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Date: August 31, 2009
Refer To: EP2009-0387

James Bearzi, Bureau Chief
Hazardous Waste Bureau
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, NM 87505-6303

Subject: Bayo Canyon Aggregate Area Strontium-90 Removal Field Implementation Plan

Dear Mr. Bearzi:

Enclosed please find a copy of the Bayo Canyon Aggregate Area Strontium-90 Removal Field Implementation Plan. In accordance with the U.S. Department of Energy policy and the Los Alamos National Laboratory (the Laboratory) letter dated August 19, 2008, we are voluntarily providing this information regarding cleanup of strontium-90 in former Technical Area 10 to the New Mexico Environment Department (NMED). Once this plan has been implemented, the Laboratory will voluntarily provide the results of the cleanup activities and confirmation sampling to NMED.

If you have any questions, please contact Becky Coel-Roback at (505) 665-5011 (becky_cr@lanl.gov) or Cheryl Rodriguez at (505) 665-5330 (crodriguez2@doeal.gov).

Sincerely,

Michael J. Graham, Associate Director
Environmental Programs
Los Alamos National Laboratory

Sincerely,

Cheryl J Rodriguez for

David R. Gregory, Project Director
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MG/DG/DM/BCR:sm

Enclosures: (1) One hard copy with electronic file – Bayo Canyon Aggregate Area Strontium-90 Removal Field Implementation Plan (LA-UR-09-5162)

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LA-UR-09-5162
August 2009
EP2009-0387

Bayo Canyon Aggregate Area Strontium-90 Removal Field Implementation Plan

Los Alamos
NATIONAL LABORATORY
EST. 1943

Prepared by the Environmental Programs Directorate

Los Alamos National Laboratory, operated by Los Alamos National Security, LLC, for the U.S. Department of Energy under Contract No. DE-AC52-06NA25396, has prepared this document pursuant to the Compliance Order on Consent, signed March 1, 2005. The Compliance Order on Consent contains requirements for the investigation and cleanup, including corrective action, of contamination at Los Alamos National Laboratory. The U.S. government has rights to use, reproduce, and distribute this document. The public may copy and use this document without charge, provided that this notice and any statement of authorship are reproduced on all copies.

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1.0 INTRODUCTION AND OBJECTIVES

This field implementation plan (FIP) describes the fieldwork to be accomplished for the Bayo Canyon Aggregate Area at Technical Area 10 (TA-10) at Los Alamos National Laboratory (LANL). TA-10 consists of Consolidated Units 10-001(a)-99 and 10-002(a)-99, Solid Waste Management Units (SWMUs) 10-004(a) and 10-006, and Areas of Concern (AOCs) C-10-001 and 10-009. The primary goals of this fieldwork are (1) to conduct remediation activities at two locations where radiological surveys and characterization results indicate strontium-90 is present at elevated levels in the surface soils near SWMU 10-002(b) [part of Consolidated Unit 10-002(a)-99] and (2) to collect confirmation samples.

All field activities are being conducted by the Environmental Programs (EP) Directorate's Corrective Actions Projects (CAP) and in support of EP's ongoing mission to minimize impacts of LANL's past operations on the surrounding environment. This fieldwork will be completed following the guidelines established in Bayo Canyon field change order #9, dated March 2, 2009, the accompanying statement of work (SOW), and the recommendations presented in the investigation report for Bayo Canyon Aggregate Area (LANL 2008, 102424).

2.0 DESCRIPTION AND HISTORY

2.1 Current Site Description

TA-10 is located in the central portion of Bayo Canyon, situated between Kwage Mesa to the south and Otowi Mesa to the north, approximately 0.5 mi. west of the former Los Alamos County Sewage Treatment Plant (Figure 2.1-1). Bayo Canyon is located at an elevation of approximately 6000 to 6740 ft above sea level (asl) and slopes to the southeast at an approximate grade of 3%. The former TA-10 is at an elevation of approximately 6600 to 6700 ft asl, and the elevations of adjacent mesa tops range from about 7000 to 7100 ft asl. The upper portions of the canyon walls are vertical to near-vertical cliffs cut into the upper Tshirege Member of Bandelier Tuff. The canyon floor cuts into the lower Otowi Member of Bandelier Tuff and is overlain with 1 to 6 ft of colluvium and a sandy soil. A narrow, braided stream channel with low banks occupies the center of the canyon and is underlain with Quaternary stream alluvium (LANL 1996, 054491, p. 3). Vegetation in Bayo Canyon is a mixture of grasses, sagebrush, chamisa, and conifer trees.

Surface water flow in the canyon is ephemeral, with runoff occurring primarily during the summer months (July through August) from heavy thunderstorms. The runoff generally occurs over a period of several hours. Individual flooding events may cause realignment of the main channel. No perched or alluvial groundwater was encountered during subsurface investigations conducted at TA-10 in 1961–1962, 1973, 1974–1975, 1980, 1994, and 2007. The elevation of the regional aquifer at TA-10 is about 6000 ft asl, or approximately 600 ft below the level of Bayo Canyon (LANL 1997, 056660.423).

The TA-10 area underwent extensive decontamination and decommissioning (D&D), including the razing of all structures. D&D activities began in 1960 and were completed in 1963; all explosives testing ceased in 1961. After D&D, the site was released to Los Alamos County in 1967 but has remained under U.S. Department of Energy (DOE) administrative control. Bayo Canyon is currently open to the public and used for recreational activities. The area encompassing the central liquid disposal complex [SWMUs 10-003 (a–o)] was posted with monuments to prohibit excavation before the year 2142. The area encompassing former TA-10 is fenced and gated to prohibit public access; a locked chainlink fence surrounds AOC 10-009 and the debris landfill at SWMU 10-007 that are also posted as a radiological

controlled area (RCA). A path directs hikers and bikers along the north side of former TA-10 away from the SWMUs and AOCs. Recreation is the current and reasonably foreseeable future land use.

2.2 Operational History

TA-10 was used as a firing test site from 1943 through 1961, and the area and all related structures were constructed to test assemblies that contained conventional high explosives (HE), including components made from depleted or natural uranium. The principal structures associated with TA-10 were a radiochemistry laboratory (TA-01-1), two assembly buildings (TA-10-10 and TA-10-12), an inspection building (TA-10-8), a personnel building (TA-10-21), and structures at two detonation control complexes (TA-10-12 and TA-10-15) and adjacent firing pads. Previously, TA-10 also included various ancillary facilities associated with waste disposal, particularly for the radiochemistry laboratory. Associated facilities included sanitary and radioactive liquid waste sewage lines, manholes, septic tanks, seepage pits, and solid radioactive waste disposal pits (Mayfield et al. 1979, 011717, p. 12).

TA-10 now consists of two consolidated units [10-001(a)-99 and 10-002(a)-99], two SWMUs [10-004(a) and 10-006], and two AOCs (10-001 and 10-009). The rationale for the consolidation of 10-001(a)-99 and 10-002(a)-99 was based on the operational history, waste streams, geographical proximity, transport mechanisms, and on the investigation required to assess contamination (LANL 1999, 063175).

The following section describes the operational history of Consolidated Unit 10-002(a)-99. The SWMUs that make up Consolidated Unit 10-002(a)-99 are as follows:

- SWMU 10-002(a,b): solid waste disposal pits
- SWMU 10-003(a-o): radiochemistry liquid waste disposal complex
- SWMU 10-004(b): 540-gal. reinforced concrete sanitary septic tank
- SWMU 10-007: building-debris landfill

Consolidated Unit 10-002(a)-99 is comprised of SWMUs 10-002(a,b), 10-003(a–o), 10-004(b), and 10-007 that were once part of a liquid disposal complex (Figure 2.2-1). This complex served the radiochemistry laboratory (building TA-10-01) at TA-10, and waste was discharged to leach fields and pits. SWMUs 10-002(a,b) are former waste disposal pits used during radiochemistry laboratory operations. SWMUs 10-003(a–o) represent the majority of the liquid disposal complex that consisted of liquid disposal pits, industrial waste manholes and septic tanks, industrial waste lines, and a leach field that served the radiochemistry laboratory. SWMU 10-004(b) was a reinforced-concrete sanitary septic tank that served the radiochemistry laboratory between 1944 and 1963 and may have also received liquid waste from radiochemistry laboratory operations. The entire area underwent D&D in 1963 (Blackwell and Babich 1963, 004751), and SWMU 10-007 was created as a building-debris landfill where any remaining materials from the D&D activity were placed. This SWMU was in the footprint created by the excavation of solid waste disposal pits (containing radioactive, inorganic, and organic chemicals) used by the radiochemistry laboratory from 1945 to 1950. The wastes were removed, and the pits backfilled with the uncontaminated shot pad building debris and site soil during the 1963 D&D activities.

A more detailed description of these sites and their history is presented below in section 3.0, Historical Investigations, and in the historical investigation report (HIR) for TA-10 (LANL 2005, 089658).

3.0 HISTORICAL INVESTIGATIONS

Most of the sites at TA-10 have undergone previous characterization and remediation efforts, including several investigations conducted between 1954 and 1992, and Resource Conservation and Recovery Act (RCRA) facility investigations (RFIs) that are described in detail in the Bayo Canyon Aggregate Area HIR (LANL 2005, 089658). Brief descriptions of the characterization and remediation investigations conducted at TA-10, specifically in the vicinity of Consolidated Unit 10-002(a)-99, which includes SWMU 10-002(b), are presented below.

1954 Radiological Survey

A radiological survey (radioassay) of surface sediments was conducted during the summer of 1954 at the radiochemical laboratory (former building TA-10-01). Twenty-four samples were collected and analyzed for plutonium, polonium, strontium, and uranium. Strontium-90 was detected at 5000 disintegrations per minute per gram (dpm/g) of soil gross-beta activity in a small area next to the radiochemical laboratory (no longer in use at the time of this survey). A gross beta/gamma activity of 15,000 dpm/g was recorded from a soil sample taken from the same area (Dodd 1956, 004695, pp. 4, 10).

1956 Investigation of TA-10 Disposal Pits

The U.S. Geological Survey (USGS), in conjunction with the Los Alamos Scientific Laboratory (LASL), conducted a reconnaissance investigation of TA-10 in July 1956. Their report noted, “Several concrete disposal pits were located but the location of the buried stainless-steel tanks, believed to contain radioactive material, was not determined.” Soil samples were collected near the old radiochemistry laboratory and analyzed for radioactivity. The results indicated radioactivity in soil and alluvial samples decreased with depth. The results are documented in a report entitled “Radioactive Waste Disposal at Los Alamos, New Mexico” (Abrahams 1962, 001306, p. 14).

1960 to 1963 Shrapnel Removal and D&D at TA-10

Decommissioning of TA-10 began in 1960 and was completed in 1963. Most of the buildings were burned in place and any remaining debris and/or ash was disposed of in Material Disposal Area (MDA) G at TA-54 (Mayfield et al. 1979, 011717, p. 24). More than 550 dump-truck loads of underground piping, contaminated waste, and burial pits were dug up and the material removed to TA-54 and disposed of at MDA G. All excavations were backfilled and the site graded. A detailed account of structure and pit material removal is reported in Blackwell and Babich (1963, 004751).

1961 to 1962 Subsurface Sampling and Radiation Surveys

Test holes were drilled at TA-10 to determine if perched water was present at the contact between the Bandelier Tuff and the Puye Formation. No indication of perched water or any “excessive” moisture in the tuff was observed above the Puye, and no analyses of samples were performed (Mayfield et al. 1979, 011717, pp. 50–54). An Aerial Radiological Measuring Survey (ARMS II) was conducted between 1961 and 1962. This survey was part of a nationwide program designed to measure current environmental gamma-radiation levels by conducting aerial surveys using a thallium-activated sodium iodide detector to count activity at specific altitudes. The survey concluded that “no unique observations were noted for Bayo Canyon itself” (Mayfield et al. 1979, 011717, p. 14).

1966 to 1976 Annual Inspections of TA-10

From July 1966 to February 1976, LANL safety engineers conducted surveys and inspections of Bayo Canyon debris. During these surveys, additional surface debris was located, some contaminated with strontium-90 and uranium. However, grass cover was considered excellent in the area visited by the general public, and former structures were no longer visible or easy to locate (Drake et al. 1976, 002078).

1973 Subsurface Sampling and Radiation Surveys

In 1973, the LASL Health Division began additional survey work in Bayo Canyon to assess the extent of radiological material remaining on-site. The survey was necessary to provide a basis for estimating potential exposures under conditions of continued recreational use, during light construction, and as an occupied residential area. Three boreholes were drilled to approximately 20 ft below ground surface (bgs) around the former radiochemistry lab (TA-10-01). Several samples were collected from the boreholes and analyzed for plutonium isotopes and strontium-90. The results indicated that plutonium concentrations were within background values (BVs), but concentrations of strontium-90 were slightly elevated with respect to BVs (Mayfield et al. 1979, 011717, p. 51).

1974 to 1975 Additional Subsurface Sampling and Aerial Survey

In 1974, 11 additional boreholes were drilled to investigate the extent of elevated strontium-90 identified in subsurface samples collected around the radiochemistry lab. These boreholes were drilled in the vicinity of the radiochemistry lab and were analyzed for gross-alpha and gross-beta activity. Analytical results from samples collected north and west of SWMU 10-002(b), north of the acid leaching field [SWMU 10-003(n)], and the sanitary outfall [SWMU 10-004(b)] indicated that “no migration had occurred” (Mayfield et al. 1979, 011717, p. 14). Elevated (3 to 20 times local background) beta activity was reported in samples collected from 0 to 4.0 ft bgs near the sanitary outfall. Sampling results north of former industrial acid waste pits [SWMUs 10-003(a,b)] indicated both gross-alpha and gross-beta activity in tuff to a depth of 33 ft.

In October 1975, ARMS II performed a second aerial survey that included flights over Bayo Canyon. As in 1962, exact mapping of radioactivity proved difficult, and the results showed no measurable quantity of yttrium-90 or depleted uranium in the vicinity of TA-10 (Mayfield et al. 1979, 011717, p. 15). Yttrium-90 is a short-lived (64-h half-life) daughter product of strontium-90, which was widely dispersed during the firing-site operations.

1976 to 1977 FUSRAP Survey

In 1976, a radiological resurvey of Bayo Canyon was initiated to determine whether any further corrective action was necessary. Surface and subsurface sampling were conducted using a variety of sampling methods (drive samples, hand auger, borehole samples, trench samples, etc.) near former structures, in the canyon bottom, at the former firing sites, and in the stream channel (Mayfield et al. 1979, 011717, p. 25). A detailed description of these sampling techniques can be found in Appendix C of the Mayfield report (Mayfield et al. 1979, 011717). The results indicated that residual strontium-90 surface contamination averaged about 1.4 pCi/g (approximately 3 times the level attributable to worldwide fallout). Surface uranium averaged about 4.9 µg/g (approximately 1.5 times the amount naturally present in the native soils). Subsurface contamination associated with the former waste disposal locations is largely confined within a total area of about 10,000 m^2 to a depth of about 16.4 ft. Of the 378 subsurface samples collected, fewer than 12% exceeded 13 pCi/g of gross-beta activity, which is comparable to the upper range of activities for uncontaminated local soils (Mayfield et al. 1979, 011717).

1980 Additional Surface and Subsurface Sampling at TA-10

Following the FUSRAP survey (Mayfield et al. 1979, 011717), an additional 14 locations were selected for surface and subsurface sample collection. Eight boreholes were drilled near the former waste pits and radiochemistry laboratory. The results from the 1976–1977 FUSRAP survey and this additional investigation concluded that the extent of contamination is limited to a small area near the former solid waste pits [SWMUs 10-002(b) and 10-003(m)] and a more extensive area around SWMU 10-003(b) (Ford et al. 1981, 008032, pp. 2–5).

1986 CEARP Field Survey at TA-10

A Comprehensive Environmental Assessment and Response Program (CEARP) field survey was conducted around the firing sites that identified the presence of metal cable and small pieces of shrapnel. The shrapnel consisted of aluminum and steel with small amounts of lead, wood, and other shot residue (DOE 1986, 036442, p. 2). During the survey, six survey monuments and associated guard posts were installed in an area that roughly encompasses the old Tank Farm, radiochemistry laboratory (TA-10-01), and the area of waste disposal pit TA-10-48. The monuments are marked “buried radioactive material no excavation prior to 2142 AD see county records” (DOE 1986, 036442, p. 4). A depression in the ground surface at SWMU 10-005 was observed 100 ft west of Firing Point 3 (LANL 1990, 007512, p. 4).

1994 RFI Activity (Subsurface Sampling)

The objective of the Phase I investigation associated with the subsurface disposal aggregate SWMUs 10-002(a,b), 10-003(a–o), 10-004(a,b), 10-005, and 10-007 “was to characterize the nature, concentrations, and lateral and vertical extent of potential subsurface contamination related to historic activities at the site” (LANL 1996, 054617, p. 4). Subsurface sampling was conducted to address potential contaminant releases from SWMUs 10-002(a,b), 10-003 (a–o), 10-004(a,b), 10-005, and 10-007. A total of 93 boreholes in 11 drilling arrays were drilled in the vicinity of the radiochemistry laboratory. Two boreholes were completed as monitoring wells BCO-1 (total depth [TD] 67.9 ft bgs) and BCM-1 (TD 68.0 ft bgs). Radiological field-screening data collected during the investigation identified the presence of subsurface beta contamination in the alluvium from 5 ft bgs to 32 ft bgs. Field screening for volatile organic compounds (VOCs) using a photoionization detector (PID) identified 15 boreholes with VOCs concentrations above 2.0 mg/kg. The analytical data indicated that no target analyte list (TAL) metals or semivolatile organic compounds (SVOCs) were detected above 1995 screening action levels (SALs). Radionuclides were retained as chemicals of potential concern at SWMUs 10-003(a-o), 10-007, and 10-002(b) (LANL 1996, 054617, pp. ii, 64).

2007 Investigation

The 2007 investigation was primarily a drilling campaign: 55 boreholes were drilled for a total of more than 2500 linear ft. Surface and shallow subsurface sampling were also conducted using hand methods. Approximately 200 surface and subsurface samples were collected for analysis. In addition to sampling, surface radiological and geophysical surveys were conducted, and test pits were excavated in areas of known and suspected subsurface disposal. Based on the results of sampling and analysis, evaluation of nature and extent of contamination, and the assessment of potential risk and dose, the 2007 investigation recommended corrective action complete without controls for Consolidated Unit 10-001(a)-99, SWMUs 10-004(a) and 10-006, and AOCs 10-009 and C-10-001.

The radiological surveys in conjunction with surface sampling indicated the presence of small areas of elevated activity resulting from strontium-90 at Consolidated Unit 10-002(a)-99, south of

SWMU 10-002(b). The following action was recommended in the investigation report for Bayo Canyon Aggregate Area (LANL 2008, 102424) for Consolidated Unit 10-002(a)-99, specifically the area south of SWMU 10-002(b):

- remove two isolated areas of elevated strontium-90 activity identified outside of the Central Area within Consolidated Unit 10-002(a)-99 as a good stewardship practice

Four surface and shallow subsurface samples were collected from the two isolated areas with elevated strontium-90 activity (Figure 3.0-1). All surface and shallow-subsurface samples were placed in appropriate sample containers and submitted for laboratory analysis of the following chemical suites: strontium-90, TAL metals, explosives compounds, pH, cyanide, perchlorate, VOCs, SVOCs, isotopic uranium, and gross-alpha and -beta, and -gamma spectroscopy. A summary of the samples collected from the two areas is presented in Table 3.0-1. The results of the inorganic and organic chemicals detected above BVs are presented in Tables 3.0-2 and 3.0-3, respectively. Table 3.0-4 presents the results of the radionuclides detected above BVs/fallout values (FVs).

4.0 SCOPE OF ACTIVITIES

The purpose of this field campaign is (1) to remove two isolated areas contaminated with strontium-90, and (2) to collect appropriate confirmation samples at the base of each excavation. The cleanup goal for each removal will be at or below the residential standard (7 pCi/g). To meet these objectives, the following activities will be conducted:

- site mobilization and setup
- excavation of two areas of strontium-90–contaminated soil
- shallow subsurface sampling
- decontamination of equipment
- site demobilization and restoration
- off-site disposal of all generated waste

Currently, these activities are anticipated to begin in August 2009 and to be completed in September 2009. Field crews will work 10 h per day, 5 days per week. In the event that field activities fall behind schedule, a 12-h per day and/or 6-day workweek will be implemented. Information detailing the execution of the procedures for this investigation is provided in the appropriate subsections of section 5, Field Methods.

5.0 FIELD METHODS

The subcontractor shall perform all work as specified in this FIP and in accordance with the controls set forth in the Environmental Safety and Health Plan for Bayo Canyon (ES&H Plan), the Bayo Canyon Aggregate investigation site-specific health and safety plan (SSHASP), all associated integrated work documents (IWDs), and the most current versions of internal LANL-approved standard operating procedures (SOPs). Information detailing the procedures and protocol to be implemented for the activities listed above is provided in the subsections below.

5.1 Site Mobilization and Setup

This fieldwork will be conducted within Bayo Canyon, which resides on Los Alamos County property. The land was transferred from DOE to Los Alamos County in 1967 and is open to the public for recreational activities. To continue fieldwork in Bayo Canyon, the access agreement obtained from Los Alamos County in 2007 will be renewed before site setup and execution of this field campaign.

Site setup for fieldwork in Bayo Canyon will include establishing the following areas:

- work zones and support zones
- parking and muster area
- equipment storage area
- waste storage and containment area(s) for investigation-derived waste (IDW)
- equipment decontamination area, if necessary

Before any subsurface is disturbed, the field team will ensure the following tasks are completed.

- All permits and access agreements required by LANL to conduct fieldwork have been granted and copies obtained for reference on-site.
- All utilities within the work zone have been located and marked in the field and any necessary changes to excavation or sampling locations have been assessed and documented accordingly.
- All areas requiring best management practices (BMPs) have been identified and appropriate BMPs have been installed.
- All necessary equipment required for the execution of the designated field activity has been identified and mobilized to the site.

Throughout the duration of the fieldwork, field personnel will ensure site control is maintained; unauthorized entry into work zones and support areas by workers or the public will be prevented with the use of fencing and postings and/or other appropriate measures. In addition, the subcontractor will conduct or arrange quality control (QC) surveillances and management site walks to ensure all quality requirements are met and will deploy a health and safety professional for all sampling activities to ensure the project is safely executed.

5.2 Excavation of Strontium-90–Contaminated Soil and Rock

Two locations south of SWMU 10-002(b) are contaminated with strontium-90 and were recommended for removal in the 2008 investigation report (LANL 2008, 102424). Excavation 1 is approximately 10 ft by 20 ft and will be excavated to 3 ft bgs. Excavation 2 is west of Excavation 1, is approximately 5 ft by 5 ft and will also be excavated to 3 ft bgs (Figure 5.2-1). A backhoe will be used to excavate the areas of contaminated soil and rock. If necessary, a backhoe equipped with a pneumatic hammer may be used to remove the large boulder that is part of the Excavation 2 area. A water truck will be used to wet the excavation areas before and during the excavation to minimize dust. After the areas are excavated and confirmation samples are collected, clean fill will be used to backfill the excavations. Field screening for VOCs and radiological contamination will be conducted as required by the SSHASP and the radiological work permit (RWP). Personal protective equipment (PPE) requirements for this activity will follow those listed in section 5.3, Surface and Shallow Subsurface Sampling, or as outline in the approved SSHASP and RWP.

5.3 Shallow Subsurface Sampling

Confirmation shallow subsurface sampling will be conducted at the base of both excavations. A total of 20 confirmation samples will be collected for off-site analysis. Approximately 15 samples will be collected from the base of Excavation 1, and 5 samples will be collected from the base of Excavation 2 (Figure 5.3-1). All shallow subsurface samples will be collected from 0 to 1 ft bgs (0 is defined as the base of the excavation) and analyzed for strontium-90 only. Shallow subsurface sampling will be collected following SOP-6.09, Spade and Scoop Methods for the Collection of Soil Samples, and SOP-6.10, Hand Auger and Thin Wall Tube Sampler. If the surface location is in bedrock, a hammer and chisel may be necessary to produce sufficient material for a full-suite analytical sample.

Surface and shallow subsurface samples will be field screened for VOCs and radioactivity for health and safety purposes before samples are collected, then placed in zip top bags and/or sample jars as composite grab samples taken from hand augers, scoops, or chiseling devices in accordance with the sampling guidance document and appropriate SOPs. Radiological field screening will be conducted using an Eberline E600 with either a 380AB or SHP360 probe (or equivalent) and an ESP-1 rate meter with a 210 probe (or equivalent). VOC screening will be performed using a PID equipped with an 11.7-eV bulb following SOP-6.33, “Headspace Vapor Screening with a Photoionization Detector.”

All sample collection activities will be coordinated with LANL’s Sample Management Office (SMO). After they are collected, the samples will remain in controlled custody of the field team at all times or stored in the secure sample staging area until they can be delivered to the SMO. All samples will be field screened for radioactivity before they are sent to the SMO. Additionally, samples will be submitted to ARS laboratory in White Rock, NM, for gross-alpha, -beta, and -gamma analyses before the SMO ships the samples to the analytical laboratory to ensure compliance with U.S. Department of Transportation (DOT) requirements. Upon receipt of the samples, custody will be remanded to the SMO for delivery to a preapproved off-site analytical lab. Quality assurance (QA)/QC samples (field duplicates and rinsate blanks) will be collected at a rate of 1 per every 10 analytical samples collected (10% frequency). Field trip blanks will be obtained from the SMO only if VOC samples are collected.

PPE

Use of PPE for excavation and surface sampling will be required at all locations. Specifically, Level D construction PPE is required for excavation work and collecting surface samples with the additional requirement that Tyvec coveralls and booties be worn when in the RCA.

If field screening results indicate that additional PPE requirements may be necessary, the radiological control technician (RCT) will stop work and collect a smear sample, and the crew will wait for the results. If the smears indicate that alpha exceeds 2000 dpm/100 cm^2 and/or combined beta gamma exceeds 100,000 dpm/100 cm^2, additional PPE will be required before sampling activities continue. Additional information is presented the Bayo Canyon Aggregate Area investigation SSHASP and RWP.

5.4 Decontamination of Equipment

Excavation and sampling equipment will be decontaminated to minimize the potential for cross-contamination between excavation and sampling locations. Dry decontamination methods will be used whenever possible. Decontamination procedures will follow SOP-1.08, Field Decontamination of Drilling and Sampling Equipment. All equipment will be screened by an RCT and released following DOT regulations before it enters and exits the site. Only equipment and materials essential for excavation and

confirmation sample collection will be brought into the work zone; nonessential equipment will be stored outside the work zone to minimize the potential for contaminating nonessential equipment.

5.5 Site Demobilization and Restoration

Upon completion of investigation activities, all investigation-related equipment will be removed promptly from the site, and staging areas no longer in use (i.e., sampling and equipment staging areas, decontamination areas etc.) will be dismantled. Because of pending waste characterization results, site demobilization will be completed in two phases: (1) following completion of excavation and sampling activities and (2) following the removal of waste containers, after receipt of waste characterization results, to the appropriate waste disposal facility.

During the first phase of demobilization, the field team will perform the following tasks:

1. decontaminate equipment using dry decontamination methods,
2. release of all equipment by an RCT before site demobilization can occur,
3. remove all equipment and materials from the site, and
4. perform a postjob geodetic survey of excavated areas and sampling locations.

During the second phase of demobilization, the field team will remove all waste containers and dismantle all waste containment storage areas. To ensure that the site is properly restored to prejob conditions, the field team will perform the following tasks:

1. regrade disturbed/excavated slopes to predisturbed condition;
2. reseed disturbed areas with native seed mix (applicable only to areas that supported grass/shrubs before field activity disturbance) and lay straw blankets and/or wattles on the downslope side of the excavated areas;
3. ensure all required BMPs necessary to maintain effectiveness of reseeding, drainage, and erosion control efforts are properly installed and secure; and
4. ensure the site is left clean of all investigation-related debris.

6.0 HEALTH, SAFETY, AND SECURITY

All activities described in this FIP will be conducted under the applicable contractor-approved ES&H plan, SSHASP, IWD, and RWP and in accordance with all LANL requirements. Field team members will be briefed on all appropriate documents. In addition, Bayo Canyon is located on Los Alamos County property, and all guidelines specified in the access agreement will be followed. Public access to the work zone will be restricted and controlled, and signs will be posted describing the potential dangers that may exist in the work zone.

The following SOPs have been adapted by Terranear PMC, the subcontractor performing the work, from existing LANL procedures and are applicable to the investigation methods proposed in this plan.

- SOP-5055, General Instructions for Field Investigations
- SOP-5056, Sample Container and Preservation
- SOP-5057, Handling, Packaging and Transporting Samples

- SOP-5058, Sample Control and Field Documentation
- SOP-5059, Field Quality Control Samples
- SOP-5181, Notebook Documentation for Technical field Activities
- SOP-5061, Field Decontamination of Equipment
- SOP-5022, Characterization and Management of Environmental Restoration Project Waste
- SOP-01.12, Field Site Closeout Checklist
- SOP-3.11, Coordinating and Evaluating Geodetic Surveys
- SOP-06.09, Spade and Scoop Methods for the Collection of Soil Samples
- SOP-06.10, Hand Auger and Thin-Wall Tube Sampler
- SOP-6.33, Headspace Vapor Screening with a Photo Ionization Detector

7.0 WASTE MANAGEMENT AND DISPOSAL

IDW refers to all solid waste generated during field investigations. For the field campaign, anticipated IDW may include, but is not limited to, (1) excavated material; (2) contact waste (PPE, paper towels, gloves, etc.); (3) potential fluids from the decontamination of sampling equipment; (4) petroleum-contaminated soil; and (5) municipal solid waste. A waste characterization strategy form (WCSF) amendment will be prepared and approved for the excavation and strontium-90 removal per the requirements of SOP-5022, Characterization and Management of Environmental Restoration Project Waste.

It is anticipated that the IDW generated during implementation of these activities will be characterized as low-level radioactive waste. Waste characterization will be completed using one or more of the following methods: (1) acceptable knowledge (e.g., review of existing data and/or documentation) and/or (2) direct sampling. All IDW generated during this field campaign will be managed in accordance with the approved site-specific WCSF and amendment and applicable SOPs. These SOPs incorporate the requirements of applicable U.S. Environmental Protection Agency and New Mexico Environment Department (NMED) regulations, and DOE orders.

Waste containers will be selected based on appropriate DOT requirements, waste types, and the estimated volumes generated. Immediately following containerization, each waste container will be individually labeled with a unique identification number and with information regarding waste classification, item(s), and date generated. Waste will be contained 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.

All IDW types anticipated for the Bayo Canyon soil removal along with their anticipated characterization, storage, and disposal methods are summarized in the WCSF and amendment.

8.0 IMPLEMENTATION SCHEDULE

Fieldwork activities are anticipated to begin in August 2009 and end in September 2009. Field crews will work 10 h per day, 5 days per week. If necessary (i.e., if field work is behind schedule), a 12-h per day and/or a 6-day work week will be implemented.

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.

Abrahams, J.H., Jr., July 1962. "Radioactive Waste Disposal at Los Alamos, New Mexico," U.S. Geological Survey Administrative Release, Albuquerque, New Mexico. (Abrahams 1962, 001306)

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Dodd, A.O., April 1956. "A Survey of Some Los Alamos County Canyons for Radioactive Contamination, Spring 1953 to Spring 1955," Los Alamos Scientific Laboratory report LAMS-2038, Los Alamos, New Mexico. (Dodd 1956, 004695)

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Drake, R.W., C.D. Blackwell, and W.C. Courtright, March 29, 1976. "Survey of Old TA-10, Bayo Canyon," Los Alamos Scientific Laboratory memorandum (H-3-76-114) to R. Reider (LANL) from R.W. Drake (WX-DO), C.D. Blackwell (H-1), and W.C. Courtwright (H-3), Los Alamos, New Mexico. (Drake et al. 1976, 002078)

Ford, Bacon, and Davis (Ford, Bacon, and Davis Utah Inc.), September 1981. "Engineering Evaluation of the Bayo Canyon Site, Los Alamos, New Mexico," report prepared under subcontract to Bechtel National, Inc., for Los Alamos National Laboratory, Bechtel Report No. OR1/044/01, Subcontractor Report No. 409-317, Salt Lake City, Utah. (Ford, Bacon, and Davis 1981, 008032)

LANL (Los Alamos National Laboratory), November 1990. "Solid Waste Management Units Report," Vol. II of IV (TA-10 through TA-25), Los Alamos National Laboratory document LA-UR-90-3400, Los Alamos, New Mexico. (LANL 1990, 007512)

LANL (Los Alamos National Laboratory), April 1996. "Interim Action Report for TA-10, Bayo Canyon Shrapnel," Los Alamos National Laboratory document LA-UR-96-1088, Los Alamos, New Mexico. (LANL 1996, 054491)

LANL (Los Alamos National Laboratory), September 1997. “RFI Report for Potential Release Site 10-008,” Los Alamos National Laboratory document LA-UR-97-3771, Los Alamos, New Mexico. (LANL 1997, 056660.423)

LANL (Los Alamos National Laboratory), April 23, 1999. “Los Alamos National Laboratory's Environmental Restoration Project's Final Table (Revision 1) Listing Agreed Upon Annual Unit Audit Numbers,” Los Alamos National Laboratory letter (EM/ER:99-103) and enclosures to B. Garcia (NMED-HRMB) from J. Canepa (ER Program Manager) and T.J. Taylor (DOE-LAAO), Los Alamos, New Mexico. (LANL 1999, 063175)

LANL (Los Alamos National Laboratory), July 2005. “Historical Investigation Report for Technical Area 10,” Los Alamos National Laboratory document LA-UR-05-3955, Los Alamos, New Mexico. (LANL 2005, 089658)

LANL (Los Alamos National Laboratory), May 2008. “Investigation Report for Bayo Canyon Aggregate Area, Revision 1,” Los Alamos National Laboratory document LA-UR-08-3202, Los Alamos, New Mexico. (LANL 2008, 102424)

Mayfield, D.L., A.K. Stoker, and A.J. Ahlquist, June 1979. “Formerly Utilized MED/AEC Sites, Remedial Action Program: Radiological Survey of the Bayo Canyon, Los Alamos, New Mexico,” U.S. Department of Energy Report No. DOE/EV-0005/15, Los Alamos, New Mexico. (Mayfield et al. 1979, 011717)

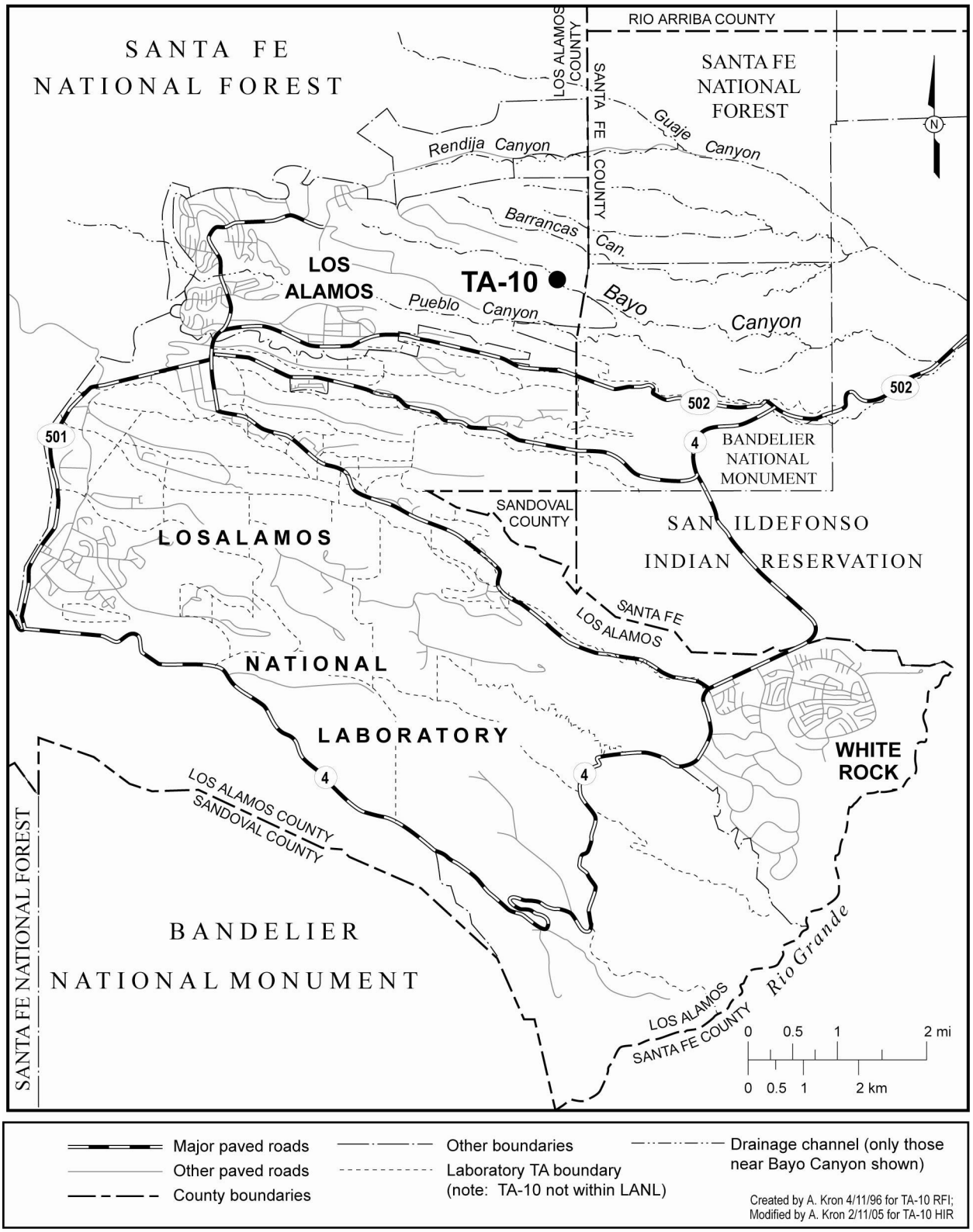

Figure 2.1-1 Location of TA-10 with respect to LANL TAs

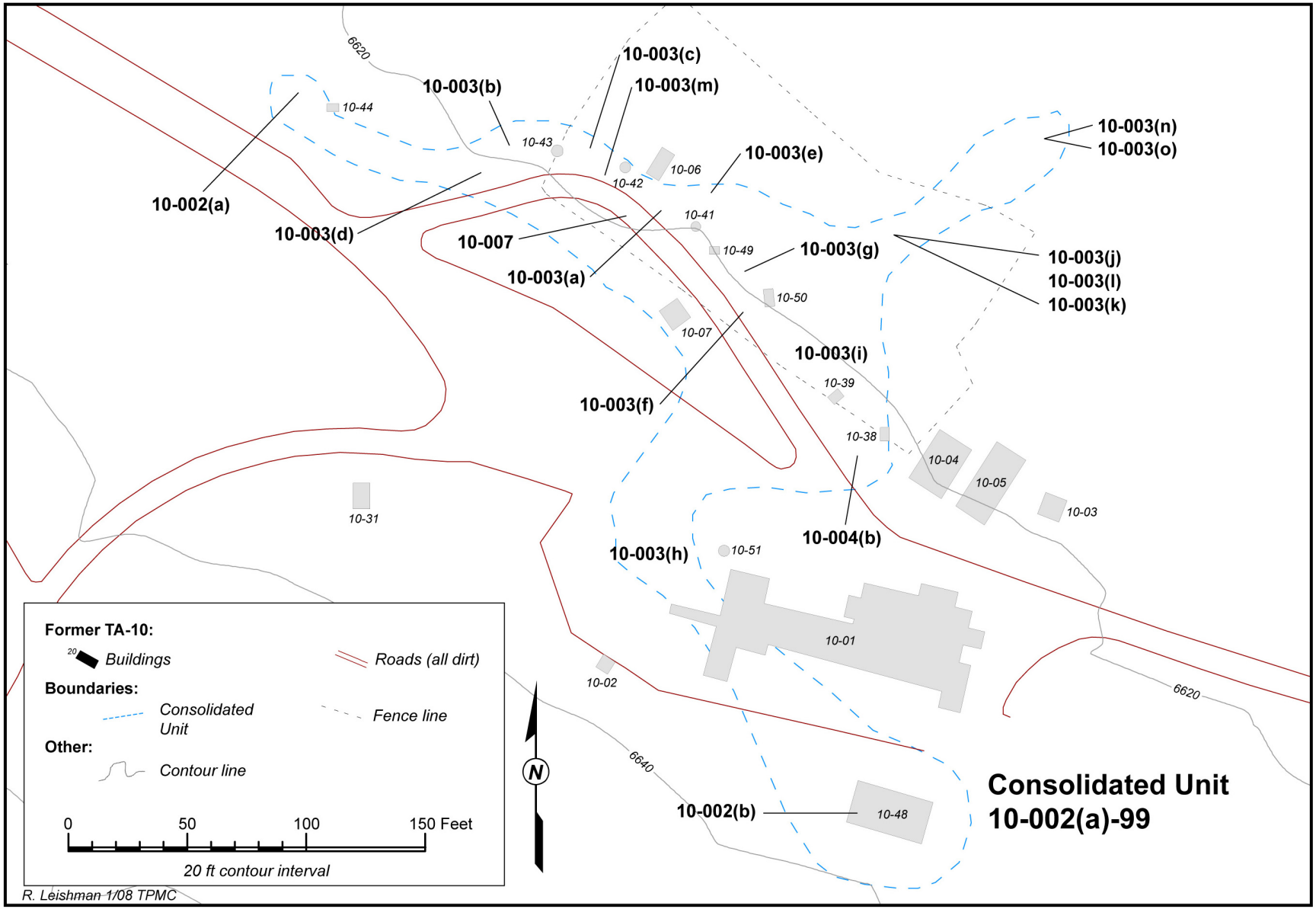

Figure 2.2-1 Location of SWMUs and AOCs within Consolidated Unit 10-002(a)-99

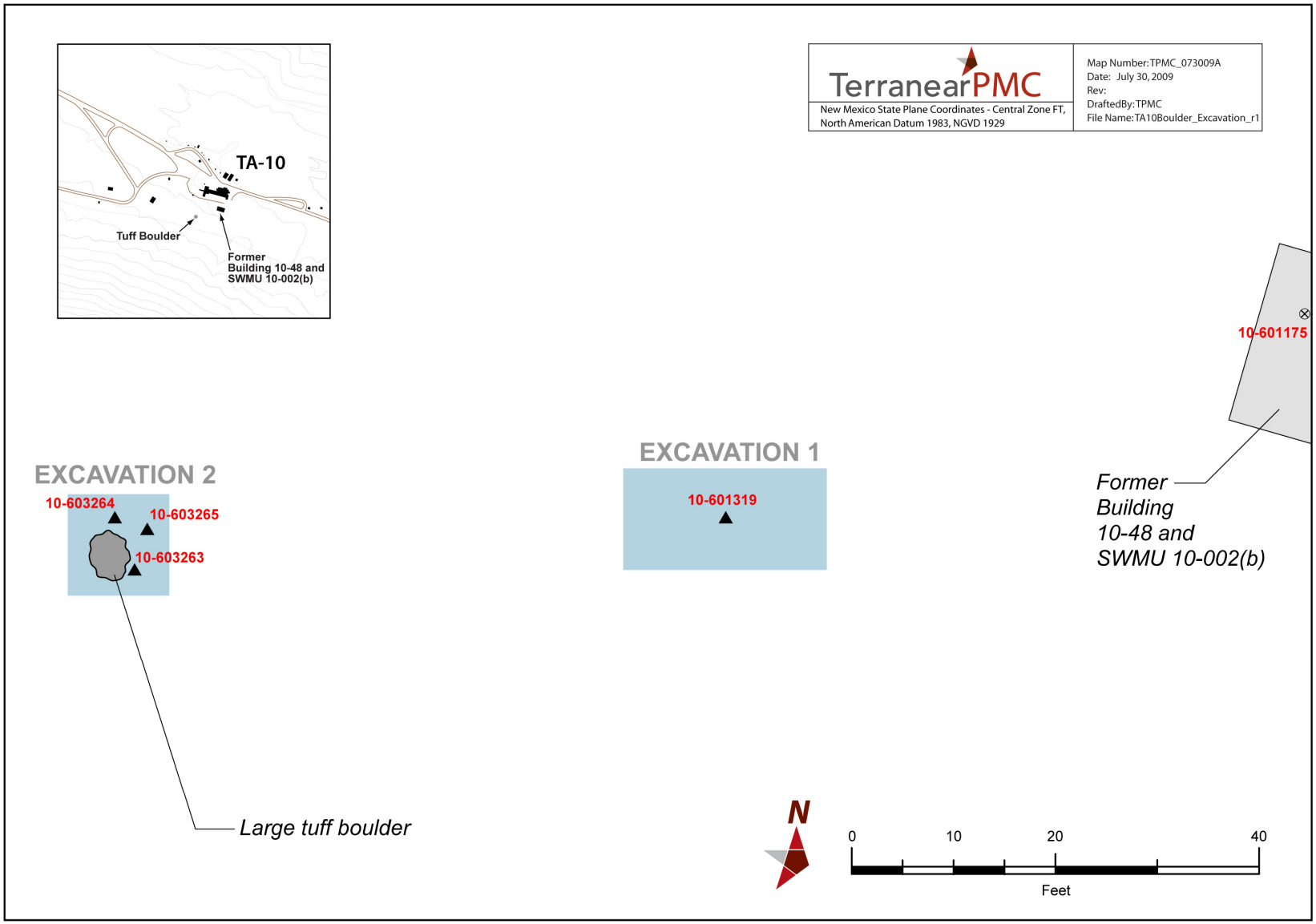

Figure 3.0-1 **Location of surface samples collected from two isolated areas with elevated strontium-90 and two proposed areas to be excavated south of SWMU 10-002(b) shaded in blue**

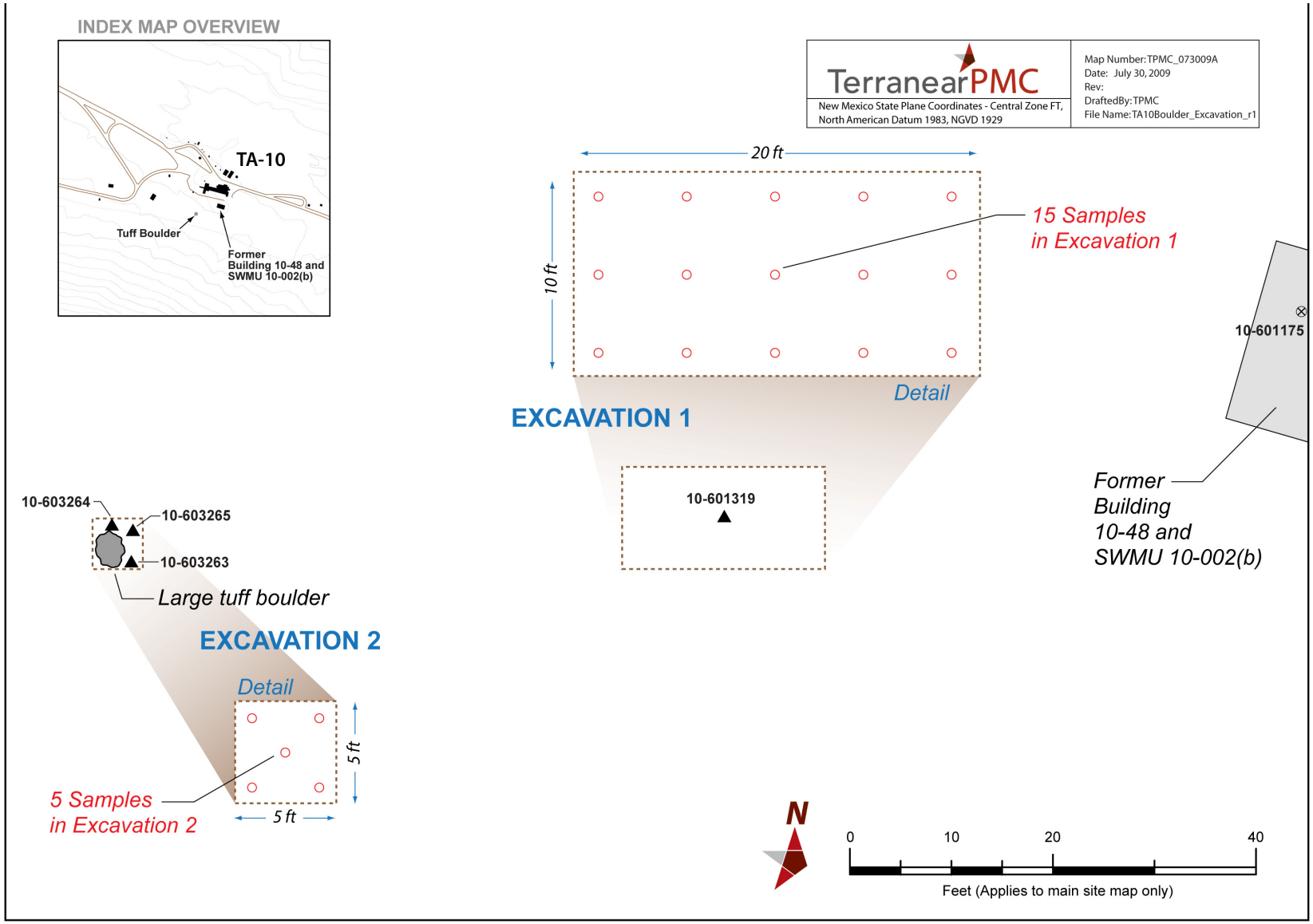

Figure 5.3-1 Proposed location of confirmation samples to be collected from the base of Excavation 1 and Excavation 2 south of SWMU 10-002(b)

Table 3.0-1
Summary of Samples Collected South of SWMU 10-002(b)

Sample ID	Location ID	Depth (ft)	Media	Americium-241	Gamma Spectroscopy	Gross Alpha/Beta	HEXP	Isotopic Uranium	Metals	Perchlorate	Strontium-90	SVOC	VOC
RE10-08-9973	10-601319	1.5000–2.0000	SOIL	—*	—	—	—	—	—	—	08-452	—	—
RE10-08-9965	10-603263	0.0000–1.0000	SOIL	08-452	08-452	08-452	08-452	08-452	08-452	08-452	08-452	08-452	08-452
RE10-08-9966	10-603263	1.5000–2.0000	SOIL	08-452	08-452	08-452	08-452	08-452	08-452	08-452	08-452	08-452	08-452
RE10-08-9967	10-603264	0.0000–1.0000	SOIL	08-452	08-452	08-452	08-452	08-452	08-452	08-452	08-452	08-452	08-452
RE10-08-9968	10-603264	1.5000–2.0000	SOIL	08-452	08-452	08-452	08-452	08-452	08-452	08-452	08-452	08-452	08-452
RE10-08-9969	10-603265	0.0000–1.0000	SOIL	08-452	08-452	08-452	08-452	08-452	08-452	08-452	08-452	08-452	08-452
RE10-08-9970	10-603265	1.5000–3.2000	SOIL	08-452	08-452	08-452	08-452	08-452	08-452	08-452	08-452	08-452	08-452

*— = Not detected.

Table 3.0-2
Summary of Inorganic Chemicals above BVs in Soil South of SWMU 10-002(b)

Sample ID	Location ID	Depth (ft)	Media	Aluminum	Antimony	Arsenic	Barium	Beryllium	Cadmium	Calcium	Chromium	Copper	Cyanide (Total)	Iron	Lead	Magnesium	Manganese	Mercury	Molybdenum	Nickel	Perchlorate	Selenium	Silver	Thallium	Uranium	Vanadium	Zinc
QAL BV				**29200**	**0.83**	**8.17**	**295**	**1.83**	**0.4**	**6120**	**19.3**	**14.7**	**0.5**	**21500**	**22.3**	**4610**	**671**	**0.1**	**na[a]**	**15.4**	**na**	**1.52**	**1**	**0.73**	**1.82**	**39.6**	**48.8**
QBO BV				**3560**	**0.5**	**0.56**	**25.7**	**1.44**	**0.4**	**1900**	**2.6**	**3.96**	**0.5**	**3700**	**13.5**	**739**	**189**	**0.1**	**na**	**2**	**na**	**0.3**	**1**	**1.22**	**0.72**	**4.59**	**40**
QBOF BV				**3560**	**0.5**	**0.56**	**25.7**	**1.44**	**0.4**	**1900**	**2.6**	**3.96**	**0.5**	**3700**	**13.5**	**739**	**189**	**0.1**	**na**	**2**	**na**	**0.3**	**1**	**1.22**	**0.72**	**4.59**	**40**
QBOG BV				**3560**	**0.5**	**0.56**	**25.7**	**1.44**	**0.4**	**1900**	**2.6**	**3.96**	**0.5**	**3700**	**13.5**	**739**	**189**	**0.1**	**na**	**2**	**na**	**0.3**	**1**	**1.22**	**0.72**	**4.59**	**40**
SOIL BV				**29200**	**0.83**	**8.17**	**295**	**1.83**	**0.4**	**6120**	**19.3**	**14.7**	**0.5**	**21500**	**22.3**	**4610**	**671**	**0.1**	**na**	**15.4**	**na**	**1.52**	**1**	**0.73**	**1.82**	**39.6**	**48.8**
RE10-07-6291	10-601319	0.0000–0.2500	SOIL	—[b]	—	—	—	—	0.539 (U[c])	—	—	—	—	—	23.9	—	—	—	NA[d]	—	—	—	—	—	NA	—	—
RE10-08-9965	10-603263	0.0000–1.0000	SOIL	—	—	—	—	—	0.56 (U)	—	—	—	—	—	—	—	—	—	NA	—	—	1.68 (U)	—	—	NA	—	—
RE10-08-9966	10-603263	1.5000–2.0000	SOIL	—	—	—	—	—	0.529 (U)	—	—	—	—	—	—	—	—	—	NA	—	—	1.59 (U)	—	—	NA	—	—
RE10-08-9967	10-603264	0.0000–1.0000	SOIL	—	—	—	—	—	0.559 (U)	—	—	—	—	—	—	—	—	—	NA	—	0.000756 (J[e])	—	—	—	NA	—	—
RE10-08-9968	10-603264	1.5000–2.0000	SOIL	—	—	—	—	—	0.56 (U)	—	—	—	—	—	—	—	—	—	NA	—	—	—	—	—	NA	—	—
RE10-08-9969	10-603265	0.0000–1.0000	SOIL	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.219	NA	—	—	—	—	—	NA	—	—
RE10-08-9970	10-603265	1.5000–3.2000	SOIL	—	—	—	—	—	0.531 (U)	—	—	—	—	—	—	—	—	—	NA	—	—	—	—	—	NA	—	—

Note: Units are mg/kg.
[a] na = Not available.
[b] — = Not detected.
[c] U = The analyte was analyzed for but not detected.
[d] NA = Not analyzed.
[e] J = The analyte was positively identified, and the associated numerical value is estimated to be more uncertain than would normally be expected for that analysis.

Table 3.0-3
Summary of Organic Chemicals above BVs in Soil South of SWMU 10-002(b)

Sample ID	Location ID	Depth (ft)	Media	Acenaphthene	Acetone	Benzene	Benzoic Acid	Bis(2-ethylhexyl)phthalate	Bromobenzene	Bromoform	Butanone[2-]	Butylbenzene[sec-]	Butylbenzene[tert-]	Butylbenzylphthalate	Carbon Tetrachloride	Chlorobenzene	Chloroform	Chlorophenol[2-]	Di-n-butylphthalate	Dichlorobenzene[1,2-]	Dichlorobenzene[1,3-]	Dichloroethane[1,1-]	Dichloroethene[1,1-]	Diethylphthalate	Dimethyl Phthalate	Isopropyltoluene[4-]	Methyl-2-pentanone[4-]	Methylene Chloride	Naphthalene	Phenol	Tetrachloroethene	Toluene	Trichloro-1,2,2-trifluoroethane[1,1,2-]	Trichloroethane[1,1,1-]	Trichloroethene	Trimethylbenzene[1,2,4-]	Trimethylbenzene[1,3,5-]	Xylene (Total)	Xylene[1,3-]+Xylene[1,4-]
RE10-07-6291	10-601319	0.0000–0.2500	SOIL	—[a]	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	NA[b]	0.000279 (J[c])
RE10-08-9970	10-603265	1.5000–3.2000	SOIL	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.0404 (J)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	NA	—

Note: Units are mg/kg.
[a] — = Not detected.
[b] NA = Not analyzed.
[c] J = The analyte was positively identified, and the associated numerical value is estimated to be more uncertain than would normally be expected for that analysis.

Table 3.0-4
Summary of Radionuclides above BVs/FVs in Soil South of SWMU 10-002(b)

Sample ID	Location ID	Depth (ft)	Media	Cesium-137	Europium-152	Gross Alpha/Beta	Gross Beta	Strontium-90	Uranium-234	Uranium-235	Uranium-238
QAL BV				**1.65**	**na**[a]	**na**	**na**	**1.31**	**2.59**	**0.2**	**2.29**
QBO BV				**na**	**na**	**na**	**na**	**na**	**4**	**0.18**	**3.9**
QBOF BV				**na**	**na**	**na**	**na**	**na**	**4**	**0.18**	**3.9**
QBOG BV				**na**	**na**	**na**	**na**	**na**	**4**	**0.18**	**3.9**
SOIL BV				**1.65**	**na**	**na**	**na**	**1.31**	**2.59**	**0.2**	**2.29**
RE10-07-6291	10-601319	0.0000–0.2500	SOIL	—[b]	—	19	319	193	—	—	—
RE10-08-9973	10-601319	1.500–2.0000	SOIL	NA[c]	NA	NA	NA	2.89	NA	NA	NA
RE10-08-9965	10-603263	0.0000–1.0000	SOIL	4.48	—	12.7	44.6	15	—	—	—
RE10-08-9966	10-603263	1.5000–2.0000	SOIL	0.505	—	12.1	27.3	0.768	—-	—	—
RE10-08-9967	10-603264	0.0000–1.0000	SOIL	3	—	21.9	62.5	6.06	—	—	—
RE10-08-9968	10-603264	1.5000–2.0000	SOIL	—	—	9.14	36.6	0.221	—	—	—
RE10-08-9969	10-603265	0.0000–1.0000	SOIL	0.352	—	11.4	42	0.531	—	—	—
RE10-08-9970	10-603265	1.5000–3.2000	SOIL	—	—	10.8	40.2	—	—	—	—

Note: Units are pCi/g.
[a] na = Not available.
[b] — = Not detected.
[c] NA = Not analyzed.