disposal Area (MDA) A, Solid Waste Management Unit (SWMU) 21-014, at Los Alamos National Laboratory (LANL or the Laboratory). MDA A consists of a fenced 1.25-acre, radiologically controlled area situated on the eastern end of DP Mesa and is bounded by DP Canyon to the north and Los Alamos Canyon to the south. Figure 1.0-1 depicts the location of Technical Area 21 (TA-21) and MDA A with respect to other Laboratory TAs and surrounding landholdings. MDA A is currently inactive and undergoing corrective action. The location of MDA A in relation to TA-21 and surrounding MDAs and other SWMUs is shown in Figure 1.0-2. The site contains potential hazardous waste or constituents subject to provisions of the Resource Conservation and Recovery Act (RCRA) and the New Mexico Hazardous Waste Act, as described in the March 1, 2005, Compliance Order on Consent (the Consent Order). A previously approved investigation report (IR) (LANL 2006, 095046) discussed the results of sampling and analysis and the nature and extent of contaminants released in and adjacent to MDA A, but the contents of the eastern trenches, central pit, and Plutonium Tanks (formerly known as the General's Tanks) are largely uncharacterized.

MDA A also contains radioactive wastes managed by the U.S. Department of Energy (DOE), pursuant to the Atomic Energy Act of 1954. MDA A is a Hazard Category 2 nuclear facility (DOE 2003, 087047, p. 1), based on the contents of the Plutonium Tanks. The eastern trenches and central pit are currently being recategorized in accordance with DOE Standard 1027-92, and preliminary indications are they will be downgraded to a less than Hazard Category 3 nuclear facility before implementation of work described in this work plan. DOE will assess the hazards and work controls required to conduct the work described in this work plan for compliance with the implementing regulations and DOE orders under the Atomic Energy Act and may require additional engineered controls once the characteristics of the Plutonium Tanks are fully identified. Information on radioactive materials and radionuclides is voluntarily provided to the New Mexico Environment Department (NMED) in accordance with DOE policy.

1.1 General Site Information

MDA A is situated within a fenced 1.25-acre area divided into two separate sections comprising the Plutonium Tanks and two eastern trenches and a central pit situated on the eastern end of DP Mesa.

MDA A was historically used to dispose of wastes generated during operations and contains the following.

- Two 50,000-gal. cylindrical steel storage tanks (referred to as the Plutonium Tanks and designated as TA-21-107 [West] and TA-21-108 [East]) were constructed for underground storage that contain residual plutonium salts, referred to as sludge in this work plan. Historic analyses of the sludge indicated that the solutions are contaminated with plutonium-239/240 and americium-241. The two tanks reportedly received materials from 1945 to 1947.
- Two eastern trenches containing solid waste potentially were contaminated with polonium, plutonium, uranium, thorium, and other unidentified chemicals associated with Laboratory operations. The two eastern pits received waste from 1945 to 1946.
- One central pit containing TA-21 decontamination and decommissioning (D&D) debris was potentially contaminated with radionuclides. The central pit reportedly received waste from 1969 to 1978.

The relative locations of the disposal units described above with respect to the MDA A fenceline, topography, and other SWMUs/areas of concern are shown in an orthophotograph taken in 2005 (Figure 1.1-1). Site characterization activities were conducted from April 27 to October 5, 2006, and in November 2007 (LANL 2007, 100482).

1.2 Investigation Objectives

MDA A has been investigated numerous times since disposal operations were discontinued. These investigations focused on surface characterization and subsurface releases outside the actual waste disposal trenches/pit and beneath the Plutonium Tanks. As discussed in the MDA A IR (LANL 2006, 095046), waste disposal practices during MDA A's operational lifetime are not well documented. The contents of the MDA A disposal trenches and central pit are largely uncharacterized but represent an ongoing potential source for release of contamination beyond the boundaries of the eastern trenches and central pit.

The principal objectives of this work plan are to

- remove and properly dispose of all waste material buried in the central pit and eastern trenches;
- remove and properly dispose of the Plutonium Tanks, including the waste material contained inside; and
- confirm the radionuclide, organic chemical, and inorganic chemical concentrations in the soil and rock adjacent to and below the eastern trenches, the central pit, and the Plutonium Tanks excavation sides and bottoms after removal activities are complete.

All data collected will be included in the Phase II IR to be submitted to NMED after completion of the investigation and source-removal activities. This Phase II IR will also include any recommendations deemed appropriate for modifying the technical approach associated with excavation of the eastern trenches and central pit as well as for finalizing the waste treatment and removal of the Plutonium Tanks, if necessary.

This work plan describes the rationale for the proposed scope of work and specifies the excavation and sampling methodologies and protocols that will be used for collecting, analyzing, and evaluating the data.

2.0 BACKGROUND

This section summarizes the historical and current characteristics of MDA A, as excerpted from the historical investigation report (HIR) for MDA A (LANL 2005, 088052.5, pp. 1-30). The central pit operational history has been augmented with newly found information (see section 2.1.4). Table 2.0-1 summarizes the operational history of the site.

2.1 Operational History

TA-21 comprises two operational areas, DP West and DP East, both of which produced liquid and solid radioactive wastes. The operations at DP West included plutonium processing, while the operations at DP East included the production of weapons initiators. MDA A was used between 1945 and May 1978 to dispose of and store solid and liquid wastes, as described in sections 2.1.1 through 2.1.5.

Site stabilization activities were performed in 1985, such as removing surface contamination, adding cover material, recontouring, and reseeding. In 1987, isolated areas at MDA A were reseeded and fertilizer was applied. Gravel mulch was also spread on the site's north side (LANL 2005, 088052.5, p. 2).

2.1.1 Plutonium Tanks

In 1945, the Plutonium Tanks (two 50,000-gal. cylindrical steel storage tanks) were constructed and buried at the western end of MDA A (Figure 2.1-1). The tanks were designed and installed to receive waste solutions containing plutonium-239/240 and americium-241 from the plutonium purification and recovery operations. Liquids with very high magnesium and iron salt contents were to be stored until improved chemical methods could be developed to extract and recover the plutonium. Some liquids were eventually removed from the tanks in 1975 and 1976, but an uncertain volume of sludge remains in the bottom of the tanks (LANL 2005, 088052.5, p. 4). In this work plan, the residual sludge is referred to as the heel of the tank.

2.1.2 Vertical Shafts

In 1975, two 4-ft-diameter vertical shafts were excavated to a depth of approximately 65 ft below ground surface (bgs), south of the Plutonium Tanks (Figure 2.1-1). The shafts were installed to clarify rinse water generated by cleaning cement paste from the transfer hose between the pug mill and the Plutonium Tanks. The tanks were never filled with cement paste, so the vertical shafts were not used. In 1977, the vertical shafts were filled with soil (LANL 2005, 088052.5, p. 3).

2.1.3 Eastern Disposal Trenches

In 1945, the two eastern trenches were excavated to receive radioactive solid waste from DP East. Little, if any, liquids or pressurized containers are anticipated to have been disposed of. The location of the eastern disposal trenches is shown in Figure 2.1-1. Early engineering drawings indicate that the pits are approximately 18 ft wide × 125 ft long × 12.5 ft deep. In 1946, crushed Bandelier tuff was used to backfill and cover the trenches (LANL 2005, 088052.5, pp. 3–4). Based upon the dimensions provided, each disposal trench has a calculated air space of 1000 yd^3.

2.1.4 Central Pit

The central pit was opened in 1969 and used to dispose of demolition debris during rehabilitation of TA-21 after TA-50 came online as the new plutonium-processing facility at the Laboratory. The rehabilitation work was essentially complete in 1976, with the central pit being three-quarters full (Keenan 1976, 000507). The central pit may have received waste until September 1977 and was backfilled in May 1978 (Merrill 1990, 011721). There are only partial records of the demolition wastes placed in the central pit, but based on the history of the TA-21 facilities, interior portions of building 21-061—decontaminated in either 1960 or 1969—may be in the bottom of the pit if demolition occurred at the later date (LANL 2005, 088052.5). Building 21-061 was used as a laboratory and was a concrete slab on grade metal structure with metal siding and roof. It contained fume hoods and sinks. There are no other records of demolition activities at TA-21 during 1969.

The central corridors located between buildings 21-001, 21-002, 21-003, 21-004, and 21-005 were replaced by new structures in 1971. The replacement structures are associated with a newer ventilation system that replaced an earlier ventilation system located along the ridgelines of buildings 21-002, 21-003, 21-004, and 21-005 and along the north side of the north plant road, ultimately connecting to the 21-12 filter building (which handled only room air after 1959). Building 21-005 ductwork was reported as being disposed of in the central pit (Enders 1972–1975, 000514, p. 2). The new filter system went online in 1973 (Christensen et al. 1975, 005481). The date for demolition matches the central pit's operational dates, and old photographs show portions of the ductwork in the central pit (LANL 2005, 088052.5). A radiation control technician logbook describes the number of trucks and content of loads going to the central pit (Christensen 1973, 001599). The demolition report from structure 21-12, removed in 1973 (Christensen et al. 1975, 005481), indicated most of the higher contaminated waste, including the blowers, went to MDA G and that only cleaner structural debris, foundations, soil, and some larger structural components with surface contamination went to the MDA A central pit. Photographs taken during the filling of the central pit indicate the filter frames were also sent to the central pit (Gerety et al. 1989, 006893; LANL 2005, 088052.5). A central pit volume of approximately 18,000 yd^3 (Merrill 1990, 011721) has been provided in historic documents. However, based on the shape of the excavation sides and ends (Purtymun 1969, 000519), the volume appears to be too large. Based on Purtymun's dimensions of the central pit, the air space of the empty pit has been calculated to be approximately 16,000 yd^3. The 1991 RCRA facility investigation (RFI) work plan (LANL 1994, 026073) states that unspecified waste was placed in the unused portion of the central pit. There is no supporting documentation for this statement. If the pit was filled only three-quarters full, only 12,000 yd^3 would have been used, based on waste-generating activities occurring at TA-21 during the central pit waste disposal time period. It is likely the remaining volume was backfilled with clean soil. Using volumes estimated from existing records discussed above, approximately 10,000 yd^3 of waste is calculated to have been placed in the central pit.

2.1.5 Former Drum Storage Area

Although not a subject of this investigation, several hundred 55-gal. drums containing iodide waste were stored on the surface at the eastern end of MDA A in the late 1940s and early 1950s (Table 2.0-1). The stored drums can be seen at the eastern end of MDA A in a 1949 aerial photograph and in a subsequent 1950 aerial photograph (LANL 2005, 088052.5). These drums contained sodium hydroxide solution and stable iodine used to scrub ventilation exhaust air, containing plutonium and possibly uranium. The corrosion of the drums resulted in liquid releases to the surface soil at MDA A. The drums were removed in 1960 and the storage area was paved (LANL 2005, 088052.5, pp. 4–5). The MDA A IR (LANL 2006, 095046) investigated potential releases from the drum storage area.

2.1.6 Surface Storage

Although not a subject of this investigation, historical photographs show that the area of the central pit (before excavation) was used to store equipment that was removed during remodeling of the process buildings before shipment to other disposal areas. The MDA A IR (LANL 2006, 095046) discusses the investigation of the subsurface storage area for nature and extent of contamination.

2.1.7 Summary of Subsurface Utilities

Active and inactive utility lines present in the immediate vicinity of MDA A are shown in Figure 2.1-1.

Immediately north of MDA A is a 3-in. cast-iron radiological waste line in the southern shoulder of North Perimeter Road. This line previously conveyed liquid waste from the Tritium Science and Fabrication Facility and the Tritium Systems Test Assembly (TSTA) to the building 21-257 waste treatment facility, located west of MDA A. The depth of the line varies between 4 and 4 ft 10 in.; the line is equipped with two cleanout valves at the northeastern and northwestern corners of MDA A. The line has been in service since the 1970s, concurrent with the initial operations at TSTA, and it is scheduled for decommissioning and removal as part of the DP Aggregate Phase II investigation effort. An underground telemetry cable runs parallel to the radiological waste line and transmits operating information on the sump pumps and other facilities at the TSTA. This telemetry cable is currently inactive and will be abandoned.

Two parallel 8-in. cast-iron water lines run east-west along the northern shoulder of the North Perimeter Road parallel to the MDA A site and branch off to facilities to the east and west. Both of these water lines will be abandoned as part of this MDA A remediation effort. A fire hydrant is located adjacent to the northeastern corner of MDA A.

A 6-in. steel natural gas line runs along the west and southwest of the SWMU. Immediately west of the Plutonium Tanks (far western portion of the site), the gas line and associated valves are abovegrade and will be abandoned in the near future when building 21-257 is deactivated. The gas line is temporarily active and conveys natural gas to building 21-257 until it is deactivated.

A culvert runs beneath North Perimeter Road near the northeastern corner of MDA A and conveys storm drainage from the roadways adjacent to MDA A to DP Canyon.

2.2 Inventory Estimates

Plutonium Tanks: There have been various estimates of the radionuclide inventory contained in the Plutonium Tanks. These were made for the entire tank contents before pumping and treating the liquid (Rogers 1977, 005707). Posteffluent samples taken on the tank sludge indicate most of the inventory remains in the tanks (LANL 2004, 088713.2). The total estimated current-day inventory corrected for decay of radionuclides of the west tank is approximately 111 Ci plutonium-equivalent and that of the east tank is 28 Ci plutonium-equivalent (LANL 2004, 088713.2). Based on the processes used during operation of the plutonium facility and on information obtained from 1947 Laboratory notebooks of chemical experiments conducted on the tanks' contents, chemical content of the sludge includes the presence of the following for both tanks: plutonium, americium, calcium nitrate, magnesium nitrate, iodine, peroxide, potassium nitrate, aluminum, iron, chromium, nickel, magnesium, lanthanum, pH, nitrate, ammonium, magnesium, and calcium. Other test results indicate the presence of sodium, chlorine, and potassium in both tanks. Notebooks from tests conducted in the mid-1970s and 1980s indicate the pH of the east tank sludge was 8.3 and that of the west tank sludge was 11.4 (LANL 2006, 095046). Total dissolved solids were approximately 233, 480, and 90,690, respectively (units of measure not reported; probably in parts per million). No samples have been collected or tests performed on the wastes using RCRA-accepted analytical methods.

Eastern Trenches: Very little documentation has been found detailing the types of chemicals and quantities of radionuclides and/or chemical contamination in the two eastern trenches. Material in the trenches consists of all contaminated waste from the Chemistry and Metallurgy Research operations, including laboratory equipment, building construction material, paper, rubber gloves, filters from air-cleaning systems, and contaminated or toxic chemicals (Meyer 1952, 028154). Polonium and plutonium-239/240 were thought to be the major contaminants in the waste. Polonium would no longer be present at the site because of its short half-life (138.4 d).

The eastern trenches were excavated in 1945 and likely contain the similar inventory as would be found in the early portions of the MDA B disposal. Based upon the MDA B inventory, the potential radionuclides in the form of contamination present on waste materials in the trenches include plutonium, polonium, uranium, americium, curium, radium-lanthanum, actinium, and waste products from a water boiler (Meyer 1952, 028154). The radiological inventory of MDA A has been conservatively estimated, based on data developed for the MDA B HIR (LANL 2006, 095499); adjusting for the difference in volumes between the two trenches results in 19 g of plutonium-239 (50th percentile) and 28 g of plutonium-239 for the 90th percentile inventory estimate.

No chemical inventory records are found for the eastern trenches. Based on chemicals encountered in the investigation of the MDA A site (LANL 2006, 095046), it has been concluded that chemicals of potential concern (COPCs) in the soil surrounding MDA A include aluminum, iodine, arsenic, barium, beryllium, cyanide, iodide, nitrate, perchlorate, selenium cadmium, chromium, copper, iron, manganese, nickel and vanadium, acenaphthene, acetone, anthracene, Aroclor-1254, Aroclor-1260, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, benzoic acid, bis(2-ethylexyl)phthalate, chrysene, dichlorobenzene[1,4-], fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, isopropyltoluene[4-], methylene chloride, phenanthrene, pyrene, toluene, numerous dioxins and furans, americium-241, cesium-137, plutonium-238, plutonium-239, strontium-92, uranium-235, and tritium. Found in various formations below the disposal site or in surface soil directly affected by site runoff, these COPCs are possibly present in the MDA A waste. The levels of these COPCs present in the eastern trenches are uncertain. However, it may be concluded that the primary contaminants present in the eastern trenches are radioactive isotopes based on (1) the low levels observed in the foundation soil and rock at MDA A, (2) the period (1945) when the materials were disposed of, (3) qualitative historical documentation of disposal, and (4) photographs taken of the disposal trenches during operation.

Small quantities of volatile organic compounds (VOCs) may remain in the trenches as disposed chemicals but will not constitute a significant source of contamination.

The dioxins and furans are likely a result of surface-air contamination and of a fire that occurred around 1946.

Central Pit: As with the eastern trenches, there is no record for chemical or radiological inventory of contamination that might be associated with the D&D material disposed of (such as any coating inside of disposed pipes). It is postulated that a similar list of COPCs might be present, as in the eastern trenches, because the D&D operations were on buildings used for the same period as materials disposed of in MDAs A and B.

2.3 Results from Previous Investigations

The MDA A IR (LANL 2006, 095046) and the status report for supplemental sampling (LANL 2007, 100482) reported on the characterization of the media outside of the waste for nature and extent of contamination, with the exception of pore gas. The investigation report for MDA A evaluated the residential and industrial scenarios for present-day risk. The risk screening for the residential scenario was based on data collected from 0 to 10 ft in boreholes and surface data, none of which were through waste or within 10 ft of the trenches, pit, or Plutonium Tank. The risk screening for the industrial scenario was based on data collected from 0 to 1 ft (surface data), none of which were through waste or within 10 ft of the trenches, pit, or Plutonium Tanks.

No industrial soil screening levels (SSLs) or industrial screening action levels (SALs) were exceeded. One residential SSL was exceeded for arsenic at a depth interval of 30–32 ft in borehole (BH) 21-26485. However, the 4.26 mg/kg arsenic concentration is within the range of the background data for arsenic in the upper tuff geologic units—maximum background concentration for Bandelier Tuffs (Qbt) 2, 3, 4—is 5 mg/kg (LANL 1998, 059730). Therefore, it is not a risk issue for MDA A, even though the concentration exceeds the residential SSL. The borehole is located just north of the MDA A fence adjacent to the central pit.

The investigation report stated that the total estimated excess cancer risk for the residential scenario is approximately 3×10^{-5}, which is above the NMED target level of 1×10^{-5}, and the total estimated excess cancer risk for the industrial scenario is approximately 8×10^{-6}, which is below the NMED target level of 1×10^{-5}. The hazard indices (HIs) and total doses for the two scenarios are below the respective NMED and DOE target levels. The total estimated excess cancer risk did not meet the residential cancer risk target level because of dioxins and furans. However, the residential and SSLs for 2,3,7,8-tetrachlorodibenzodioxin (TCDD[2,3,7,8-]) were incorrectly presented because the U.S. Environmental Protection Agency (EPA) Region 6 values used were not adjusted to the NMED risk levels (multiplied by 10 to adjust from 10^{-6} to 10^{-5}). The corrected SSLs are 3.9×10^{-5} mg/kg for the residential scenario and 1.8×10^{-4} mg/kg for the industrial scenario. When compared with the exposure point concentrations for TCDD[2,3,7,8-], the cancer risks become 2×10^{-6} and 7×10^{-7} for the residential and industrial scenarios, respectively (i.e., an order of magnitude lower than originally calculated). This change in cancer risks results in total estimated excess cancer risks of approximately 6×10^{-6} and 2×10^{-6} for the residential and industrial scenarios, respectively. Therefore, cancer risks for both residential and industrial scenarios are below the NMED target level of 1×10^{-5}. Table 2.3-1 (revised Table I-4.1-7 from the IR) presents the total estimated excess cancer risks for MDA A with the correct SSLs for TCDD[2,3,7,8-].

3.0 SITE CONDITIONS

The site conditions at MDA A are described in detail in the approved IR for MDA A (LANL 2006, 095046).

The following sections summarize the surface and subsurface conditions at MDA A.

3.1 Surface Conditions

Figure 2.1-1 depicts the elevation of DP Mesa in the vicinity of MDA A, which ranges from 7125 to 7135 ft, with a gentle slope into DP Canyon to the north. The DP Canyon slope ranges in elevation from 7035 ft at the bottom to 7125 ft on the northern edge of DP Mesa, immediately north of MDA A.

The surface of MDA A is heavily vegetated with forbs, native grasses, and sagebrush. The surface slopes at a gradient of less than 5% (2.25 degrees) downward across the site from south to north. Approximately 30 ft north of the site, the slope increases to approximately 67% (30 degrees).

3.2 Subsurface Conditions

The natural or undisturbed surface soil cover is limited because of Laboratory operations, such as building, road construction, and demolition. Where undisturbed, soils on the mesa surface are thin and poorly developed. The texture of soils tends to be sandy near the surface and more claylike beneath the surface. Soil profiles tend to be more poorly developed on the cliff-forming, south-facing slopes than on the north-facing slopes, which tend to have a higher organic content. A discussion of soils in the Los Alamos area is presented in section 2.2.1.3 of the installation work plan (LANL 1998, 062060, pp. 2-21) and in Nyhan et al. (1978, 005702, pp. 24-25).

3.2.1 Stratigraphy

The generalized stratigraphy of DP Mesa in the area of MDA A is shown in Figure 3.2-1. DP Mesa consists of Qbt overlain by a thin layer of alluvium and soil. The Bandelier Tuff unit is subdivided into two members, the Otowi and the Tshirege (in ascending order). MDA A is situated within the Tshirege

Member, which is a compound-cooling unit divided into four distinct cooling units (Broxton et al. 1995, 050121, pp. 33-63). The bedrock directly underlying TA-21 is cooling unit 3 (Qbt 3) of the Upper Tshirege, a cliff-forming, nonwelded to partially welded tuff. Below MDA A, the Otowi and Tshirege Members are separated at about 340 ft bgs by the Cerro Toledo (Qct) interval, a 10- to 40-ft-thick sequence of volcaniclastic sediments deposited in braided stream systems. Bandelier Tuff and deposits of the Cerro Toledo interval are derived primarily from explosive volcanic eruptions in the Valles Caldera, approximately 1.2 million years ago (Goff 1995, 049682, p. 7). The basal Guaje Pumice Bed of the Otowi Member separates Bandelier Tuff from the underlying clastic fanglomerate sediments of the Puye Formation (LANL 2004, 087358, p. 13).

3.2.1.1 Quaternary Bandelier Tuff Unit 3

Qbt 3 is approximately 110 ft thick at MDA A and consists of nonwelded to moderately welded ash-flow tuff. The degree of welding tends to increase with depth. However, the degree of welding is not closely associated with an increase in fracture density.

3.2.1.2 Quaternary Bandelier Tuff Unit 2

Qbt 2 is a vertical cliff-forming unit, typically 80 to 90 ft thick. The upper contact is defined by the appearance of generally thin, nonwelded, and unconsolidated tuff. The lower contact is generally marked by an abundance of phenocrysts and pumice fragments. Fracture zones tend to be prevalent in this unit. The unit is described in the log for BH 12 (location 21-26588), as presented in Appendix C of the MDA A IR (LANL 2006, 095046).

3.2.1.3 Quaternary Bandelier Tuff Units 1v and 1g

Qbt 1v is used to identify the vapor-phase unit of Qbt 1. Qbt 1g represents the glass phase of the unit. The vapor-phase unit (Qbt 1v) separates the glass-phase unit (Qbt 1g) from the overlying Qbt 2. At MDA A, the Qbt 1v unit was found to be 50 ft thick and consisted primarily of devitrified, nonwelded ash-flow tuff. The unit is described in the BH 12 log (location 21-26588), as presented in Appendix C of the MDA A IR (LANL 2006, 095046).

3.2.1.4 Tsankawi Pumice Bed

The Tsankawi Pumice Bed (approximately 4 ft thick at MDA A) is the basal pumice fall of the Tshirege Member of Bandelier Tuff. The Tsankawi Pumice Bed consists of a gray to white angular pumice layer, grading from 0.39- to 1.18-in.-diameter pumice gravel in the basal layer at a depth of 345–346 ft bgs. The unit is described in the BH-12 log (location 21-26588), as presented in Appendix C of the MDA A IR (LANL 2006, 095046).

3.2.1.5 Cerro Toledo and Otowi Intervals

The Tshirege and Otowi Members are separated by the Cerro Toledo interval, a volcaniclastic sequence of sediments deposited as part of a braided stream system (Broxton and Eller 1995, 058207). Drilling at BH-12 (location 21-26588) advanced 10 ft into the Otowi Member to a depth of 353 ft bgs. The Otowi Member, a light-gray ash-flow tuff with light-gray pumice clasts, is estimated to be 180 ft thick at TA-21.

3.2.1.6 Guaje Pumice Bed

The Guaje Pumice Bed occurs at the base of the Otowi Member and is an extensive marker horizon in both outcrops and wells. It is a slightly to moderately consolidated stratified unit that contains sorted layers of pumice fragments, ash, and crystals with an aggregate thickness of 10 to 30 ft. In vapor-monitoring well location 21-25262 at MDA T adjacent to MDA A, the Guaje Pumice Bed was encountered from 670 to 693 ft bgs.

3.2.1.7 Puye Formation

The Puye Formation unconformably overlies rocks of the Santa Fe Group, and the Otowi Member of the Bandelier Tuff unconformably overlies the previous formation. The Puye Formation is a heterogeneous unit consisting of crudely stratified deposits of weakly cemented lithic sandstones, silts, conglomerates, and ash beds. In location 21-25262 at MDA T, the Puye Formation was encountered at a depth of 693.7 ft bgs.

3.2.2 Groundwater

Two geologic properties of Bandelier Tuff that influence recharge rates are the degree of welding and devitrification; both bear the effects of the prolonged presence of residual gases and high temperatures after deposition. Cooling of the units was not uniform because the different tuff units were deposited at different temperatures. Welding tends to vary spatially, both between units and within separate depositional layers. Welded tuffs tend to be more fractured than nonwelded tuffs. Fractures within the tuff, however, do not enhance the movement of dissolved contaminants unless saturated conditions exist because the fractures tend to be clay-filled, resulting in generally higher sorptive capacity.

Based upon information reported in the MDA A IR (LANL 2006, 095046), the moisture content of site soils ranged from 6% to 20%, averaging less than 20%. At these moisture levels, the fractures beneath the site are unsaturated. Fractures will conduct water only in situations where substantial infiltration occurs from the ground surface; however, past modeling studies indicate that when fractures become discontinuous at stratigraphic subunit contacts, fracture moisture is absorbed into the tuff matrix (Soll and Birdsell 1998, 070011, pp. 200-201).

The regional aquifer is approximately 1265 ft bgs at MDA A (Figure 3.2-2). During the 2006 investigation, groundwater was not encountered beneath MDA A to a depth of 360 ft bgs.

4.0 SCOPE OF ACTIVITIES

Except for pore gas, the nature and extent of contamination in the media surrounding the disposal trenches, central pit, and Plutonium Tanks have been characterized (LANL 2006, 095046). Executing the activities included in this work plan will result in the removal of buried waste and of the Plutonium Tanks at MDA A. The disposal of trench and pit excavation waste will maximize efficiency and safety and optimize the ability to stage material and equipment on the site. An emergency response plan will be implemented to provide specific steps for notifying and protecting the public if there is a release of hazardous material. The impact on the public will be minimized to the degree practicable by careful planning of the excavation and investigation activities. Activities related to investigation/remediation and materials management will be conducted within a designated area of contamination Trench and pit excavations will be backfilled with soils and overburden meeting residential SSLs and SALs. By controlling where excavation equipment goes, it was found that the potential for tracking contamination onto clean surfaces will be eliminated.

4.1 Scope of Activities for Eastern Trenches and Central Pit

4.1.1 Justification for Proposed Scope of Work

On April 16, 2009, the Laboratory and the National Nuclear Security Administration (NNSA) requested that NMED approve a request to prepare a Phase II work plan in conjunction with the withdrawal of the previously submitted MDA A corrective measures evaluation report. In a letter dated May 4, 2009 (NMED 2009, 106017), NMED approved the request. The scope of this work plan; the sampling conducted for the 2006 IR (LANL 2006, 095046) approved by NMED; the previous RFIs and data collected for TA-21, MDA A, and contained in the “Investigation Report for Material Disposal Area A, Solid Waste Management Unit 21-014, at Technical Area 21” (LANL 2006, 095046); and the “Status Report for Supplemental Sampling at Material Disposal Area A, Technical Area 21” (LANL 2007, 100482) form a basis for compliance with the Consent Order.

Cleanup levels are based on current and expected future land uses. At MDA A, the current and reasonably foreseeable land use is industrial and is the basis of the cleanup levels presented in the work plan. As the owner of the site, DOE is committed to cleanup to at least industrial levels to allow continued use of the site for industrial purposes. At present, no commitment has been made concerning future development or transfer of the site for other than industrial purposes. DOE recognizes, however, the advantage of cleanup to residential levels in terms of eliminating potential future land-use restrictions and a reduction in long-term monitoring costs if the site meets residential cleanup levels. Therefore, DOE has established the goal of meeting residential cleanup levels at MDA A if practicable within the upper 10 ft below final grade or 2 ft below the limit of the waste excavation, whichever is deeper at the location being considered. Site conditions will be evaluated during implementation of the cleanup to determine whether attainment of residential cleanup levels is practicable, i.e., SSLs for chemicals and SALs for radionuclides, as determined by NMED (2005, 090802, or current version) or EPA (2005, 091002, or current verison) radionuclides (LANL 2005, 088493, or current version).

4.1.2 Regulatory Basis for Technical Approach

The regulatory basis for handling waste materials during the MDA A investigation/remediation is the application of EPA’s area of contamination concept. This concept was discussed in detail in the preamble to the National Contingency Plan (55 Federal Register 8758–8760, March 8, 1990) and more recently in an Office of Solid Waste and Emergency Response guidance memorandum, “Use of the Area of Contamination Concept During RCRA Cleanups” (Shapiro and Luftig 1996, 082288). The area of contamination concept provides for areas of contiguous contamination to be designated as a RCRA “unit” (for example, a landfill) for the purpose of implementing a remedy. In general, excavation, movement, consolidation, in situ treatment, and redeposition of hazardous remediation wastes within the area of contamination will not trigger RCRA Subtitle C requirements because they are not considered treatment, storage, or disposal (TSD) activities. These activities must occur entirely within the area of contamination boundaries and cannot be associated with any ex situ treatment or storage units either within or outside the area of contamination.

A request to obtain an area of contamination designation for this work will be submitted to NMED for approval no less than 30 d before a notification of site investigation sampling. The request will specify the boundaries of the proposed area of contamination, the rationale for how the boundaries were established, and an explanation of how the boundaries will be delineated.

With respect to the Plutonium Tanks, decisions regarding waste removal (tank heel) and physical tank removal can be made only after receipt of the characterization data. This work plan will be conducted under the requirements of the Consent Order.

The removal of contaminant source material will involve the excavation of buried historical waste. Contaminated surrounding soil and tuff will also be removed until inorganic chemical and organic chemical levels are below industrial cleanup levels and until they are below residential cleanup levels to the extent practicable. As specified in Section VIII.B.1 of the Consent Order, cleanup goals of 1×10^{-5} cancer risk and an HI of 1 will be met, as will DOE's dose limit of 15 millirems per year (mrem/yr), based on the reasonably foreseeable land use of the site. Once initial screening and segregation activities have been completed, the excavated material will be transferred to a staging facility for final identification, packaging, and shipping to appropriate off-site disposal facilities. Waste will be containerized and managed in accordance with RCRA regulatory requirements upon transfer outside of the area of contamination boundaries.

Long-Term Effectiveness of the Proposed Activities

Achieving cleanup standards will ensure long-term effectiveness by removing all waste and most contaminated media. Starting with the highest priority, the long-term benefits of this action are as follows:

- removing the primary source term for contaminant releases to the environment
- eliminating the potential for future contaminant releases to the environment
- rendering the site suitable for future development
- providing the most expeditious approach to waste characterization and remediation of MDA A

As the excavation proceeds, confirmation samples will be taken to at least 2 ft below the exposed excavation bottom and side slopes. This sampling will directly determine any residual contamination and allow a high confidence in determining potential risk/dose.

Possible Contingencies if Cleanup Levels Cannot Be Achieved

Based on existing data, the proposed cleanup should allow the site to pass residential risk scenario, although some soil and/or bedrock may remain at depth with contamination above residential SALs or SSLs and less than industrial SALs and SSLs. If it appears industrial SALs or SSLs cannot be met, NMED will be notified and concurrence will be obtained for any changes to the criteria on a case-by-case basis, subject to a demonstration to NMED that the proposed cleanup levels are deemed impracticable, pursuant to Section VIII.E of the Consent Order. Specific actions related to this demonstration will be identified and may include the following possible contingencies:

- performing assessments to determine enhancements to the remediation
- establishing deed restrictions and/or other institutional controls if ownership of the property is transferred
- developing a long-term monitoring plan and/or other institutional controls
- selecting a combination of the above options based on discussions with NMED

Any contingency action will be designed to meet the cleanup goals contained in the Consent Order as well as the DOE dose limit of 15 mrem/yr, based on the reasonably foreseeable future land use of the site.

4.1.3 Health and Safety and Environmental Protection

4.1.3.1 Integrated Safety Management

Efforts are ongoing to categorize the disposal trenches and central pit as a radiologically controlled area. If the Laboratory is successful with this recategorization effort, compliance with 29 Code of Federal Regulations (CFR) 1910 (Hazardous Waste Operations and Emergency Response) will be required. In addition, an approved site-specific health and safety plan (SSHASP) must be in place before work begins.

4.1.3.2 Environmental Protection Monitoring

Activities within the excavation areas will be monitored using real-time continuous air monitoring (CAM) systems or similar devices. The CAMs will survey airborne radioactive particles inside the work zone and outside the excavation areas at specific locations around the site. In particular, beta and/or alpha activities will be monitored to ensure that they remain below action levels identified in the SSHASP. Levels of VOCs and airborne particulates (dust) will also be monitored. The need for air-net monitoring stations will be evaluated, and the network will be adjusted to fill any potential gaps, most likely in areas that are closest to the public. The SSHASP will specify the monitoring requirements to ensure that federal, state, and local environmental protection limits are not exceeded. Details of radiation monitoring equipment and procedures will be included in a radiation protection program to be developed, specifically for MDA A activities.

4.1.3.3 Emergency Response

An emergency response plan will be prepared to establish a program that optimizes a safe and informed response to emergency situations, with the intent of protecting project personnel, the public, the environment, and property in the event of hazardous substance releases, employee contamination, accidents, injuries, fires, or natural disasters. At a minimum, the emergency response plan will contain the following elements:

- training
- drills and exercises
- site security and control
- notification procedures (emergency responders and the public)
- personnel accountability process
- site evacuation
- medical support
- emergency response equipment
- emergency response equipment maintenance and inspection
- emergency response actions to the following:
    - ❖ radiological material releases
    - ❖ hazardous chemical releases
    - ❖ accidents resulting in property damage or injury
    - ❖ fires and explosions

- natural disasters
- emergencies resulting from personal protective equipment failure

A critical part of any emergency response will be the ability of on-site project personnel to recognize and mitigate actual or potential emergency situations. To accomplish this, on-site personnel will train to the emergency response plan and will demonstrate their ability to effectively respond to emergency situations through the use of mockups, drills, and exercises. Additionally, the abilities of on-site personnel will be independently confirmed using the Laboratory readiness assessment process.

4.1.4 Topsoil and Overburden Excavation

Topsoil and overburden material will be removed from all areas requiring waste removal. To allow for potential reuse of topsoil as the site restoration rooting media, the upper 12 in. will be segregated from other overburden soil.

Overburden found below the upper 12-in. of topsoil, above bedrock or waste, and contaminated above residential cleanup levels will be excavated and treated as contaminated soil. Overburden having contamination below residential cleanup levels will be removed and stockpiled as suitable fill soil.

4.1.5 Excavation of Central Pit and Disposal Trenches

As part of the waste excavation of the eastern trenches and central pit, inspection trenches will be excavated ahead of and into the working face of the waste to obtain information regarding the wastes before excavating the full face (see Figure 4.1-1). This observational approach to waste excavation will include visual logging and field screening of waste removed from the inspection trenches to guide the further advance of the trench/pit excavation.

The central pit and eastern trenches waste will be completely excavated, and contaminated media adjacent to the waste will be removed as necessary to meet cleanup standards. Field screening of the excavation floor and sidewalls will be used to determine if further excavation is required.

4.1.6 Segregation of Waste by Material Type

Excavated wastes will be segregated according to identifiable waste types. Segregation will help with the evaluation of waste streams and the estimation of waste volumes. Visual identification of waste forms, such as ductwork, batteries, building debris, etc., will be used to separate wastes. Soils may be stained or show other signs of contamination. Segregation may also be performed based on field screening, swipes, and other forms of sampling. Labels may identify the contents of bottles. Polychlorinated biphenyl (PCB) screening will be performed as appropriate.

4.1.7 Waste Management

Qualitative and quantitative analytical tests will be performed on-site to rapidly identify primary physical, radiological, and chemical hazards to the site worker. Based on the historical information available about the MDA A area, the primary hazard characteristics for rapid identification will be radioactivity, flammability, corrosivity, oxidation potential, physical properties, and reactivity with air and water. Investigation-derived waste (IDW) expected to be generated during the MDA A activities is described in Appendix A.

Waste materials excavated from MDA A will be containerized appropriately for off-site disposal. Wastes will be characterized to segregate waste materials for treatability, selection of appropriate waste packaging, and compliance with U.S. Department of Transportation (DOT) requirements. Waste analyses will be performed at an analytical laboratory that is certified for specific analyses needed to meet the waste acceptance criteria (WAC) for the receiving facility. The laboratory will be equipped with analytical instruments, which may include a gas chromatograph, immunoassay kit, x-ray fluorescence spectrometer, or other instruments suitable for the specific analyses needed for the WAC. Characterization of containers exhibiting special physical or chemical hazards (e.g., high-pressure gas cylinders) may require the use of both manual and remote sample-handling techniques.

Some waste, such as batteries and transformers that will not require direct sampling for determination of WAC, will be visually identified.

The inventory of excavated materials will be recorded in an electronic database developed specifically to meet the MDA A data collection requirements and populated with data from each step in the investigation/remediation.

The regulatory classification for each of the possible waste streams includes solid waste, industrial solid waste, New Mexico special waste, RCRA hazardous waste, low-level radioactive waste (LLW), transuranic (TRU) waste, mixed low-level waste (MLLW), and mixed TRU waste (TRU waste).

An analysis of treatment and disposal pathways will be used to define specific waste streams, their parameters, and their acceptability for treatment or disposal at specific off-site TSD facilities.

4.1.8 Confirmation Sampling

The confirmation samples will be collected to confirm that cleanup standards are met within the upper 10 ft below final grade or 2 ft below/adjacent to the limit of the waste excavation, whichever is deeper at the location being considered. Confirmation samples will also be used to determine whether it is practicable to meet residential cleanup levels. Samples of geologic material will be collected from beneath the waste excavation floor and adjacent to the excavation sidewalls (Figure 4.1-2) after waste removal. Confirmation sampling results will be used with the MDA A IR data to define the horizontal and vertical extent of potential contamination in the media. The results will be evaluated to determine if additional excavation is necessary.

Sample analytical results will be evaluated to determine if additional excavation is necessary and if residual contamination poses any unacceptable risk or dose to human health or the environment and to support further contingencies if cleanup levels are not achieved.

4.1.9 Surveying Locations and Features of Excavation

Primary features of the excavation(s) will be located and recorded as part of the record for the remediation. Redline drawings will record the conditions as found that deviate from remediation design drawings. A survey will be made of locations and thickness of overburden, waste limits, excavation limits, locations and elevations of samples, locations of buried items of interest, locations of potential residual contamination identified by field screening, and any other features deemed important to the investigation/remediation. Final-grade topography will be determined.

4.1.10 Site Restoration

After confirmation results indicate the site has been remediated, excavations will be backfilled to original grade using the excavated overburden soil meeting residential SALs, SSLs, and imported soil, as needed. Topsoil removed before removal of the overburden and meeting residential SALs and SSLs will be replaced, and the site will be seeded with native vegetation.

4.2 Scope of Activities for Plutonium Tanks

4.2.1 Justification for Proposed Scope of Work

The scope of activities described in this work plan includes the complete removal and disposal of the Plutonium Tanks as part of the overall work scope proposed for the remediation of MDA A. Associated with this scope of work is the characterization and disposal of all tank waste and the tanks as well as confirmation that the remediation meets the cleanup standards. Confirmation sampling will also be used to determine whether it is practicable to meet the residential cleanup levels. This proposed approach (excavation and complete removal of the Plutonium Tanks) provides several advantages over the interim process, as described in the Consent Order. Advantages of the Laboratory's proposed approach include the following.

- Removal of the potential contaminant source associated with the Plutonium Tanks will reduce the overall environmental risk and dose associated with the site.
- Potential risk and dose to the public will be reduced or eliminated by removing the contaminant source in a single effort.

4.2.2 Regulatory Basis for Technical Approach

The work plan for the Plutonium Tanks will be conducted under the requirements of the Consent Order. The removal of contaminant source material (tank components, residual sludge, and surrounding environmental media) will involve the excavation of the Plutonium Tanks, soil overburden, reinforced concrete slab, existing backfill material, and concrete piers until contaminant levels are below cleanup levels, as specified in Section VIII.B.1 of the Consent Order.

An analytical sampling program will be developed to investigate the presence of RCRA constituents in the sludge. Based upon the analytical results of this sludge sampling, a determination will be made whether the waste disposal approach for the eastern trenches and the central pit should be modified for the sludge. In addition, because of the high radiological content of the sludge, the available technical options associated with sludge disposal may be affected.

Because the waste in the Plutonium Tanks is likely TRU greater than 100 nCi plutonium-equivalent material, DOE will require the material to be treated as newly generated TRU waste. The Laboratory will test, process, handle, and dispose of this material under the TRU waste program.

Section 4.1.2 provides the remaining discussion regarding the regulatory basis.

4.2.3 Health and Safety and Environmental Protection

The health and safety and environmental protection approaches applicable to the Plutonium Tanks are defined in section 4.1.3.

4.2.3.1 Integrated Safety Management

The integrated safety management (ISM) approach for the Plutonium Tanks will be the same for the eastern trenches and central pit (see section 4.1.3.1), in addition to the following.

The nuclear safety program for the Plutonium Tanks will be implemented in two stages: (1) preliminary screening activities to characterize headspace gas and residual tank sludge and (2) excavation and removal, including possible waste retrieval/treatment of residues within the Plutonium Tanks.

The Plutonium Tanks are categorized as a Hazard Category 2 nonreactor nuclear facility. The hazard category is based on inventories documented in the DOE/NNSA-approved documented safety analysis (DSA) (LANL 2004, 088713.2). The DSA was developed and approved in 2004 to provide safety basis coverage for ongoing surveillance and maintenance activities at the Plutonium Tanks and other nuclear environmental sites.

The nuclear safety program for sampling and characterization will revise the current approved nuclear environment site DSA to include the characterization activities identified in this work plan. Revisions to the current DSA will use a graded approach and will be consistent with requirements established in

- 10 CFR 830, Subpart B, “Safety Basis Requirements”;
- DOE Standard 3009-94, “Change Notice 3, Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facilities Documented Safety Analysis”;
- DOE Order 420.1B, “Facility Safety”;
- DOE Guide 420.1-2, “Guide for the Mitigation of Natural Phenomena Hazards for DOE Nuclear Facilities and Nonnuclear Facilities”; and
- DOE-STD-1027-92, “Hazard Categorization and Accident Analysis Techniques for Compliance with DOE Order 5480.23, Nuclear Safety Analysis Reports.”

The nuclear safety program for excavation and tank removal may require a separate DSA to be prepared and maintained for the Plutonium Tanks. The DSA will employ a graded approach, consistent with 10 CFR 830, Subpart B, to establish the safety envelope and boundaries for the full range of planned activities associated with the complete removal of the Plutonium Tanks. The Plutonium Tanks removal DSA will incorporate the results from tank sampling and characterization, operational history/process knowledge, and past tank characterization data to establish the engineered safety features necessary to prevent or mitigate the consequences of an operational accident. The DSA will contain controls to protect the public, workers, and environment from the hazards associated with the Plutonium Tanks calculated inventory, primarily radionuclides. Work conducted as part of the Plutonium Tanks removal will be performed in accordance with the controls established by the DSA and any technical safety requirements. The controls will be incorporated into the SSHASP required by 29 CFR 1910 and 29 CFR 1926, the Laboratory’s ISM requirements, and other site-specific procedures. The DSA for the Plutonium Tanks removal operation will be prepared by the Laboratory and approved by DOE.

4.2.3.2 Environmental Protection Monitoring

The approaches to environmental protection monitoring for the Plutonium Tanks will be as described for the eastern trenches and central pit (see section 4.1.3.2).

4.2.3.3 Emergency Response

Emergency response is discussed in section 4.1.3.3.

4.2.4 Preliminary Screening Activities

Preliminary tank screening of the headspace gas and the residual sludge will be performed to determine the presence of flammable gas, evaluate sludge physical properties, and establish the nature of radiological and hazardous constituents. The results of the preliminary sampling will support development of a separate tank excavation and removal DSA; development of safety basis requirements, engineering designs, safe work control processes, and hazard mitigation strategies; identification of potential waste streams and disposal pathways; and selection of potential sludge retrieval technologies.

Headspace screening can be accomplished by excavating to the surface of the tank and tapping the sidewall, tapping existing tank fill and vent lines to install gas-sampling ports, or accessing the existing 18-in.-diameter postconstruction access hole installed in the tanks in 1974. Because the location and condition of the fill and vent lines are unknown, accessing the postconstruction access port is the most effective approach. To access the port, the overburden soil will be removed over the center of each tank. Standard field-screening methods will be used during excavation to determine the presence of potential contamination and volatiles. Overburden will be stockpiled for future contouring backfill operations; contaminated soil will be segregated and appropriately packaged for disposal. The excavation will be secured with caissons (portable shoring devices) to support the sidewalls and prevent collapse. If access at this location is difficult, then access will be attempted through the pipes at the end of the tanks. Although technically more difficult, this is a proven technology for accessing tanks containing potentially flammable vapors.

4.2.5 Excavation of Plutonium Tanks

The excavation process for the tanks will be similar to the eastern trenches and central pit. Waste residues can be retrieved and treated and the Plutonium Tanks can be excavated (including removal of the reinforced concrete slab and concrete support piers). All environmental media (e.g., soil, overburden material, concrete, and tuff) will be characterized for the purpose of reuse as backfill if soil or tuff and for evaluating treatment and disposal options before shipping. Waste from the Plutonium Tanks will be processed for disposal at approved off-site disposal facilities. Tank externals, piping, and other ancillary components and debris will be processed for disposal at approved off-site disposal facilities. Soil surrounding the Plutonium Tanks will be excavated to the base of the four concrete piers supporting each of the Plutonium Tanks. The entire width of the tank trenches will be excavated; sidewalls will be sloped as needed to eliminate the need for shoring, in compliance with 29 CFR 1926, Subpart P.

Two primary methods exist for removing the Plutonium Tanks. The first method includes retrieving the sludge, packaging the waste, and removing the tanks as either a single structure or size-reduced for off-site disposal. A potential second method involves grouting the sludge to create a homogeneous mass within each tank; however, this can work only if the activity of the grouted mass is reduced to less than 10 nCi/g. This second method solidifies the sludge and allows disposal of the tanks as a single waste package or allows size reduction of the monolith for disposal in an appropriate off-site repository. The means and methods to remove the Plutonium Tanks will be developed through a systematic and progressive process, starting with the assessment of the preliminary tank characterization data and sludge properties. Sludge properties as well as the radionuclide content will significantly impact potential sludge retrieval/tank removal alternatives. Once the sludge characterization data are evaluated, the Laboratory will conduct an alternatives analysis to select the appropriate technology and methods to retrieve and remove the Plutonium Tanks. The alternatives analysis and technology selection for removal of the Plutonium Tanks are not part of this document but will be included in a future tank survey report.

4.2.6 Segregation of Waste Material by Type

The approach to segregation of waste material by type is discussed in section 4.1.6 and Appendix A. Upon excavation, materials will be segregated, according to identifiable waste types.

4.2.7 Waste Management

The approach to waste management is discussed in section 4.1.7.

4.2.8 Confirmation Sampling

The strategy associated with confirmation sampling is discussed in section 4.1.8. Confirmation sampling following removal of the Plutonium Tanks will be limited to the footprint and sidewalls of the original tank construction excavation at the base of the tanks and two depths below the bottom of the original construction excavation. If a release from the Plutonium Tanks is confirmed, additional removal and sampling will be performed.

4.2.9 Surveying Locations and Features of Excavation

Techniques for surveying locations and excavation features are the same as discussed in section 4.1.9.

4.2.10 Site Restoration

The approach to be taken for restoring the site is the same as discussed in section 4.1.10.

5.0 INVESTIGATION METHODS

The methods for conducting the activities identified in this work plan are presented below. Specific procedures and standardized methods are available for some activities, such as sample collection and analysis. If there is no approved method for a specific activity, a method will be developed as part of design specifications that will be written before beginning field operations.

5.1 Topsoil and Overburden Sampling and Excavation Methods

The upper 12 in. of the site soils is topsoil. The topsoil layer will be removed from excavation areas using conventional earth moving equipment, such as bulldozers and end loaders, and stockpiled within the area of contamination, pending results of analytical data that indicate the potential for reuse as backfill. One sample will be collected following removal for each 100 yd^3 of topsoil removed.

To ensure that clean overburden soils are not mixed with contaminated soils, the Laboratory will use systematic grid sampling to characterize the overburden soils in place. EPA recommends the use of grid sampling to spatially identify areas of contamination, including "hot spots" (http://www.epa.gov/QUALITY/qksampl.html#adaptive). An advantage of systematic grid sampling is that it ensures uniform coverage of the site. It also avoids the situation created by excavating and placing soils in piles or containers where clean soils are mixed with contaminated soils, resulting in dilution of the contaminated soils or contamination of the clean soils. The proposed systematic grid sampling will allow the Laboratory to excavate and segregate contaminated soils before they are mixed with clean soils.

Based on the IR data, the overburden underlying the topsoil in the area of the central pit and eastern trenches ranges from 1.5 to 5 ft deep, averaging 3.4 ft. Once the topsoil over the central pit and eastern trenches is removed, the remaining overburden samples will be collected by use of hand or mechanical augers to obtain samples before excavation. Samples will be collected in the center point of a grid, sized so that a minimum of one sample is collected for each 100 yd^3 of material. The grid spacing is approximately 20 ft × 20 ft, based on the maximum remaining overburden soil thickness of 5 ft. A sample will be composited over the entire remaining overburden thickness to obtain a sample representing the mixing that will occur during excavation. Overburden contaminated above residential SSLs/SALs will be managed as waste and removed from a grid location using excavators. Contaminated overburden will be placed into rolloff containers as waste. Once any contaminated overburden has been removed, larger earthmoving equipment will remove and stockpile the remaining overburden in an environmentally protective manner by means of appropriately designed and controlled (e.g., bermed and covered) staging piles for reuse as excavation backfill for MDA A.

Samples will be analyzed for target analyte list (TAL) metals, gamma-emitting radionuclides, isotopic uranium, isotopic plutonium, tritium, americium-241, strontium-90, VOCs, semivolatile organic compounds (SVOCs), dioxins/furans, perchlorate/nitrate, and cyanide.

Any additional field quality assurance/quality control (QA/QC) samples (e.g., field duplicates) will be collected at a minimum frequency of 10% of the total samples collected, in accordance with Section IX.C of the Consent Order.

Explosive compounds analyses will not be performed because there is no operational history to indicate that these materials are present at MDA A, nor did the investigation report encounter these constituents in the media surrounding the waste.

Field screening will be performed and will provide additional protection of the health and safety of the workers. Field screening may include visual examination, radiation screening, headspace vapor screening for VOCs and pH, and metal screening using x-ray fluorescence. Total petroleum hydrocarbons and PCBs will be sampled if staining of the soil is detected.

5.2 Excavation Methods of the Central Pit and Eastern Trenches

Excavations will be completed using a standard track-mounted hydraulic excavator (a trackhoe) to carefully expose and remove landfill contents for inspection and screening using the observational method, identification, and removal. The primary method employed will involve initiating the excavation with a downward-sloping ramp leading to the initial access point within the waste trench area. A sloping dig face will be established on which the buried waste is exposed for inspection and initial characterization. The slope of the dig face may vary, depending upon the angle of repose of the waste trench contents, but it will not be so steep that hazardous conditions are created. The dig face will be advanced in lifts—the thickness of which will be determined by the nature of the buried waste—by the ease or difficulty of removing material with the excavator and by the need to prevent the spread of contaminated material through keeping the excavator on clean material. Lift thickness will be the maximum practicable to minimize the variability of exposed material and the volume of material being processed at any given time.

Excavation of the eastern trenches will also be guided by experience gained from the excavation of the western end of MDA B, which was open during the same time period and received similar waste as the eastern trenches at MDA A.

To avoid the danger of excavation wall collapse, the excavation will be in compliance with 29 CFR 1926, Subpart P.

The waste excavation will consist of the following activities.

- Excavation will proceed until all waste is removed and confirmation sample analyses indicate the exposed soil/tuff meets cleanup levels. Excavated waste material will require careful initial screening and segregation immediately after its removal from the dig face. Excavated material will be staged for initial screening and segregation.
- Field technicians will perform an initial survey of newly exposed material for immediately dangerous to life and health (IDLH) or other dangerous conditions.
- If initial screening results indicate conditions are acceptable, the excavator equipment operator will shut down the excavator and screening personnel may enter, using appropriate levels of personal protective equipment. If initial screening results indicate conditions are not safe for entry, the excavator equipment operator may cover the suspect material with clean soil until the appropriate course of action is determined.
- Material may be removed by hand or with the excavator equipment and then segregated into proper transfer containers (equipment) or overpacks. The material may be transferred to the area of contamination for stockpiling and additional sorting and packaging. Hand excavation is permitted if initial IDLH and other screening results indicate safe conditions and if the excavation is evaluated and approved for personnel access to the face.
- Excavation will continue until analytical results indicate that cleanup standards and DOE's cleanup goals are met.

5.2.1 Initial Screening Methods

Several screening tools will be used for initial health and safety monitoring. Radiological monitoring equipment includes a gamma-dose rate meter (ion chamber), sodium iodide detector, a neutron-dose rate meter, and a CAM instrument. VOCs will be screened using a photoionization detector with an 11.7-electronvolt lamp. Combustible gases can be screened by using Drager tubes for acid gases, basic gases, carbon monoxide, hydrocyanic acid, nitrous gases, and others as appropriate for the trenches. Combustible gases may be screened by using a multigas detector if voids within the disposal area are present. The heat of waste trench contents will be regularly monitored using a handheld infrared thermometer. The infrared thermometer will also help monitor for pyrophoric materials (pyrophoric materials can spontaneously ignite when exposed to air). Conditions will be continuously monitored for changes that could affect the safety of workers in the excavation. Health and safety requirements may preclude personnel entry into the excavations, so it may be necessary to equip the end of the boom of the excavator with a camera or other continuous monitoring tools, as required. 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.

5.2.2 Initial Waste-Segregation Methods

The excavated waste and any other excavated material will be initially sorted by using the excavator bucket. If manual sorting is required, appropriate handling devices will be used to minimize the direct handling of material. A variety of other segregation methods, such as mechanical screens, hand operations, and robotic arms, may be evaluated and used, as appropriate.

The initial segregation of waste will be based on field observations, physical characteristics, and initial screening results. Waste will be segregated or may be staged, opened, and tested.

Segregated material may be containerized in drums, boxes, rolloff bins, or other appropriate waste containers. Size reduction of debris (i.e., compaction) may be performed if appropriate but only after the initial characterization and identification of potential hazards have been completed. Inspection and declassification of materials will be conducted during the initial sorting.

All materials will be managed appropriately to prevent the release of any contamination to the environment within the area of contamination or off-site.

5.2.3 Final Waste-Segregation Methods

Materials identified as waste will be segregated into specific waste types for appropriate disposal. Investigation/remediation activities will minimize the waste generated by following the most recent version of the Laboratory's annual “Hazardous Waste Minimization Report.” Any containers removed from the excavation will be physically inspected for their ability to continue to hold the waste materials safely. If warranted, the contents will be either transferred to a new container or placed in an overpack. The waste material’s hazardous characteristics and compatibility will dictate the manner in which the containers will be handled further. Small containers (<5 gal.) of similar hazard class or compatibility may be placed in larger containers, such as a laboratory pack, for subsequent safe storage and/or transportation. Large containers of similar hazard class, compatibility, and/or waste stream will be grouped together for subsequent safe storage and/or transportation.

5.2.4 Confirmation Sampling Methods for Soil and Tuff

Postwaste removal confirmation samples will be collected at depths corresponding to approximately 0–0.5 ft and 1.5–2.0 ft below the excavation bottom and 0.0–0.5 and 1.5–2.0 ft laterally adjacent to the sidewalls. The deeper samples will be collected at a depth with little or no evidence of contamination, based on visual observation and field-screening results. In addition, the samples will be collected at areas where elevated field screening, visual staining, fractures, or areas of elevated moisture are observed.

Samples will be analyzed for inorganic chemicals, organic chemicals, and radionuclides. Analyses will include pH, TAL metals, gamma-emitting radionuclides, isotopic uranium, isotopic plutonium, tritium, americium-241, strontium-90, VOCs, SVOCs, dioxins/furans, perchlorate/nitrate, asbestos, and cyanide (Table 5.2-1). Confirmation samples will be processed under chain of custody through the Sample Management Office and sent to off-site analytical laboratories for the requested analyses. Field duplicate, equipment rinsate, and field trip blank samples will be collected at a frequency of 5% for QA/QC purposes and in accordance with the Consent Order.

Additional analytes (such as PCBs) may be added to the confirmation sample analytical suites, based on initial waste-screening results and results from waste characterization samples collected before waste disposal.

Analysis for explosive compounds will not be performed because there is no operational history to indicate that these materials are present at MDA A, nor did the investigation report encounter these constituents in the media surrounding the waste.

The locations of all samples will be identified by use of global positioning system (GPS) coordinates obtained when the locations are selected or when the samples are collected. If saturated conditions or free water is encountered in the excavation bottom in sufficient quantities, water samples will be collected and submitted for off-site analytical laboratory analysis. The extent of saturation or high-moisture conditions, if any, will be observed and documented during excavation and sampling.

5.2.5 Geodetic Survey Methods

The geometry and primary features of the excavation(s) will be surveyed using a GPS or other appropriate method.

5.2.6 Site Restoration

If additional fill material is required to reach the site final grade, it will be brought in from off-site. All affected surfaces will be contoured, reseeded, and a straw mulch or appropriate erosion-control fabric will be applied to help stabilize the surface. To prevent future subsidence, moisture content and lift thickness of fill will be controlled. In addition, use of heavy equipment will be used for compacting. Best management practices will be established to monitor and prevent erosion. Conditions for returning environmental media to the site will be addressed further as part of the Laboratory's request for an area of contamination designation to be submitted to NMED upon approval of this work plan.

5.2.7 Waste Management Methods

Representative samples of the waste will be collected from the waste containers in a manner compliant with Environmental Program Directorate standard operating procedures, EPA methods, and/or the disposal facility's sampling guidelines. The WAC will prescribe analytes, sample frequencies, sample sizes, sample type (discrete or composite), and the analytical techniques for the chosen disposal facilities. Waste characterization samples, where required, will be submitted to analytical laboratories.

The investigation/remediation activities described in this work plan will generate various types of IDWs that will be managed in accordance with applicable federal, state, DOE, and Laboratory requirements (Appendix A).

Bar code labels and scanners will be used to link containers and samples to the database and to track movement of containers and samples among the excavation and staging area(s). The database will contain fields for capturing the following types of data:

- type, location, and volume of excavated materials
- physical descriptions and initial hazard classification
- hazard identification results
- waste characterization 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
- geodetic survey or GPS data for the locations of key features in the excavations, such as disposal trench geometry, disposal trench contents of specific interest, and sampling locations

5.2.8 Equipment Decontamination Methods

After excavation and transportation activities, all the equipment involved in sampling, excavation, and material removal activities will be decontaminated. Residual material adhering to equipment will be removed using dry decontamination methods, including the use of wire brushes and scrapers (EP-ERSS-SOP-5061). If equipment cannot be free-released after dry decontamination, a high-pressure sprayer, along with long-handled brushes and rods, will be used to more effectively remove contaminated material from equipment. Pressure-washing of equipment will be performed on a temporary wash pad with a high-density polyethylene liner. Cleaning solutions and wash water will be collected and contained for proper disposal. Decontamination fluids will be sampled to determine final disposition. Air filters on equipment operating in the exclusion zone will be considered contaminated and will be removed and processed for disposal; the filters will be replaced with new clean filters before equipment leaves the site. Equipment will be surveyed and tagged for free release by a heath safety and radiation protection technician before being demobilized.

5.3 Excavation/Removal Methods for the Plutonium Tanks

5.3.1 Initial Screening Methods

As discussed in section 4.2, waste treatment/disposal activities that lead to final excavation and disposal will be guided by the initial screening activities and the means and methods used for characterization of the contents. Initial screening methods will be dictated within the safety basis documentation as well as site-specific safety and health criteria developed for the Plutonium Tanks.

Lessons-learned activities from within the DOE Complex have been utilized. It has been determined that preliminary tank samples will be collected from the headspace gas and within the residual sludge to determine the presence of flammable gas, evaluate sludge physical properties, and establish the nature and extent of radiological and hazardous constituents. The results of the preliminary sampling will support development of a separate tank excavation and removal DSA; development of safety basis requirements, engineering designs, safe work control processes, and hazard mitigation strategies; identification of potential waste streams and disposal pathways; and selection of potential sludge retrieval technologies.

Headspace samples will be obtained by (1) excavating to the surface of the tank and possibly tapping the sidewall and existing tank fill and vent lines (to install sample ports) or (2) accessing the existing 18-in.-diameter postconstruction access hole installed in the tanks in 1974. Because the location and condition of the fill and vent lines are unknown, accessing the postconstruction sample port is the most effective approach. To access the sample port, the overburden soil will be removed over the center of each tank. Standard field-screening methods (see section 5.1) will be used during excavation to determine the presence of potential contamination and volatiles. Soil meeting residential SSLs/SALs will be stockpiled for future backfill operations; contaminated soil will be segregated and appropriately packaged for disposal as waste. The excavation can be secured with caissons to support the sidewalls and prevent collapse. If impedance to access this location is encountered, access will be attempted through the pipes at the end of the tanks. Although technically more difficult, this is a proven technology for accessing tanks containing potentially flammable vapors.

Standard industrial sampling methods will be used to determine the presence of VOCs, SVOCs, and potential explosive vapors before removing the rolled-steel cover placed over the access hole. Tank headspace samples will be obtained through the postconstruction access hole.

5.3.2 Characterization of Atmosphere and Tank Sludge

Once headspace gases have been analyzed and evaluated, a visual examination will be performed to inspect tank integrity, determine the presence of internal structural members and visual staining, and evaluate limited sludge properties (physical appearance, moisture, sludge depth, and volume).

Visual examination and initial screening and inspection activities will be used to aid in the decision process regarding the waste disposition. Radiological screening will determine the level of activity of the sludge. Because the activity of the sludge is expected to exceed that of TRU waste, sampling and analytical laboratory testing will not be performed. The sludge will be assessed in a similar manner as the Laboratory TRU waste management program, where acceptable knowledge is used to determine the potential RCRA hazardous waste constituents for waste disposition. The Laboratory TRU waste program has developed a mixed TRU waste profile for TA-21.

5.3.3 Removal of Topsoil, Overburden, and Concrete Pad

Removal of the Plutonium Tanks' overburden and concrete pad will begin after the MDA A trenches and central pit waste have been removed. During excavation, overburden at the Plutonium Tanks will be handled as waste and maintained within the area of contamination. Excavation will be accomplished using commercial excavator(s) outfitted with buckets, breakers, and shears. The size of the commercial equipment (i.e., weight) will be limited as necessary to ensure the structural integrity of the tanks is not compromised. Topsoil, soil, and demolition debris consisting of the concrete slab and the vent/fill piping will be separated. Overburden will be further separated, based on radiological screening because the former surface (at a depth of 2 ft below existing grade) at the Plutonium Tanks was subject to spills during filling of the tanks. Topsoil and overburden soil will be stockpiled in the area of contamination for testing, as described in Appendix A. If the material is visually identified as soil- or tuff-free of waste forms, debris, or rubble, and if test results indicate that contaminants are below residential screening levels, the material will be stockpiled for use as site restoration and grading fill. A minimum of one test per 100 yd^3 of material will be performed for determining the level of contamination in topsoil and soil. Topsoil may be removed from the central pit, eastern trenches, and the Plutonium Tanks areas as a single operation.

Contaminated overburden soil (above residential screening levels) and rubble will be processed as waste for disposal at approved off-site disposal facilities.

5.3.4 Removal of Tank Waste

Mechanical properties of the sludge and the radionuclide contents will significantly influence the selection of potential sludge retrieval/removal alternatives described in section 4.2.5. The technical approach for removing and remediating the tank waste will be developed through a systematic and progressive process, starting with the assessment of the preliminary tank-screening data and sludge visual mechanical properties.

Regulatory drivers that must be considered are those affecting ancillary equipment, agreeing to completion of end-state objectives, and monitoring leaks if liquid waste retrieval systems are used. Once the contents' properties—radiological, chemical, and physical—are known, a treatment system can be defined and preselected that can safely and effectively remove the contents for treatment or allow for treatment in place leading to final disposal alternatives.

5.3.5 Removal of Tanks

The removal approach for the Plutonium Tanks will be determined based on the sludge waste disposal method selected by the Laboratory through an alternatives analysis and technology selection process: sludge retrieval and separate removal of the tanks or solidification of the sludge and removal of the waste and tanks as a single disposal unit.

However, for either alternative, the Plutonium Tanks will be completely excavated and removed from MDA A. Tank externals, piping, and other ancillary components will be processed for disposal at an approved off-site disposal facility. Environmental media surrounding the tanks will be evaluated either for disposal as waste or if soil or bedrock meets residential SSLs/SALs and is stockpiled for use as backfill at MDA A. The entire width of the tank trenches will be excavated; sidewalls will be sloped, according to Occupational Safety and Health Administration requirements. Shoring may be used as necessary and where appropriate to ensure the stability of the excavation.

As appropriate, and dependent upon the technical approach selected for remediating the tank waste, the Plutonium Tanks will be size-reduced using commercial equipment or removed as single units. Development of the technical methods and the approach for removing the tanks will be included in the alternatives analysis conducted by the Laboratory as a separate document.

NMED requirements will be addressed as they apply to ancillary tank system(s) and the tanks themselves. If the contents of the tank are emptied and the waste residues and tank bottoms are retrieved for eventual treatment, the tanks can be evaluated for residual contamination. If liquid waste retrieval systems are used, the means and methods for leak detection, including mass balance calculations, can be used to safely monitor the process to mitigate and monitor progress. Another option for this tank size is to grout or similarly treat the waste in situ, resulting in a monolith that can be removed and repackaged as necessary before final disposal. Secondary waste streams are managed following the plan outlined for waste treatment and repackaging, with treatment and disposal options dependent on the characterization data received.

5.3.6 Dispositioning and Transporting Tanks

Dispositioning and transporting alternatives are dependent on the final alternative selected to implement the remedy. Proven alternatives include transporting as a single monolith, resectioning a grouted tank into smaller pieces, disposing of an empty tank and treating tank sludge residuals, and disposing of tanks using smaller DOT-compliant packages, such as 55-gal. drums. All alternatives lend themselves to off-site disposal options.

5.3.7 Equipment Decontamination

Equipment decontamination for the Plutonium Tanks remediation will use the same techniques as those used to decontaminate equipment for waste trench and pit remediation. If equipment is contaminated such that free release limits cannot be achieved, it will be handled in the same manner as contaminated waste.

5.3.8 Site Restoration

Restoration of the tank excavations will be conducted concurrently with backfilling and restoration of the MDA A trenches and central pit. Placement and compaction of fill soil for the Plutonium Tanks will be conducted as described in section 5.2.6.

5.3.9 Waste Management Methods

Wastes generated by this process will be treated and disposed of in compliance with DOE Order 435.1 and NMED regulatory requirements. Waste residuals, tank bottoms, ancillary equipment, and secondary waste will be sampled, characterized, and packaged in alignment with these requirements. Tank bottoms/heels can be treated either by means of transfer and treatment into secondary waste containers, or they might be able to be treated in place. Waste forms can be treated to meet TSD facility criteria in 55-gal. drums or other DOT-compliant packages. If waste treatment is completed in place, the package can be left as a single monolith and sent directly for disposal, and/or the waste form can be segmented and packaged into smaller packages. Loose debris associated with ancillary equipment and soils/concrete material can be packaged in appropriately sized containers. Waste profiles and disposal pathways are highly dependent on characterization sampling results, as well as secondary packaging and waste treatment alternatives selected for LLW, MLLW, or TRU waste that may be generated. Determinations can be made in alignment with NMED criteria for using on-site soil that meets residential screening levels as fill material and with pollution prevention and waste minimization opportunities preselected throughout the planning and implementation process.

6.0 SOIL VAPOR-MONITORING AND SAMPLING PROGRAM

Based on information collected from past investigation activities, it is not anticipated that monitoring will be required at MDA A after the implementation of this work plan. However, the results of the confirmation sampling will be evaluated to determine if additional soil vapor monitoring at MDA A is necessary.

7.0 COST ESTIMATE

A cost estimate for the proposed remedy is included as Appendix B of this work plan.

8.0 SCHEDULE

The Phase II IR will be submitted to NMED in December 2013. Preparatory activities for MDA A have started now and will be continuous until completion. This schedule is beyond the 2011 Consent Order date. The proposed date is based on a resource-loaded, activity-based schedule for all preparatory and remediation work involved with the removal. The Laboratory must conduct the field activities in two integrated, yet separate work sequences (the eastern trenches and central pit and the Plutonium Tanks). A justification for the schedule change is described below.

The removal of the MDA A eastern trenches and central pit will utilize lessons learned and appropriate equipment obtained for the MDA B removal. The removal of the MDA A eastern trenches and central pit will start after MDA B removal is complete. The tasks and radiological exposure hazards associated with MDA A eastern trenches are estimated to be slightly greater than MDA B, but separate safety documents are still required. Waste excavation, sorting, characterization, and packaging are estimated to take approximately 13 mo. Confirmation sampling, data validation and verification, and reporting are estimated to take approximately 4 mo and will be conducted concurrently with demobilization and site restoration.

The work activities at the plutonium tanks are much more difficult, as the configuration and contents of the tanks are unique to the Laboratory and do not exist elsewhere in the DOE Complex. The Laboratory is required to maintain the tanks and all work activities as nuclear facilities under 10 CFR 830, “Nuclear Safety Management,” to ensure adequate protection of the workers, the public and the environment. The Plutonium Tanks are classified as a Hazard Category 2 nuclear facility and because of their estimated inventory of plutonium-equivalent curies a more rigorous and documented process to implementing the remediation is required. The Laboratory has obtained engineered shoring boxes that will be installed in the next 6 to 7 mo that will allow access to the surface of the tanks and inspections of the tanks themselves and then the waste heels. The preparations for tank waste removal are the most time-consuming aspect of the proposed MDA A removal. The engineering estimate for the actual waste removal is 5 mo. Interim milestones are provided on the MDA A proposed schedule that indicate that work activities on the Plutonium Tanks is scheduled from now to completion in December 2013 (Table 8.0-1).

9.0 REFERENCES

The following list includes all documents cited in this plan. Parenthetical information following each reference provides the author(s), publication date, and ER ID. This information is also included in text citations. ER IDs are assigned by the Environmental Programs Directorate’s Records Processing Facility (RPF) and are used to locate the document at the RPF and, where applicable, in the master reference set.

Copies of the master reference set are maintained at the NMED Hazardous Waste Bureau and the Directorate. The set was developed to ensure that the administrative authority has all material needed to review this document, and it is updated with every document submitted to the administrative authority. Documents previously submitted to the administrative authority are not included.

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Soll, W., and K. Birdsell, February 1998. "The Influence of Coatings and Fills on Flow in Fractured, Unsaturated Tuff Porous Media Systems," *Water Resources Research,* Vol. 34, No. 2, pp. 193-202. (Soll and Birdsell 1998, 070011)

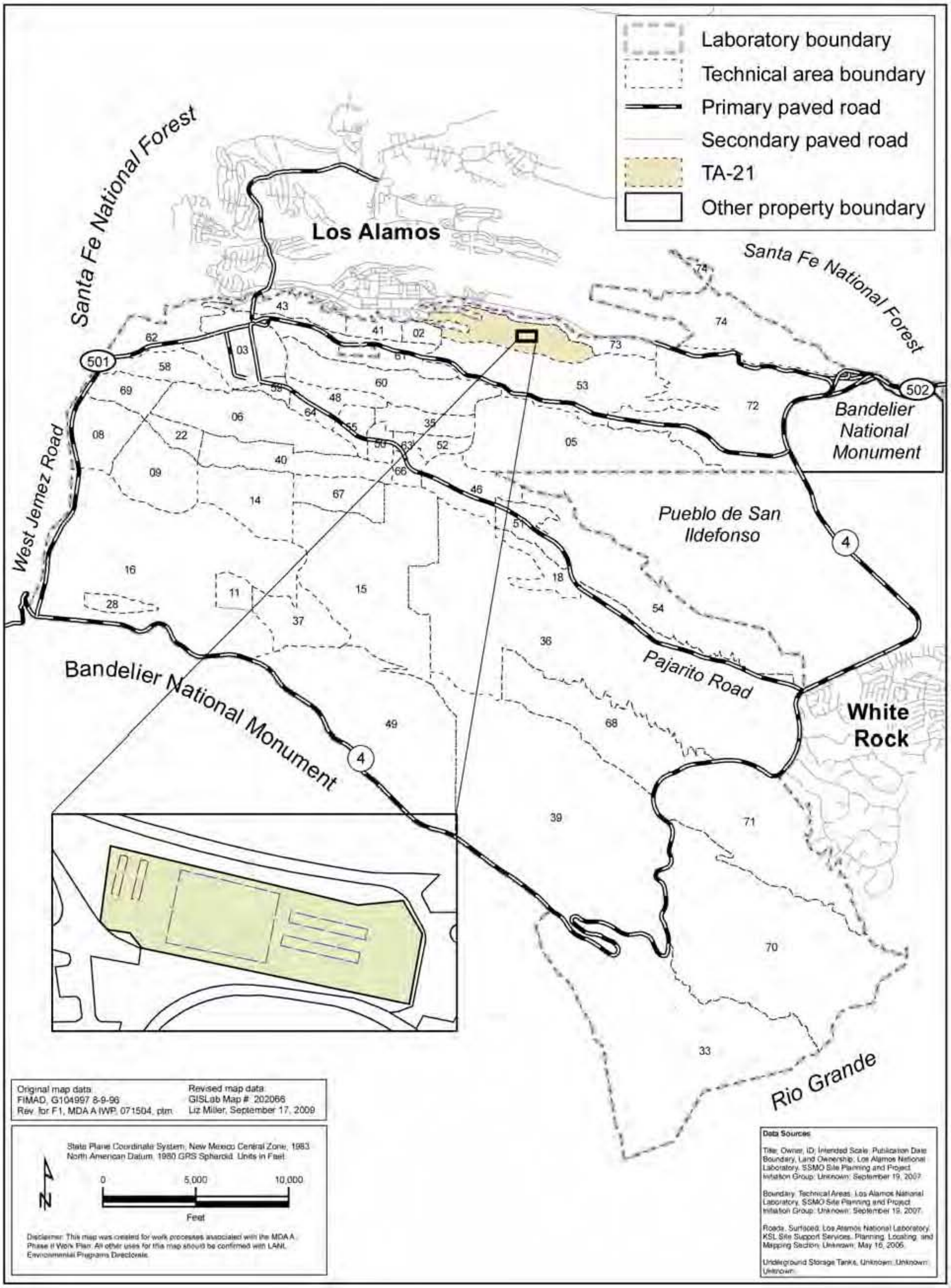


Figure 1.0-1 TA-21 and MDA A with respect to Laboratory TAs

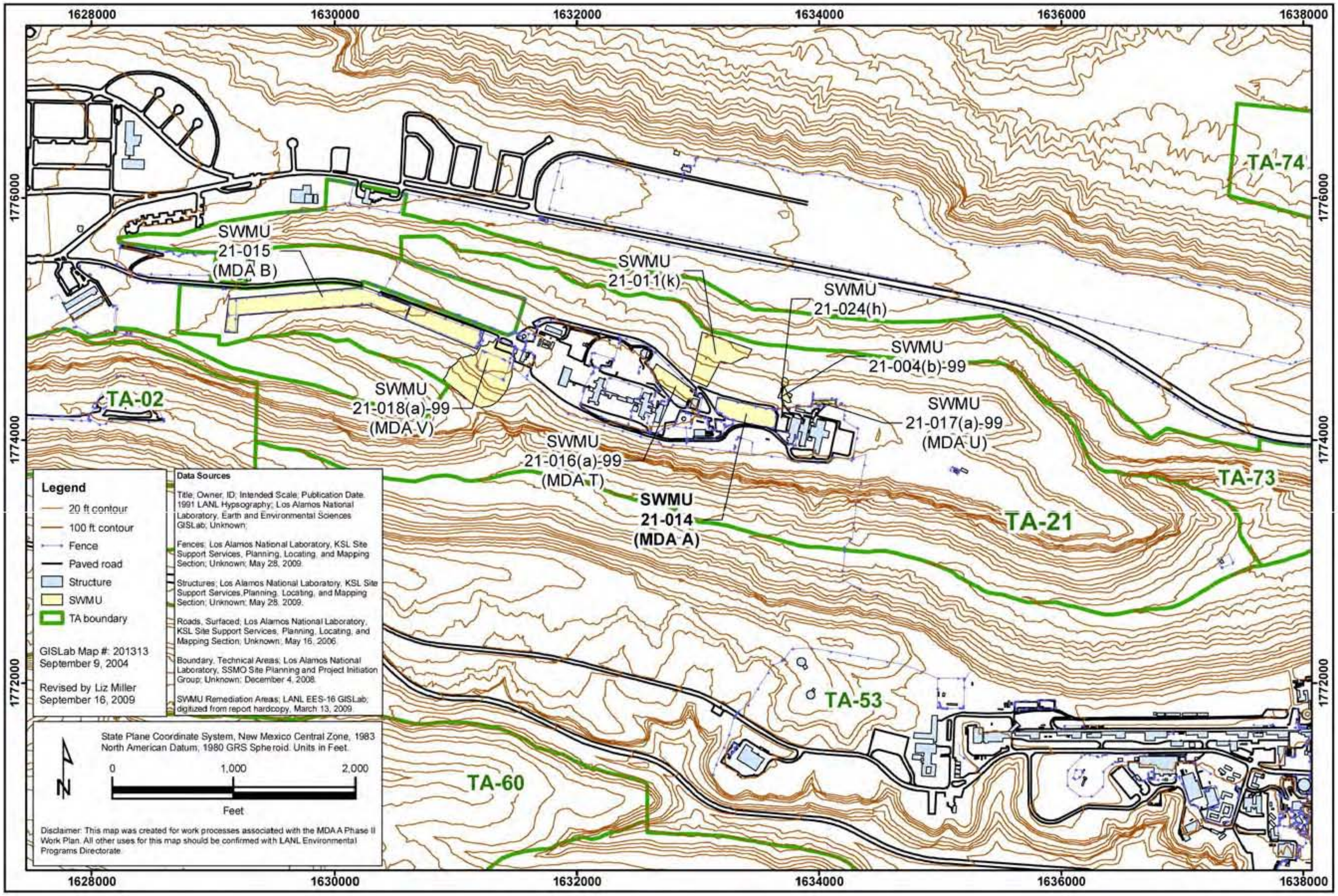


Figure 1.0-2 MDA A in relation to TA-21 and surrounding TAs, MDAs, and SWMUs

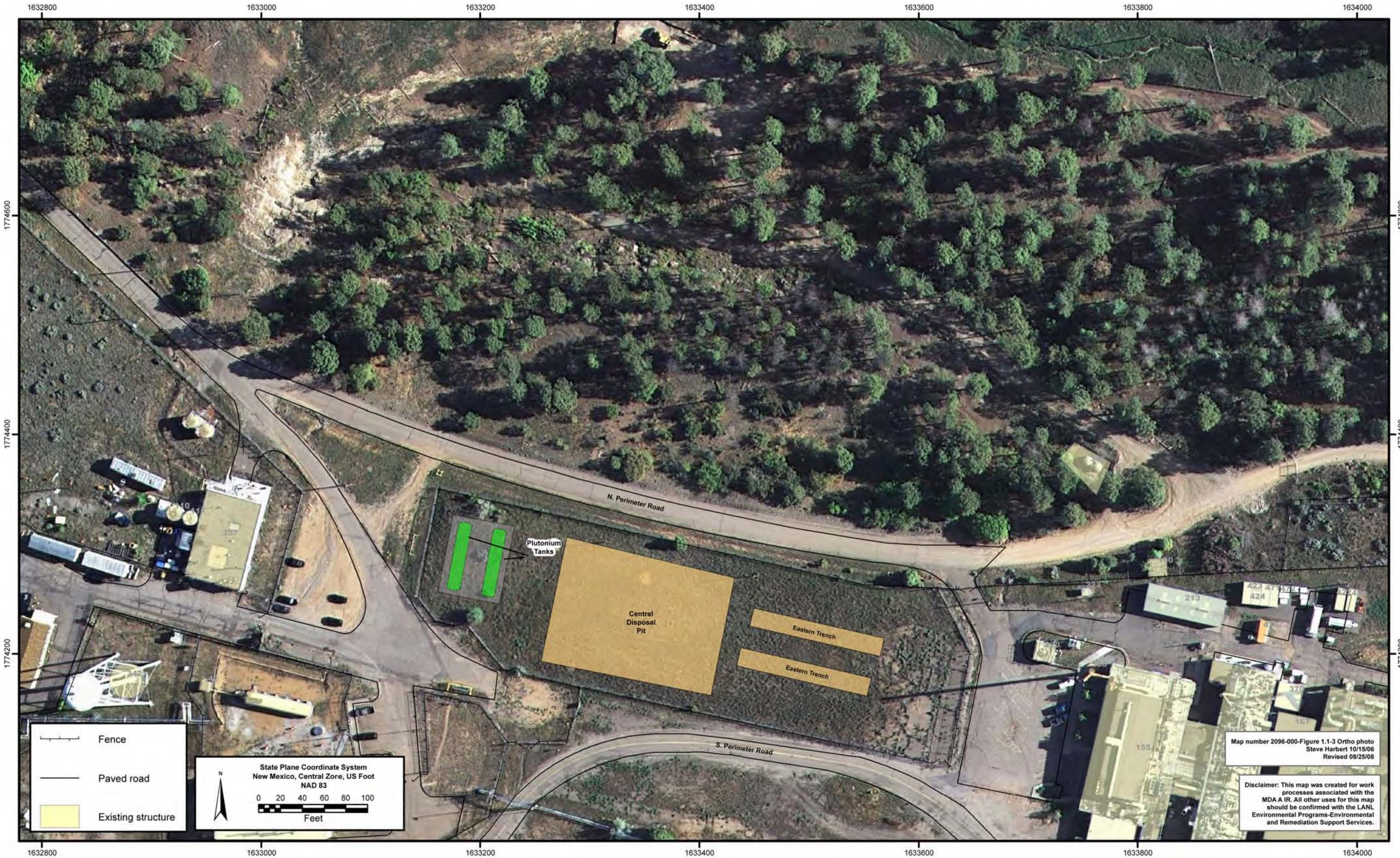


Figure 1.1-1 MDA A site plan (orthophotograph)

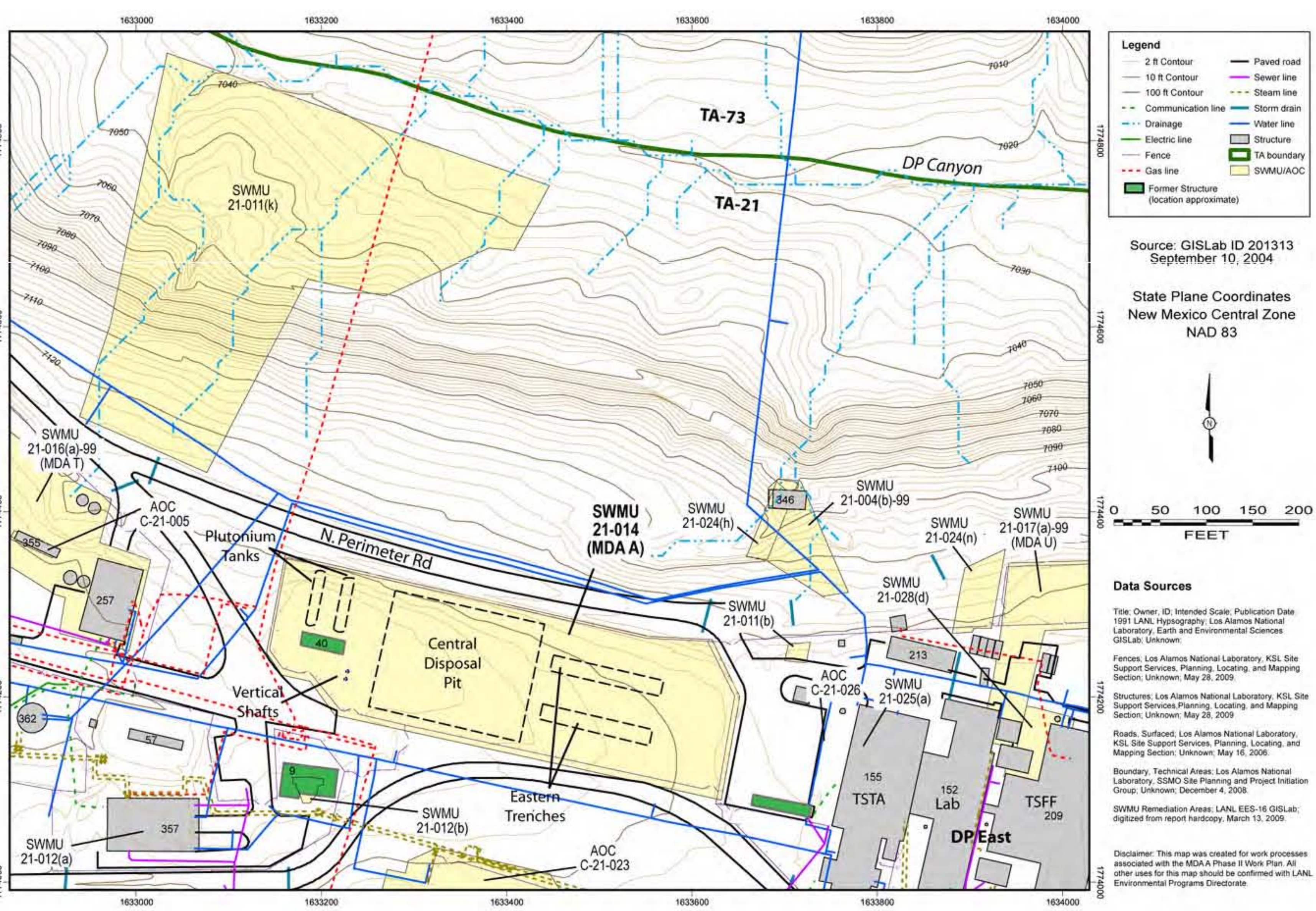


Figure 2.1-1 MDA A site plan showing the Plutonium Tanks, the central pit, the eastern trenches, and utility lines

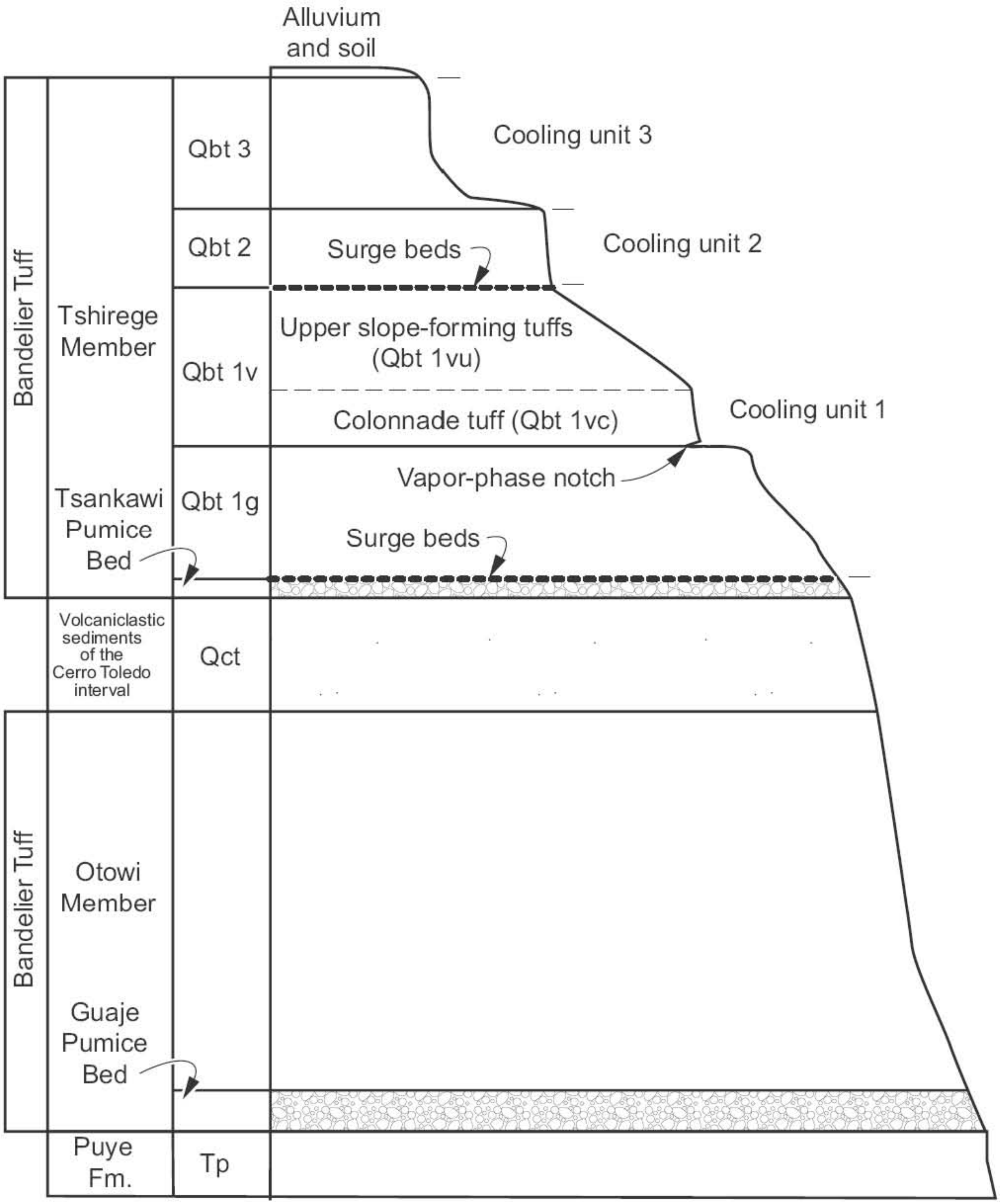


Figure 3.2-1 Generalized stratigraphy of DP Mesa in the area of MDA A

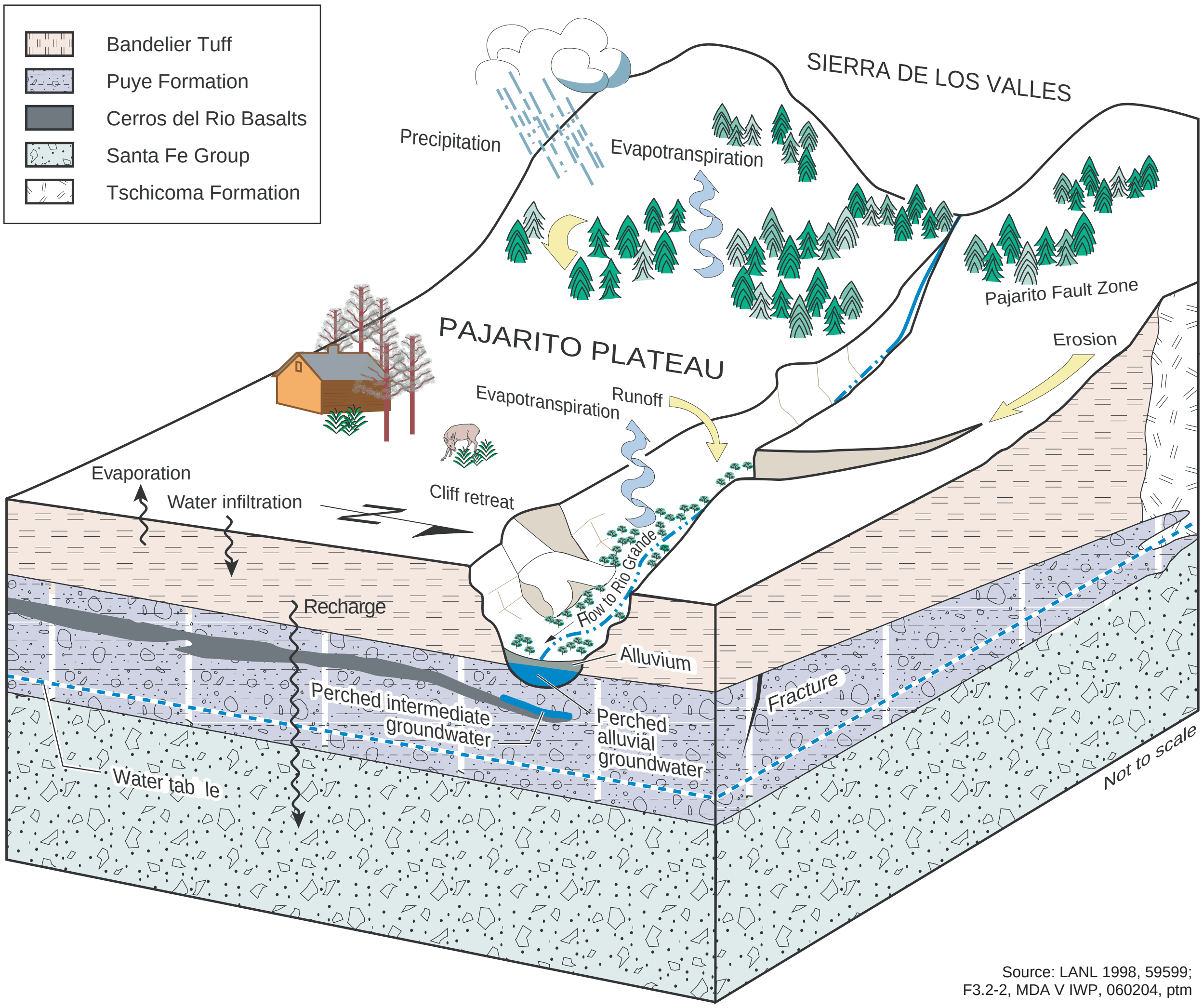


Figure 3.2-2 Perched saturation zones/regional aquifer

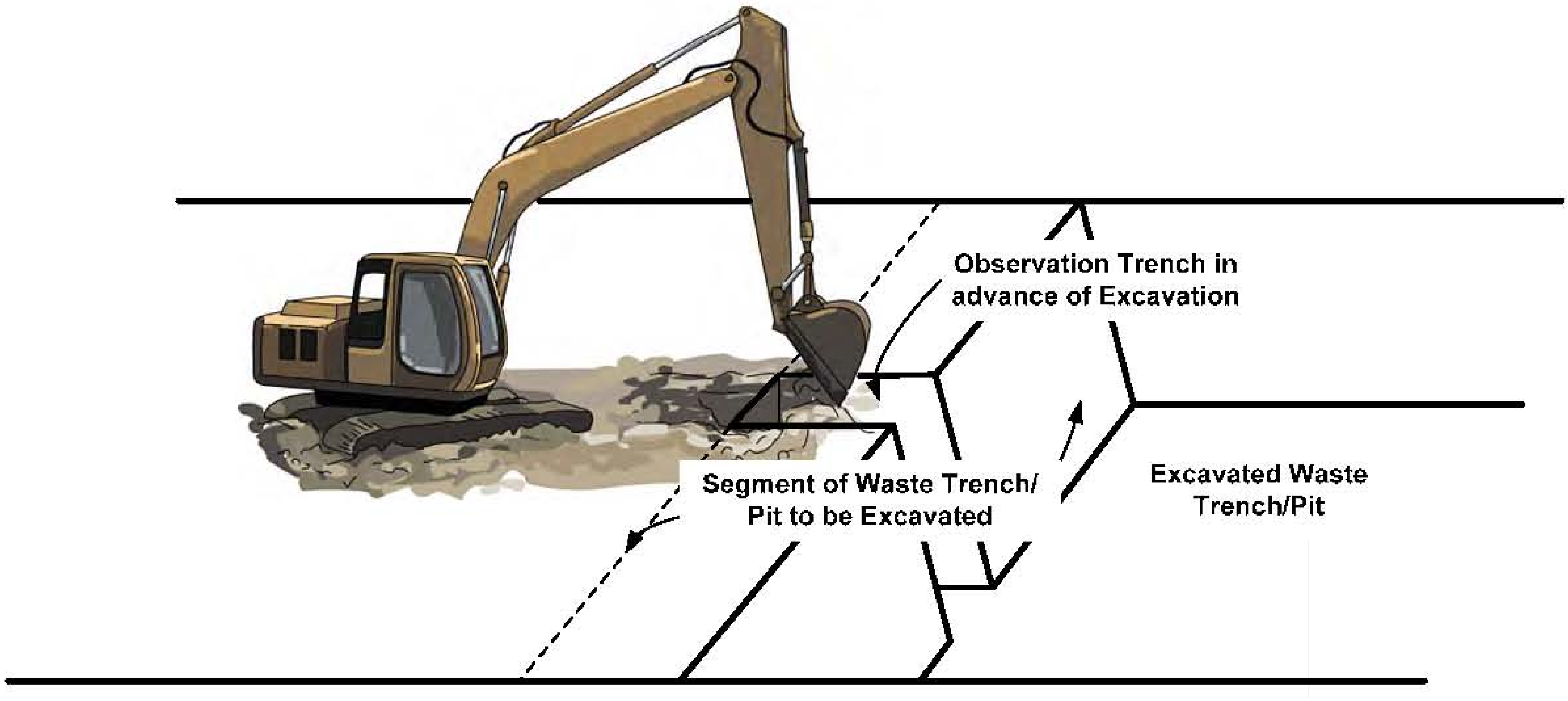


Figure 4.1-1 Inspection trenches for the observational approach to pit and trench characterization

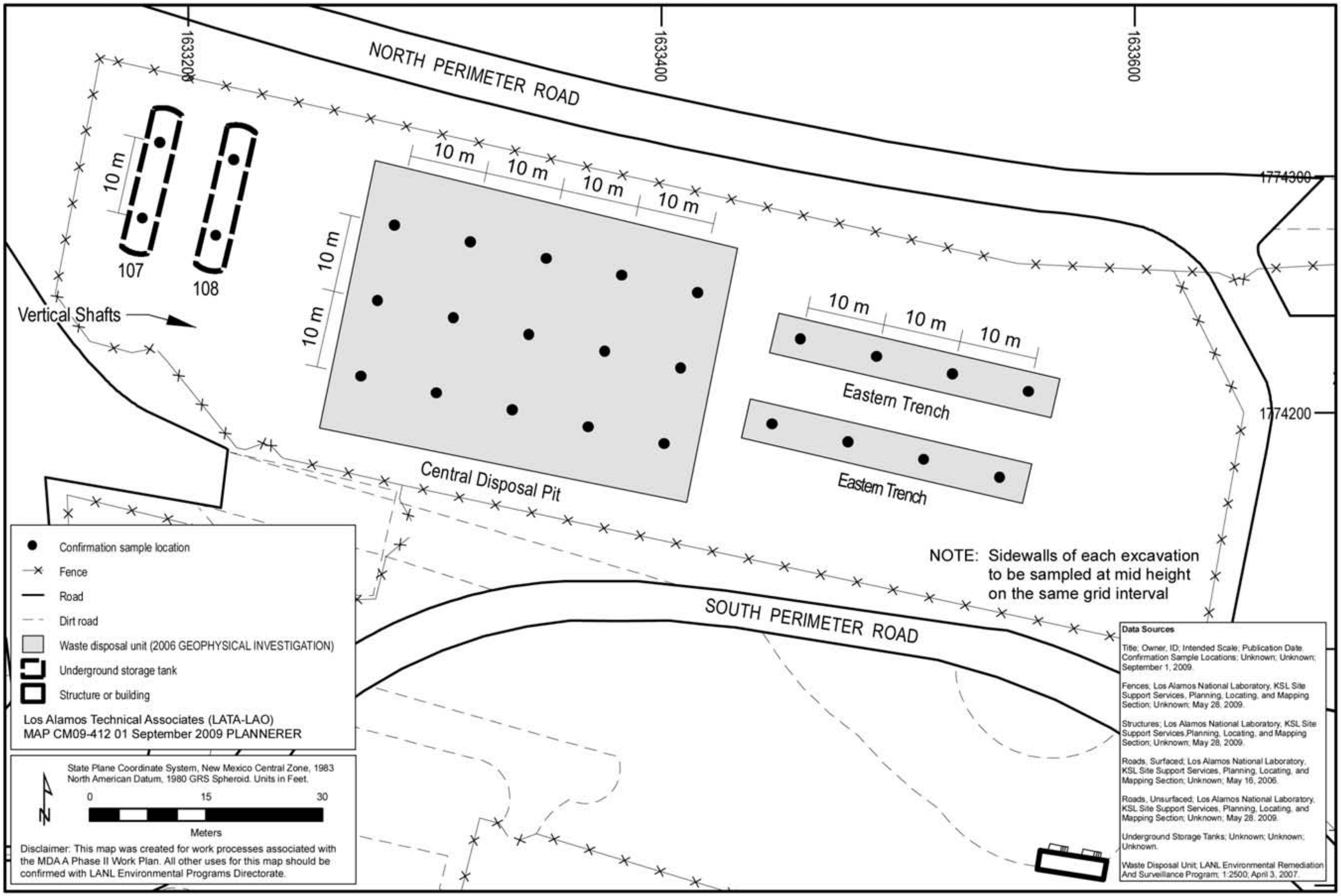


Figure 4.1-2 Confirmation sample locations

Table 2.0-1
Summary of Historical Activities at MDA A

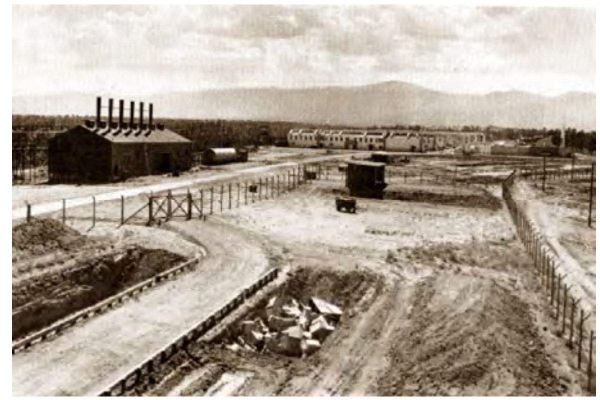
Date	Plutonium Tanks	Vertical Shafts	Eastern Trenches	Central Pit	Former Drum Storage Area
1945	Two 50,000-gal. storage tanks (12-ft diameter, 62 ft 10 in. long) were buried on the western end of MDA A to receive waste solutions, containing plutonium-239, plutonium-240 and americium-241 (photo right).[a]		Construction of two pits on eastern end of MDA A (125 ft × 18 ft × 12.5 ft) Solid waste possibly containing mainly alpha contamination and some beta and gamma contamination placed into pits (photo right)[a]		
1946	No record of waste management activities		Solid waste was placed into pits that possibly contained mainly alpha contamination and some beta and gamma contamination. Pits were closed, and crushed tuff was used to backfill and cover the trenches.		
1947–1952					Late 1940s or early 1950s: Several hundred 55-gal. drums of sodium hydroxide solution and stable iodine waste, possibly contained plutonium and uranium, stored in area (photo left).[b]
1953–1959					No record of drum activity
1960					Drums were removed and area were paved to immobilize contaminants.
1961					
1962					

Table 2.0-1 (continued)

Date	Plutonium Tanks	Vertical Shafts	Eastern Trenches	Central Pit	Former Drum Storage Area
1963–1968					
1969				Construction of large pit (150 ft × 40 ft × 22 ft) in the center of MDA A to receive debris from demolition work at TA-21 May 9, 1969: A geologic reconnaissance was made of the central disposal pit by observing geology and taking measurements with a compass.	
1970–1971				Building debris from demolition work at TA-21 placed into pit	
1972				Pit was enlarged to 172 ft × 134 ft × 22 ft to receive building debris from demolition of building 21-012.	
1973				Pit received plutonium-contaminated building debris from demolition of building 21-012 (see photo at left).[c]	
1974	May 1974: Four holes were augered adjacent to the Plutonium Tanks to a depth of 35 ft bgs, and composite samples were collected at 5-ft intervals.			Debris from TA-21 buildings and structures was placed into pit.	

Table 2.0-1 (continued)

Date	Plutonium Tanks	Vertical Shafts	Eastern Trenches	Central Pit	Former Drum Storage Area
1975	June 19, 1975: Liquid waste (approximately 10,570 gal.) was transferred from the western tank to building 21-257 for processing.	December 3, 1975: Excavation of two 4-ft-diameter vertical shafts (~65 ft deep) was adjacent to the Plutonium Tanks for disposal of nonretrievable cement paste.		Waste of an unspecified nature was placed in pit.	
1976					
1977		Shafts "grouted up" for closure.			
1978				May 1978: Pit was decommissioned and soil cover (crushed tuff) placed over the pit.	
1979	Aerial photograph at right[d]				
1980	Sampling location A-2 was sampled at three depth intervals.			Sampling location A-1 at three depth intervals	
1981					
1982					
1983	Liquid waste was transferred from the tanks to building 21-257 for processing. Six holes were drilled around the perimeter of the Plutonium Tanks to a depth of 30 ft bgs, and subsurface soil profile samples were collected from 3-ft intervals.				
1984	A radiation field survey was conducted at approximately 100 locations with a phoswich detector analyzer and high-pressure ion chamber instrument.				

Table 2.0-1 (continued)

Date	Plutonium Tanks	Vertical Shafts	Eastern Trenches	Central Pit	Former Drum Storage Area
	May–August 1984: Soil and vegetation samples were collected from 39 locations from the western third of MDA A.				
1985	Tops of the tanks were sealed because of evidence of rainwater.				
	1st quarter 1985: Seven locations were sampled for soils within and outside of MDA A at 0.03 to 0.33 ft and 0.33 to 0.98 ft.				
1986	A surface reconnaissance survey was performed, which addressed the general conditions of cover.				
1987–1988					
1989	Geophysical techniques were used, including magnetics, electromagnetics, resistivity, radar, and self-potential to determine pit geometry and accurately locate material, and determine the physical properties of sites and buried material.				
1990	October 1990: Surface soil was sampled within the boundaries of MDA A at approximately 20 locations.				
1991					
1992	March–May and June–July: Phase I RFI was performed across TA-21. Surface soil was sampled during two sampling events (grid 1 and grid 2).				
1993					
1994	August–September: A Phase I RFI was performed on the surface outside the MDA A fence and surface and near surface within the associated drainage area. Activities included a radiation field survey (59 survey locations); collection of surface and near-surface samples (51 locations, sediment samples were collected from 0 to 0.25 ft, 0.25 to 0.5 ft, and 0.5 t to 1 ft; all other surface samples were collected from 0 to 0.25 ft); field screening of samples with field instruments and a mobile laboratory; and analysis of samples at a fixed analytical laboratory.				
1995					
1996	June: An electromagnetic survey was conducted using a GEM-2.				
1997–1998					
1999	June: Geophysical surveys were conducted using ground-penetrating radar (GPR), magnetics, and electrical resistivity (students, faculty, and visitors of the Summer of Applied Geophysical Experience).				
2000–2002					
2003	September: An integrated geophysical survey was conducted using capacitively coupled electrical resistivity and digital GPR (Advanced Geological Services, Inc.).				
2004					
2005	January: Investigation work plan submitted to NMED. June: Plan approved by NMED.				

[a] Photograph 1945 or 1946 (Gerety et. al. 1989, 006893, p. 36).

[b] Aerial photograph January 1949 (Gerety et. al. 1989, 006893, p. 38).

[c] Photograph 1973 (Gerety et al. 1989, 006893, p. 44).

[d] Aerial photograph 1979 (Gerety et al. 1989, 006893, p. 50).

Table 2.3-1
MDA A, Carcinogenic Screening Evaluation

COPC	95% UCL[a] 0 to 1 ft bgs (mg/kg)	Industrial SSL[b] (mg/kg)	Industrial Cancer Risk	95% UCL 0–10 ft bgs (mg/kg)	Residential SSL[b] (mg/kg)	Residential Cancer Risk	95% UCL 0–10 ft bgs (mg/kg)	Construction Worker SSL[b] (mg/kg)	Construction Worker Cancer Risk
Aroclor-1254	0.0164	8.26E+00	1.99E-08	0.0835	2.2E+00[c]	3.8E-07	0.0835	na[d]	na
Aroclor-1260	0.18	8.26E+00	2.18E-07	0.11	2.2E+00[c]	5.0E-07	0.11	na	na
Benzo(a)anthracene	0.105	2.34E+01	4.49E-08	0.0668	6.21E+00	1.08E-07	0.0668	2.12E+02	3.15E-09
Benzo(a)pyrene	0.0743	2.34E+00	3.18E-07	0.0715	6.21E-01	1.15E-06	0.0715	2.12E+01	3.37E-08
Benzo(b)fluoranthene	0.156	2.34E+01	6.67E-08	0.16	6.21E+00	2.58E-07	0.16	2.12E+02	7.55E-09
Benzo(k)fluoranthene	0.145	2.34E+02	6.20E-09	0.0521	6.21E+01	8.39E-09	0.0521	2.12E+03	2.46E-10
Bis(2-ethylhexyl)phthalate	0.49	1.37E+03	3.58E-09	0.306	3.47E+02	8.82E-09	0.306	na	na
Chrysene	0.116	2.31E+03	5.02E-10	0.0741	6.15E+02	1.20E-09	0.0741	2.12E+04	3.50E-11
Indeno(1,2,3-cd)pyrene	0.167	2.34E+01	7.14E-08	0.0588	6.21E+00	9.47E-08	0.0588	2.12E+02	2.77E-09
Tetrachlorodibenzodioxin[2,3,7,8-][e]	1.27E-05	1.80E-04[c]	7.07E-07	9.28E-06	3.90E-05[c]	2.38E-06	9.28E-06	1.80E-04[c,f]	5.16E-07
Dichlorobenzene[1,4-]	0.989	1.03E+02	9.60E-08	0.617	3.95E+01	1.56E-07	0.617	1.96E+03	3.15E-09
Methylene chloride	n/a[g]	4.9E+02	n/a	0.00288	1.82E+02	1.58E-10	0.00288	na	na
		Total Cancer Risk	**2.0E-06**		**Total Cancer Risk**	**5.0E-06**		**Total Cancer Risk**	**6.0E-07**

[a] UCL = Upper confidence limit.

[b] SSLs from NMED (2006, 092513), unless otherwise noted.

[c] SSLs from EPA Region 6 (2005, 091002) adjusted to 1×10^{-5} cancer risk level.

[d] na = Not available. SSL is based on a noncarcinogenic effect or saturation limit. No carcinogenic SSL is available in either NMED (2006, 092513) or EPA (2005, 091002). COPC is assessed in the MDA A IR, Table I-4.1-2 (LANL 2006, 095046).

[e] Tetrachlorodibenzodioxin[2,3,7,8-] used based on toxicity equivalent quotients (LANL 2006, 095046, Table I-4.1-8).

[f] No SSL is available for construction worker; SSL for industrial worker was used (EPA 2005, 091002).

[g] n/a = Not applicable; analyte was not a COPC for this exposure scenario.

Table 5.2-1
Proposed Confirmation Sampling

Sample Type	Number of Sample Locations	Number of Samples	Depth below Bottom of Excavation (ft)	Analytical Suite
Soil/tuff	Systematic random sampling approach, as discussed in section 5.2.4	Minimum of 2 per location	0–0.5 and 1.5–2.0 or based on field observations	TAL metals Radionuclides by gamma spectroscopy Tritium Isotopic uranium Isotopic plutonium Americium-241 Strontium-90 VOCs SVOCs Dioxins/furans Perchlorate Asbestos Cyanide pH Nitrates
Water (only if saturated conditions are encountered in excavation)	TBD*	TBD	Up to 2	TAL metals Radionuclides by gamma spectroscopy Tritium Isotopic uranium Isotopic plutonium Americium-241 Strontium-90 VOCs SVOCs Dioxins/furans Perchlorate Cyanide pH Nitrates

*TBD = To be determined.

Table 8.0-1
Planned Milestones for Investigation and Remediation of MDA A

Activity Description	Date Complete
NMED Approval of Work Plan	November 2, 2009
DSA and Readiness for Plutonium Tanks and Venting	April 23, 2010
Install Plutonium Tanks Venting	July 22, 2010
Final DSA for Waste Characterization to DOE (Tanks)	December 23, 2010
Access and Survey Plutonium Tanks Contents	February 2, 2011
Submit Survey Report for Tanks to NMED/DOE	June 10, 2011
Engineering Design for Pit/Trenches Remediation	June 18, 2011
Readiness for Waste Removal (Pit/Trenches)	March 15, 2012
LANL Facility Approval of Technical Safety Requirement Implementation Plan (Tanks)	April 12, 2012
Engineering Design for Plutonium Tanks Complete	July 2, 2012
DSA Approval for Sludge and Tank Removal	September 10, 2012
Waste Removal Complete (Pit/Trenches)	May 10, 2013
Readiness and Field Operations Approved (Tanks)	June 3, 2013
Tanks and Sludge Removal Complete	October 7, 2013
Confirmation Results (All)	November 8, 2013
Final Site Grading MDA A Complete	November 13, 2013
Phase II Investigation Report to NMED	December 21, 2013

Appendix A

Investigation-Derived Waste Management

A-1.0 INTRODUCTION

This appendix describes how investigation-derived waste (IDW) generated during the Material Disposal Area (MDA) A investigation and remediation will be managed by Los Alamos National Laboratory (the Laboratory). IDW may include, but is not limited to, excavated environmental media, excavated waste, sludge, contact waste, returned samples, decontamination fluids, and all other waste that has potentially come into contact with contaminants.

A-2.0 IDW

All IDW generated during investigation activities will be managed in accordance with the current version of the Standard Operating Procedure (SOP) 5238, Characterization and Management of Environmental Program Waste. This SOP incorporates the requirements of applicable U.S. Environmental Protection Agency (EPA) and New Mexico Environment Department (NMED) regulations, U.S. Department of Energy orders, and Laboratory requirements.

The most recent version of the Laboratory's "Hazardous Waste Minimization Report" will be implemented during the investigation to minimize waste generation. The "Hazardous Waste Minimization Report" is updated annually as a requirement of Module VIII of the Laboratory's Hazardous Waste Facility Permit.

A waste characterization strategy form (WCSF) will be prepared and approved per requirements of SOP-5238. The WCSF will provide information on IDW characterization methods, management, containerization, and potential volumes. IDW characterization is completed through review of sampling data and/or documentation or by direct sampling of the IDW or the media being investigated (e.g., surface soil and subsurface soil). Waste characterization may include a review of historical information and process knowledge to identify whether listed hazardous waste may be present (i.e., due diligence reviews). If low levels of listed hazardous waste are identified, a "contained-in" determination may be submitted for approval to NMED.

Considerable amounts of material will be excavated during the remediation of MDA A. To facilitate the staging and segregation of the remediation waste, the Laboratory will submit an area of contamination designation request to NMED for approval. The request will specify the boundaries of the proposed area of contamination and describe the activities to be conducted within the boundaries.

Wastes generated or moved outside the area of contamination will be containerized and placed in clearly marked and appropriately constructed waste accumulation areas. Waste accumulation area postings, regulated storage duration, and inspection requirements will be based on the type of IDW and its classification. Container and storage requirements will be detailed in the WCSF and approved before the waste is generated. Table A-2.0-1 summarizes how waste is expected to be managed.

The primary waste streams that are anticipated to be generated during work plan implementation are described below.

A-2.1 Excavated Environmental Media

Excavated environmental media include topsoil, overburden, fill below the topsoil and covering central pit and eastern trenches waste, overburden below the topsoil and surrounding the Plutonium Tanks (formerly the General's Tanks), and any soil and rock removed to facilitate waste and tank removal operations (e.g., benching).

Topsoil will be removed before excavation of the rest of the overburden; it will be stockpiled and separately sampled. A minimum of one sample will be collected per 100 yd^3 of topsoil. If it meets residential screening standards, it will be reused as topsoil to assist in reestablishing vegetation in excavated areas.

Overburden will be handled two ways depending on location.

- At the central pit and eastern trenches overburden will be sampled before excavation using a grid system (EPA SW846, Chapter 9). Each grid area will be sized to represent no more than 100 yd^3 of overburden. Overburden within a grid block will be sampled (one sample per grid block). Grid blocks having analytical results above residential screening standards will be removed as waste. Overburden within a grid block having analytical results below residential screening standards will be removed and stockpiled as backfill. At the Plutonium Tanks and where any soil and rock are removed during waste and tank removal operations, overburden will be excavated, stockpiled, and sampled in a manner similar to topsoil.
- At the Plutonium Tanks, all soil or rock removed to facilitate waste and tank removal operations overburden will be excavated, stockpiled, and sampled. A minimum of one sample will be collected per 100 yd^3 of overburden. If it meets residential screening standards, it will be reused as backfill.

Environmental media will be screened for radionuclides and volatile organic compounds (VOCs) as they are excavated. Soils with elevated screening results will be segregated and placed in containers, such as rolloff bins or other suitable containers.

Environmental media samples will be analyzed for VOCs, semivolatile organic compounds (SVOCs), target analyte list metals, radionuclides, and toxicity characteristic leaching procedure (TCLP). If process knowledge, odors, or staining indicate that the soils may be contaminated with petroleum products, the materials will also be analyzed for total petroleum hydrocarbons and polychlorinated biphenyls (PCBs). Other constituents may be analyzed as necessary to meet the waste acceptance criteria (WAC) for a receiving facility

If the spoils are determined to be suitable for reuse (i.e., they meet residential cleanup standards, as determined using NMED's and DOE's soil screening guidance), the Laboratory will use this material to backfill the excavated solid waste management units . If the spoils do not meet residential cleanup standards, they will be treated/disposed of at an authorized facility appropriate for the waste regulatory classification. The Laboratory expects the spoils that cannot be reused to be designated as low-level waste (LLW), mixed low-level waste (MLLW), or industrial waste.

A-2.2 Excavated Man-Made Debris

Excavated man-made debris will be generated from the trenches, central pit, and Plutonium Tanks. Debris will be segregated based on factors such as the type of debris, type of alternative treatment technology that would be used to treat the debris, field screening, process knowledge, and/or staining or odors. Debris is difficult to characterize; therefore, acceptable knowledge (AK) will be used whenever possible, supplemented by sampling as needed. Sampling methods will often have to be identified on a case-by-case basis by qualified sampling personnel, and all decisions will be documented in the field activity notebook. Additional field screening may be performed (e.g., for PCBs). Swipe analyses may be needed for some waste and equipment. Based on waste placement practices of the day, a considerable volume of the waste will be mixed with soil; the soil will be characterized separately from the debris. If direct sampling is performed, the analyses will be appropriate to the type of waste or equipment. Direct samples will be analyzed for VOCs, SVOCs, radionuclides, total metals, and toxicity characteristic metals. Other constituents may be analyzed as necessary to meet the WAC for a receiving facility, or if process knowledge or visual observations indicate other contaminants may be present (e.g., PCBs or asbestos).

After being separated from soils and segregated by waste type, the excavated debris will be placed in containers (e.g., rolloff bins) within the boundaries of the area of contamination. The Laboratory expects most of this waste will be designated as industrial waste, PCBs, asbestos, hazardous waste, LLW, or MLLW that will be treated/disposed of at an authorized off-site facility

A-2.3 Sludge

The sludge may be removed from the Plutonium Tanks, containerized, and treated by cementation in a less than 90-d accumulation area within the nuclear environmental site boundary. Based on process knowledge, the untreated sludge is assumed to be mixed transuranic (TRU) waste. However, radiological screening will be used to confirm the radioactive levels both before and after treatment. It is expected that the treated waste will also be classified as mixed TRU waste to be disposed of at the Waste Isolation Pilot Plant (WIPP).

Another alternative is to grout the sludge in situ in the tanks. Based on the radiological screening and the amount of grout added to the tanks, it will be determined by calculation whether the sludge will be greater than or equal to 100 nCi/g when treated. If so, it will be treated and packaged in drums for acceptance into the Laboratory's TRU waste management program. If the treated sludge is calculated to be less than 100 nCi/g after treatment, samples will be collected and analyzed for VOCs, SVOCs, radionuclides, total metals, and TCLP. Other constituents may be analyzed as necessary to meet the WAC for a receiving facility. Sludge grouted in situ is expected to be designated as MLLW or mixed TRU that will be treated/disposed of at an authorized mixed waste landfill or the WIPP, respectively.

A-2.4 Contact Waste

The contact waste stream consists of potentially contaminated materials that "contacted" waste during sampling and excavation. This waste stream consists primarily of, but is not limited, to personal protective equipment, namely, gloves, and decontamination wastes, such as paper wipes and disposable sampling supplies. Characterization of this waste stream will use AK of the waste materials, the methods of generation, and analysis of the material contacted (e.g., soil). Contact waste generated within an area of contamination will be initially placed in containers and managed within the area. If contact waste is generated at a location that is not within the area of contamination, the initial management of waste will rely on the data from previous investigations and/or process knowledge. Contact waste will be managed in secure, designated areas appropriate to the type of the waste. If new analytical data change the expected waste category, the waste will be managed in accumulation areas appropriate to the final waste determination. The Laboratory expects most of the contact waste to be designated as LLW that will be disposed of at Technical Area 54 (TA-54), Area G, or an authorized off-site LLW facility. It may also be designated as nonradioactive waste if it passes the Laboratory's Green Is Clean program.

A-2.5 Returned Samples

This waste stream consists of excess sample material returned from an on-site or off-site analytical laboratory. The characterization of the returned samples will be based on existing environmental data and/or the results from the analysis of the returned sample. Returned samples will be containerized upon receipt and managed in a hazardous waste accumulation area, pending receipt of analytical data. If the analytical data identifies the waste as nonhazardous, the waste will be managed in accumulation areas appropriate to the final waste determination. The Laboratory expects most of the returned samples to be designated as LLW that will be disposed of at TA-54, Area G, or at an authorized off-site facility or MLLW that will be disposed at an authorized off-site facility.

A-2.6 Decontamination Fluids

The decontamination fluids waste stream will consist of liquid wastes from decontamination activities (i.e., decontamination solutions and rinse waters). Consistent with waste minimization practices, the Laboratory employs dry decontamination methods to the extent possible. If dry decontamination cannot be performed, liquid decontamination wastes will be collected in containers at the point of generation. The decontamination fluids will be characterized through AK of the waste materials, the levels of contamination measured in the environmental media, and, if necessary, direct sampling of the containerized waste. If directly sampled, the following analyses will be performed: pH, chemical oxygen demand, total dissolved solids total suspended solids, total nitrogen, total nitrates, VOCs, SVOCs, radionuclides, total metals, and if needed, toxicity characteristic metals. Other analyses, such as PCB or asbestos, may be added if materials encountered during remediation are found to contain these constituents. The Laboratory expects most of these wastes to be nonhazardous liquid waste or radioactive liquid waste that will be sent to one of the Laboratory's wastewater treatment facilities whose WAC allows the waste to be received. If the liquids are hazardous or mixed waste, they will be sent off-site for treatment, if needed, and disposal.

Table A-2.0-1
Summary of Estimated IDW Generation and Management

Waste Stream	Expected Waste Type	Estimated Volume[a]	On-Site Management	Expected Disposition
Environmental Media[a]	LLW MLLW Industrial waste PCB	1000 yd^3 10 yd^3 10 yd^3 10 yd^3	Staging in piles or B-25 boxes within the area of contamination boundaries	Reuse or disposal at authorized on-site (LLW only) or off-site treatment/disposal facility
Debris	LLW Industrial waste MLLW Hazardous waste Asbestos PCB	17,000 yd^3 600 yd^3 400 yd^3 50 yd^3 100 yd^3 50 yd^3	Accumulation in containers within the area of contamination boundaries	Treatment/disposal at an authorized on-site (LLW only) or off-site treatment/disposal facility
Sludge	Mixed TRU or MLLW	360 yd^3	Accumulation in containers or grouted in the Plutonium Tanks within the area of contamination boundaries	Disposal of TRU waste at WIPP[b] or disposal of MLLW at an authorized off-site MLLW facility
Contact Waste	Industrial waste MLLW Hazardous waste Asbestos PCB	1 × 55 gal. 1 × 55 gal. 1 × 55 gal. 1 × 55 gal. 1 × 55 gal.	Accumulation in containers (e.g., 55-gal. drum/B-25 boxes) initially within the area of contamination boundaries	Disposal at TA-54 (LLW only) or treatment/disposal at and authorized off-site facility
Returned Samples	LLW Industrial waste MLLW Hazardous waste Asbestos PCB	20 × 55 gal.	Accumulation in containers (e.g., 55-gal. drum/B-25 boxes)	Disposal at an authorized on-site facility (LLW only) or off-site treatment/disposal facility
Decontamination Fluids	LLW	<55 gal.	Accumulation in containers, (e.g., 55-gal. drums) within the area of contamination boundaries	Treatment at the Radioactive Liquid Waste Treatment Facility at TA-50

[a] Environmental media, debris, and sludge are estimated in-place waste volumes.

[b] This assumes that the plutonium sludge will be stabilized in situ to meet U.S. Department of Transportation shipping requirements, if necessary.

Appendix B

Costs Associated with Proposed Activities

Table B-1 summarizes the project costs for removal of the plutonium tanks and removal of waste and contaminated media for the central pit and eastern trenches. The cost estimates given in the table are based on planning documents and project cost estimating. These estimates were not prepared at the level of detail required for a corrective measures evaluation. The following primary factors drive the scale of the operation:

- complete removal of the Plutonium Tanks
    - ❖ excavation of all waste until all undisturbed geologic material has levels below residential cleanup levels where practicable
- complete excavation of all waste in trenches and surrounding contaminated media
    - ❖ excavation down to the bottom limit of buried waste material
    - ❖ further removal down to surfaces and media that have contamination less than residential cleanup levels to the extent practicable but no greater than residential cleanup levels where practicable
- excavation trench and pit constructed in such a way to provide maximum worker safety

The summary scope assumptions are noted in Table B-1. Additional assumptions and planning factors that are most significant to the cost estimate are as follows.

- Heavy equipment requirements address all operations, including excavation, clean and suspect contaminated soils, and the lay-down area for waste containers.
- Little or no production infrastructure is available on-site to support the project. Thus, the cost estimate includes the complete construction of a waste processing area, a containment structure for removal of the plutonium tanks, a temporary containment for size-reducing demolition debris from the central pit, and support trailers to meet operational needs.

Table B-1
Costs Associated with Proposed Activities

Activities	Cost	Scope Assumptions
Plutonium Tanks Support Activities	$5,510,298	Includes operational support during venting, planning, and remediation activities, procurement of sampling services, coordination of tank access construction, procurement of engineering design services, procurement of the tank removal subcontractor, air sampling, and dosimetry monitoring
Plutonium Tanks Planning through Readiness and Mobilization	$5,992,157	Assumes tank access installation and venting to remove potentially explosive atmosphere, sampling port and enclosure design, sampling of the tank contents to verify removal assumptions, preparation of documented safety analysis and technical safety requirements, removal of field implementation documents, design of containment and removal systems, procurement and installation of enclosure/containment system, mobilization and site preparation, and readiness and mobilization for all three sets of field activities
Plutonium Tanks Removal Operations	$872,907	Assumes tank contents are transuranic waste (greater than 100 nCi plutonium-equivalent) in sludge form with no free liquid. Includes hand removal of sludge; no special tank cleaning, processing, and size reduction of tanks; waste processing, packaging, and transportation; tank area confirmation sampling; and decontamination and demobilization of equipment
Eastern Trenches and Central Pit Support Activities	$8,847,903	Includes operational support during planning and remediation activities, procurement of engineering design services, procurement of the tank removal subcontractor, and air sampling and dosimetry monitoring
Eastern Trenches and Central Pit Planning through Readiness and Mobilization	$2,798,329	Includes development of implementation documents; training; readiness preparation and review; design of the removal operations subcontract specifications and drawings; procurement, design, fabrication and installation of size reduction facility; setup of a waste staging area (area of contamination) power to new trailers; testing all systems; and mobilization of the key labor force.
Eastern Trenches and Central Pit Removal Operations	$35,416,551	Includes the eastern trenches and central pit waste removal and disposal of all waste. Staging, waste retrieval, and heavy equipment rental. Also includes all radiological, health, safety, site laboratory equipment, and decontamination and demobilization of contaminated equipment. Assumes removal of 2000 yd^3 of topsoil, 10,000 yd^3 of reusable overburden, and an estimated 16,000 yd^3 of waste and contaminated soil removed and disposed.
Final Site Restoration and Reporting	$1,170,000	Includes removal of structures and utilities; 16,000 yd^3 of clean backfill and 10,000 yd^3 stockpiled overburden placed as backfill and compacted, graded; 1000 yd^3 topsoil replaced and seeded; and the final demobilization.
TOTAL	**$60,608,146**	