Appendix B

Field Methods

B-1.0 INTRODUCTION

This appendix summarizes the field methods used during the 2009–2010 investigation of the Threemile Canyon Aggregate Area at Los Alamos National Laboratory (LANL or Laboratory). Table B-1.0-1 presents a summary of the field methods used, and the following sections provide more detailed descriptions of these methods. All activities were conducted in accordance subcontractor procedures that are equivalent to Laboratory standard operating procedures (SOPs) listed in Table B-1.0-2 and are available http://www.lanl.gov/community-environment/environmental-stewardship/plans-procedures.php.

B-2.0 EXPLORATORY DRILLING CHARACTERIZATION

No exploratory drilling characterization was conducted. All drilling was conducted for the purpose of collecting investigation samples.

B-3.0 FIELD-SCREENING METHODS

This section summarizes the field-screening methods used during the investigation activities. Field screening for radioactivity was performed on each sample collected. The field-screening results are presented in Table 3.2-2 of the investigation report.

B-3.1 Field Screening for Organic Vapors

Field screening for organic vapors was not required per the New Mexico Environment Department–(NMED-) approved investigation work plan (LANL 2008, 105673; NMED 2008, 104256).

B-3.2 Field Screening for Radioactivity

During sampling of soil, fill, tuff, and sediment, each sample was screened for radioactivity immediately as it was collected, targeting alpha and beta/gamma emitters. Screening was conducted by a Laboratory ~~radiation~~ radiological control technician (RCT) using an Eberline E-600 radiation meter with an 380AB or SHP360 probe (or equivalent) and as ESP-1 rate meter with a 210 probe (or equivalent). The Eberline E-600 with attachment 380AB or SHP360 consists of a dual-phosphor plate covered by two Mylar windows housed in a light-excluding metal body. The phosphor plate is a plastic scintillator for the detection of beta and gamma emissions and is thinly coated with zinc sulfide for the detection of alpha emissions. The operational range varies from trace emissions to 1 million disintegrations per minute (dpm). The screening results are presented in Table 3.2-2 of the supplemental investigation report.

B-4.0 FIELD INSTRUMENT CALIBRATION

All instruments were calibrated before use. Calibration of the Eberline E-600 was conducted by the RCT. All calibrations were performed according to the manufacturers' specifications and requirements.

B-4.1 Eberline E-600 Instrument Calibration

The Eberline E-600 was calibrated daily by the RCT before local background levels for radioactivity were measured. The instrument was calibrated using plutonium-239 and chloride-36 sources for alpha and beta emissions, respectively. The following five checks were performed as part of the calibration procedures:

- calibration date
- physical damage
- battery
- response to a source of radioactivity
- background

All calibrations performed for the Eberline E-600 met the manufacturer's specifications, the requirements of SOP-5006, and the applicable radiation detection instrument manual. Calibrations were recorded in daily activity logs.

B-5.0 SURFACE AND SUBSURFACE SAMPLING

This section summarizes the methods used to collect surface and subsurface samples, including soil, fill, tuff, and sediment samples, according to the revised investigation work plan (LANL 2008, 105673) and NMED's approval with modifications letter (NMED 2008, 104256).

B-5.1 Surface Sampling Methods

Surface samples were collected within former Technical Area 12 (TA-12), TA-14, TA-15, and TA-36 using either hand-auger or spade-and-scoop methods. Surface samples were collected in accordance with approved subcontractor procedures technically equivalent to SOP-06.10, Hand Auger and Thin-Wall Tube Sampler, or SOP-06.09, Spade and Scoop Method for the Collection of Soil Samples. A hand auger or spade and scoop was used to collect material in approximately 6-in. increments. The sample material was placed in a stainless-steel bowl with a stainless-steel scoop, after which it was transferred to sterile sample collection jars or bags. Samples were preserved using coolers to maintain the required temperature and chemical preservatives, such as nitric acid, in accordance with an approved subcontractor procedure technically equivalent to SOP-5056, Sample Containers and Preservation.

Samples were appropriately labeled, sealed with custody seals, and documented before transporting to the Sample Management Office (SMO). Samples were managed according to approved subcontractor procedures technically equivalent to SOP-5057, Handling, Packaging, and Transporting Field Samples, and SOP-5058, Sample Control and Field Documentation.

Sample collection tools were decontaminated immediately before each sample was collected in accordance with a subcontractor procedure technically equivalent to SOP-5061, Field Decontamination of Drilling and Sampling Equipment (section B-5.7).

B-5.2 Borehole Logging

Borehole logs were completed for boreholes drilled with a hollow-stem auger drill rig. Information recorded on field boring logs included footage and percent recovery, lithology and depths of lithologic contacts, depth of samples collected, core descriptions, and other relevant observations. The borehole logs are presented in Appendix C (on CD).

B-5.3 Subsurface Sampling Methods

Subsurface samples were collected in accordance with approved subcontractor procedures technically equivalent to SOP-06.10, Hand Auger and Thin-Wall Tube Sampler, or SOP-06.26, Core Barrel Sampling for Subsurface Earth Materials. Borehole samples were collected in a stainless-steel split-spoon core-barrel sampler that retrieved core in 2.5-ft intervals. The samples collected, listed by location and depth, are provided in tables for each site in the supplemental investigation report.

Core retrieved from the subsurface was field screened for radioactivity and was visually inspected and logged. Following inspection, the 2.5-ft core section to be sampled was removed from the core barrel and placed in a stainless-steel bowl and homogenized. The material was crushed, if necessary, with a decontaminated rock hammer and stainless-steel spoon to allow core material to fit into sample containers.

Samples for volatile organic compound (VOC) analysis were collected immediately to minimize the loss of subsurface VOCs during the sample-collection process. After the VOC samples were collected, a stainless-steel scoop and bowl were used to transfer samples for the remaining analytical suites to sterile sample collection jars or bags for transport to the SMO. The sample collection tools were decontaminated immediately before each sample was collected in accordance with an approved subcontractor procedure technically equivalent to SOP-5061, Field Decontamination of Equipment (section B-5.7).

B-5.4 Quality Control Samples

Quality control (QC) samples were collected in accordance with an approved subcontractor procedure technically equivalent to SOP-5059, Field Quality Control Samples. The QC samples included field duplicates, field rinsate blanks, and field trip blanks. Field duplicate samples were collected from the same material as the regular investigation samples and submitted for the same analyses. Field duplicate samples were collected at a frequency of at least 1 duplicate sample for every 10 samples.

Field rinsate blanks were collected to evaluate field decontamination procedures. Rinsate blanks were collected by rinsing sampling equipment (i.e., auger buckets, sampling bowls and spoons) with deionized water after decontamination. The rinsate water was collected in a sample container and submitted to the SMO. Field rinsate blank samples were analyzed for inorganic chemicals (target analyte list metals, perchlorate, and total cyanide) and were collected from sampling equipment at a frequency of at least 1 rinsate sample for every 10 solid samples.

Field trip blanks also were collected at a frequency of one per day when samples were being collected for VOC analysis. Trip blanks consisted of containers of certified clean sand opened and kept with the other sample containers during the sampling process.

B-5.5 Sample Documentation and Handling

Field personnel completed a sample collection log (SCL) and a chain-of-custody (COC) form for each sample. Sample containers were sealed with signed custody seals and placed in coolers at approximately 4°C. Samples were handled in accordance with approved subcontractor procedures technically equivalent to SOP-5057, Handling, Packaging, and Transporting Field Samples, and SOP-5056, Sample Containers and Preservation. Samples were transported to the SMO for processing and shipment to off-site contract analytical laboratories. The SMO personnel reviewed and approved the SCL/COC forms and accepted custody of the samples. The SCL/COC forms are provided in Appendix E (on DVD).

B-5.6 Borehole Abandonment

All boreholes were abandoned in accordance with an approved subcontractor procedure technically equivalent to SOP-5034, Monitor Well and RFI Borehole Abandonment, by filling the boreholes with bentonite chips up to 2.0–3.0 ft from the ground surface. The chips were hydrated and clean soil was placed on top. All cuttings were managed as investigation-derived waste (IDW) as described in Appendix F.

B-5.7 Decontamination of Sampling Equipment

The split-spoon core barrels and all other sampling equipment that came (or could have come) in contact with sample material were decontaminated after each core was retrieved and logged. Decontamination included wiping the equipment with Fantastik and paper towels. The drilling equipment was decontaminated before mobilization of the drill rig to another borehole to avoid cross-contamination between samples and borehole locations. Residual material adhering to equipment was removed using dry decontamination methods such as the use of wire brushes and scrapers. Decontamination activities were performed in accordance with an approved subcontractor procedure technically equivalent to SOP-5061, Field Decontamination of Equipment. Field rinsate blank samples were collected in accordance with an approved procedure technically equivalent to SOP-5059, Field Quality Control Samples.

B-6.0 GEODETIC SURVEYING

Geodetic surveys of all sample locations were performed using a Trimble RTK 5700 differential global-positioning system (DGPS) referenced from published and monumented external Laboratory survey control points in the vicinity. All sampling locations were surveyed in accordance with an approved subcontractor procedure technically equivalent to SOP-5028, Coordinating and Evaluating Geodetic Surveys. Horizontal accuracy of the monumented control points is within 0.1 ft. The DGPS instrument referenced from Laboratory control points is accurate within 0.2 ft. The surveyed coordinates are presented in Table 3.2-1 of the supplemental investigation report.

B-7.0 IDW STORAGE AND DISPOSAL

All IDW generated during the field investigation was managed in accordance with an approved subcontractor procedure technically equivalent to SOP-5238, Characterization and Management of Environmental Program Waste. This procedure incorporates the requirements of all applicable U.S. Environmental Protection Agency (EPA) and NMED regulations, U.S. Department of Energy orders, and Laboratory implementation requirements. IDW was also managed in accordance with the approved waste characterization strategy form and the IDW management appendix of the approved investigation work plan (LANL 2008, 105673; NMED 2008, 104256). Details of IDW management for the Threemile Canyon Aggregate Area investigation are presented in Appendix F.

B-8.0 DEVIATIONS FROM WORK PLAN

At each solid waste management unit (SWMU) and area of concern (AOC) investigated, proposed sampling for polychlorinated biphenyls (PCBs) was changed from the approved investigation work plan (LANL 2008, 105673; NMED 2008, 104256). Additional samples were collected beyond the planned minimum 20% for PCB analysis to aid in determining the extent of contamination.

Proposed sampling locations identified in the approved investigation work plan (LANL 2008, 105673; NMED 2008, 104256) were moved as a result of site conditions encountered during the fieldwork activities. These locations were moved because they were sited on top of, or next to, underground utilities, sample refusal occurred, or the proposed locations were inaccessible. When locations were moved, the new locations were sited as close as possible to the original locations. Deviations to sampling locations and to the work plan scope are discussed below.

AOC C-12-003: Ground-truthing of the former structure was conducted. Based on the location of the structure sign and the berm, the sampling locations were moved to include the former structure.

SWMUs 12-001(a) and 12-001(b): Refusal occurred at two locations, and samples could not be collected at the second depth. Four locations were moved to be sited in the drainage.

AOC 12-004(a): Refusal occurred at one location, and a sample could not be collected at the second depth.

AOC 12-004(b): Two additional sampling locations were sampled.

AOC 15-005(c): Two locations were moved because of the presence of active utilities: one was moved a few feet to the north and the other approximately 5 ft to the east.

SWMU 15-007(c): Two sampling locations were inadvertently not sampled. These locations were in the outer row of the 20--ft sampling grid around the shaft, to the northeast of location 15-610799 and to the northeast of location 15-610812. Lateral extent is defined for all inorganic and organic chemicals detected in the sampling grid, and grid samples were not analyzed for radionuclides. Because lateral extent is defined, the omission of the planned samples at these locations does not constitute a data gap.

SWMU 15-008(b): Refusal occurred at one location, and a sample could not be collected at the second depth.

SWMU 15-009(c): Six locations were moved to be sited in the drainage. Refusal occurred at one location, and a sample could not be collected at the second depth.

SWMU 15-009(h): The septic tank was not removed because active utilities were located too close to the septic tank to safely remove it. Consequently, the proposed samples from below the tank were not collected.

SWMU 15-010(b): The high explosives settling tank was not removed. Samples were not collected from below the inlet line, the tank, or the outlet line. Two locations were moved to be sited in the drainage. Refusal occurred at one drainage location, and a sample could not be collected at the second depth.

SWMU 36-003(a): Three locations were moved north because of the presence of active utilities. One location was not sampled because refusal occurred; in addition, the location was within 5 ft of two other sampling locations. A sample could not be collected at the second depth because of refusal at two locations.

SWMU 36-008: Two locations were not sampled because they were located on solid rock and were inaccessible to a drill rig. Refusal occurred at five locations, and a sample could not be collected at the second depth.

B-9.0 REFERENCES

The following reference list includes documents cited in this appendix. Parenthetical information following each reference provides the author(s), publication date, and ERID, ESHID, or EMID. This information is also included in text citations. ERIDs were assigned by the Laboratory's Associate Directorate for Environmental Management (IDs through 599999); ESHIDs were assigned by the Laboratory's Associate Directorate for Environment, Safety, and Health (IDs 600000 through 699999); and EMIDs are assigned by N3B (IDs 700000 and above). IDs are used to locate documents in N3B's Records Management System and in the Master Reference Set. The NMED Hazardous Waste Bureau and N3B maintain copies of the Master Reference Set. The set ensures that NMED has the references to review documents. The set is updated when new references are cited in documents.

LANL (Los Alamos National Laboratory), October 2008. "Investigation Work Plan for Threemile Canyon Aggregate Area, Revision 1," Los Alamos National Laboratory document LA-UR-08-6727, Los Alamos, New Mexico. (LANL 2008, 105673)

NMED (New Mexico Environment Department), November 20, 2008. "Approval with Modifications for Investigation Work Plan for Threemile Canyon Aggregate Area, Revision 1," New Mexico Environment Department letter to D. Gregory (DOE-LASO) and D. McInroy (LANL) from J.P. Bearzi (NMED-HWB), Santa Fe, New Mexico. (NMED 2008, 104256)

Table B-1.0-1
Summary of Field Investigation Methods

Method	Summary
Spade and Scoop Collection of Soil Samples	This method is typically used to collect shallow (i.e., approximately 0–12 in.) soil or sediment samples. The spade-and-scoop method involves digging a hole to the desired depth, as prescribed in the work plan, and collecting a discrete grab sample. The sample is typically placed in a clean stainless-steel bowl for transfer into various sample containers.
Hand Auger Sampling	This method is typically used for sampling soil or sediment at depths of less than 10–15 ft but in some cases may be used to collect samples of weathered or nonwelded tuff. The method involves hand-turning a stainless-steel bucket auger (typically 3–4 in. inside diameter [I.D.]), creating a vertical hole that can be advanced to the desired sample depth. When the desired depth was reached, the auger was decontaminated before advancing the hole through the sampling depth. The sample material was transferred from the auger bucket to a stainless-steel sampling bowl before the various required sample containers were filled.
Split-Spoon Core-Barrel Sampling	In this method, a stainless-steel core barrel (typically 4 in. I.D., 2.5 ft long) is advanced using a powered drilling rig. The core barrel extracts a continuous length of soil and/or rock that can be examined as a unit. The split-spoon core barrel is a cylindrical barrel split lengthwise so the two halves can be separated to expose the core sample. Once extracted, the section of core was screened for radioactivity and organic vapors and described in a geologic log. A portion of the core was then collected as a discrete sample from the desired depth.
Handling, Packaging, and Shipping of Samples	Field team members sealed and labeled samples before packing to ensure the sample and the transport containers were free of external contamination. Field team members packaged all samples to minimize the possibility of breakage during transport. After all environmental samples were collected, packaged, and preserved, a field team member transported them to the SMO. The SMO arranged to ship the samples to the analytical laboratories.
Sample Control and Field Documentation	The collection, screening, and transport of samples were documented on standard forms generated by the SMO. These included SCLs, COC forms, and sample container labels. SCLs were completed at the time of sample collection, and the logs were signed by the sampler and a reviewer who verified the logs for completeness and accuracy. Corresponding labels were initialed and applied to each sample container, and custody seals were placed around each sample container. COC forms were completed and signed to verify that the samples were not left unattended.
Field Quality Control Samples	Field QC samples were collected as follows: *Field Duplicates*: at a frequency 10%; collected at the same time as a regular sample and submitted for the same analyses *Equipment Rinsate Blank*: at a frequency of 10%; collected by rinsing sampling equipment with deionized water, which was collected in a sample container and submitted for laboratory analysis *Trip Blanks*: required for all field events that include the collection of samples for VOC analysis. Trip blanks containers of certified clean sand were opened and kept with the other sample containers during the sampling process
Field Decontamination of Drilling and Sampling Equipment	Dry decontamination was used to minimize the generation of liquid waste. Dry decontamination included the use of a wire brush or other tool to remove soil or other material adhering to the sampling equipment, followed by use of a commercial cleaning agent (nonacid, waxless cleaners) and paper wipes.

Table B-1.0-1 (continued)

Method	Summary
Containers and Preservation of Samples	Specific requirements/processes for sample containers, preservation techniques, and holding times are based on EPA guidance for environmental sampling, preservation, and quality assurance. Specific requirements for each sample were printed on the SCL provided by the SMO (size and type of container, e.g., glass, amber glass, and polyethylene). All samples were preserved by placing them in insulated containers with ice to maintain a temperature of 4ºC.
Coordinating and Evaluating Geodetic Surveys	Geodetic surveys focused on obtaining survey data of acceptable quality to use during project investigations. Geodetic surveys were conducted with a Trimble 5700 DGPS. The survey data conformed to Laboratory Information Architecture project standards IA-CB02, GIS Horizontal Spatial Reference System, and IA-D802, Geospatial Positioning Accuracy Standard for A/E/C/ and Facility Management. All coordinates were expressed as State Plain Coordinate System 83, NM Central, U.S. feet. All elevation data were reported relative to the National Geodetic Vertical Datum of 1983.
Management of Environmental Restoration Project Waste, Waste Characterization	IDW is managed, characterized, and stored in accordance with an approved waste characterization strategy form that documents site history, field activities, and characterization approach for each waste stream managed. During the investigation, waste characterization complied with on- or off-site waste acceptance criteria. All stored IDW was marked with appropriate signage and labels. Drummed IDW was stored on pallets to prevent deterioration of containers. A waste storage area was established before waste was generated. Waste storage areas located in controlled areas of the Laboratory and were monitored as needed to prevent inadvertent addition or management of wastes by unauthorized personnel. Each container of waste generated was individually labeled with waste classification, item identification number, and radioactivity (if applicable), immediately following containerization. All waste was segregated by classification and compatibility to prevent cross-contamination. Management of IDW is described in Appendix F.

Table B-1.0-2
Standard Operating Procedures Used for the Investigation Activities at Threemile Canyon Aggregate Area

SOP-5018, Integrated Fieldwork Planning and Authorization
SOP-5238, Characterization and Management of Environmental Program Waste
SOP-5028, Coordinating and Evaluating Geodetic Surveys
SOP-5034, Monitor Well and RFI Borehole Abandonment
SOP-5055, General Instructions for Field Investigations
SOP-5056, Sample Containers and Preservation
SOP-5057, Handling, Packaging, and Transporting Field Samples
SOP-5058 Sample Control and Field Documentation
SOP-5059 Field Quality Control Samples
SOP-5061, Field Decontamination of Equipment
SOP-01.12 Field Site Closeout Checklist
SOP-06.09, Spade and Scoop Method for Collection of Soil Samples
SOP-06.10, Hand Auger and Thin-Wall Tube Sampler
SOP-06.26, Core Barrel Sampling for Subsurface Earth Materials
06.33, Headspace Vapor Screening with a Photoionization Detector
SOP-5181, Notebook Documentation for Environmental Restoration Technical Activities
EP-DIR-QAP-0001, Quality Assurance Plan for the Environmental Programs

Note: Procedures used were approved subcontractor procedures technically equivalent to the procedures listed.