Appendix B

Field Methods

B-1.0 INTRODUCTION

This appendix summarizes the field methods implemented during the 2014 investigation at Technical Area 57 (TA-57) Aggregate Area, located at Fenton Hill, which lies on the western side of the Jemez Mountains, approximately 12 mi west of Los Alamos National Laboratory (LANL or the Laboratory). Table B-1.0-1 provides a summary of field investigation methods and the following sections provide more detailed descriptions of these methods. All activities were conducted in accordance with approved subcontractor procedures technically equivalent to Laboratory standard operating procedures (SOPs) listed in Table B-1.0-2 and available at http://www.lanl.gov/community-environment/environmental-stewardship/plans-procedures.php.

B-2.0 EXPLORATORY DRILLING CHARACTERIZATION

No exploratory drilling characterization was conducted during the 2014 investigation.

B-3.0 FIELD-SCREENING METHODS

This section summarizes the field-screening methods used during the investigation activities. Field screening for organic vapors and radioactivity was performed on every sample submitted to the Sample Management Office (SMO).

B-3.1 Field Screening for Organic Vapors

Field screening for organic vapors was conducted for all samples using an IonScience PhoCheck+ photoionization detector (PID) equipped with an 11.7-electronvolt lamp. Screening was performed in accordance with the manufacturer's specifications and SOP-06.33, Headspace Vapor Screening with a Photoionization Detector. Screening measurements were recorded on the sample collection logs (SCLs) and chain-of-custody (COC) forms, provided on CD in Appendix E. The screening results are presented in Table 3.2-2 of the investigation report.

B-3.2 Field Screening for Radioactivity

All samples collected were field screened for radioactivity, targeting alpha and beta/gamma emitters. A Laboratory radiological control technician (RCT) conducted radiological screening using an Eberline E-600 radiation meter with an SHP-380AB alpha/beta scintillation detector held within 1 in. of the sample. The Eberline E-600 with attachment SHP-380AB 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 used to detect beta and gamma emissions and is thinly coated with zinc sulfide to detect alpha emissions. The operational range varies from trace emissions to 1 million disintegrations per minute. Screening measurements were recorded on the SCLs and COC forms and are provided on CD in Appendix E. The screening results are presented in Table 3.2-2 of the investigation report.

B-4.0 FIELD INSTRUMENT CALIBRATION

Instrument calibration and/or function check was completed daily. Several environmental factors affected the instruments' integrity, including air temperature, atmospheric pressure, wind speed, and humidity. Calibration of the PID was conducted by the site environmental safety and health representative.

Calibration of the Eberline E-600 was conducted by the RCT. All calibrations were performed according to the manufacturer's specifications and requirements

B-4.1 IonScience PhoCheck+PID Instrument Calibration

The IonScience PhoCheck+ PID was calibrated both to ambient air and a standard reference gas (100 ppm isobutylene). The ambient-air calibration determined the zero point of the instrument sensor calibration curve in ambient air. Calibration with the standard reference gas determined a second point of the sensor calibration curve. Each calibration was within 3% of 100 ppm isobutylene, qualifying the instrument for use.

The following calibration information was recorded daily on operational calibration logs:

- instrument identification number
- final span settings
- date and time
- concentration and type of calibration gas used (isobutylene at 100 ppm)
- name of the personnel performing the calibration

All daily calibration procedures for the IonScience PhoCheck+ met the manufacturer's specifications for standard reference gas calibration.

B-4.2 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 and the applicable radiation detection instrument manual.

B-5.0 SURFACE AND SUBSURFACE SAMPLING

This section summarizes the methods used for collecting surface and subsurface samples, including soil, fill, and tuff, according to the approved investigation work plan (LANL 2012, 214550; NMED 2012, 520936).

B-5.1 Surface Sampling Methods

Surface samples were collected using either the hand-auger or spade-and-scoop methods 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 were used to collect material in approximately 6-in. increments. Samples for volatile organic compound (VOC) analysis were collected immediately to minimize the loss of subsurface VOCs during the sample collection process. Containers for VOC samples were filled as completely as possible, leaving no or minimal headspace, and sealed with a Teflon-lined cap. Table B-1.0-1 provides additional details on the collection of samples for VOC analysis. The description provided is specific to the sampling method rather than to the media. The remaining sample material was placed in a stainless-steel bowl with a stainless-steel scoop, after which it was transferred to sterile sample collection jars. Samples were preserved using coolers with blue ice to maintain the required temperature 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 they were transported to the SMO. Samples were managed in accordance with an approved subcontractor procedure technically equivalent to SOP-5057, Handling, Packaging, and Transporting Field Samples, and WES-EDA-QP-219, Sample Control and Field Documentation.

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

B-5.2 Subsurface Tuff Sampling Methods

Subsurface samples were collected in accordance with an approved subcontractor procedure technically equivalent to SOP-06.10, Hand Auger and Thin-Wall Tube Sampler.

Subsurface samples were collected using the hand auger method. Samples for VOC analysis were collected immediately to minimize the loss of subsurface VOCs during the sample collection process. Containers for VOC samples were filled as completely as possible, leaving no or minimal headspace, and sealed with a Teflon-lined cap. Table B-1.0-1 provides additional details on collection of samples for VOC analysis. The description provided is specific to the sampling method rather than to the media. The remaining 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 preservative, 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 they were transported to the SMO. Samples were managed in accordance with an approved subcontractor procedure technically equivalent to SOP-5057, Handling, Packaging, and Transporting Field Samples, and WES-EDA-QP-219, Sample Control and Field Documentation.

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

B-5.3 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. QC samples included field duplicates, field rinsate blanks, and field trip blanks. Field duplicate samples were collected from the same material as an investigation sample 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., hand auger buckets, sampling bowls and spoons), after decontamination, with deionized water. The rinsate water was collected in a sample container and submitted to the SMO. Field rinsate blank samples were analyzed for inorganic chemicals (metals) and were collected from sampling equipment at a frequency of at least 1 rinsate sample for every 10 solid samples.

Field trip blanks were provided by SMO at a frequency of 1 per day at the time samples were collected for VOC analysis. Trip blanks consisted of containers of certified clean sand and kept with the other sample containers during the sampling process and during transportation to the SMO and the off-site analytical laboratory.

B-5.4 Sample Documentation and Handling

Field personnel completed an SCL and 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. Swipe samples were collected from the exterior of sample containers and analyzed by the RCT before the sample containers were removed from the site. Samples were transported to the SMO for processing and shipment to off-site contract analytical laboratories. The SMO personnel reviewed and approved the SCLs and COC forms and accepted custody of the samples.

B-5.5 Decontamination of Sampling Equipment

The hand augers and all other sampling equipment that came (or could have come) in contact with sample material were decontaminated immediately before and after each sample was collected. Decontamination included wiping the equipment with Fantastik and paper towels. Decontamination activities were performed in accordance with an approved subcontractor procedure technically equivalent to SOP-5061, Field Decontamination of Equipment.

B-5.6 Site Demobilization and Restoration

All field equipment was demobilized from the site on October 16, 2014. All excavated areas (see section B-6.0, Soil Removal) were reseeded with an approved native grass mix and best management practices (BMPs) were installed to prevent runoff.

B-6.0 SOIL REMOVAL

Arsenic-contaminated soil with concentrations above the residential arsenic soil screening level was removed using hand tools, including shovels and picks. A 2-ft radius was removed around locations 57-4011 and 57-4020 to depths of 2.0 ft below ground surface (bgs) and 2.5 ft bgs, respectively.

Confirmation samples were not necessary because samples collected at depth at both locations defined the depth of the soil removal. The excavated material was placed in three 55-gal. drums and characterized for waste disposal by direct sampling of the containerized soil. The excavations were backfilled with clean fill material, reseeded using an approved native seed mix, and BMPs were installed to prevent runoff. The excavated soil was managed as investigation-derived waste (IDW), as described in Appendix C.

B-7.0 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 investigation report.

B-8.0 INVESTIGATION-DERIVED WASTE STORAGE AND DISPOSAL

All IDW generated during the field investigation was managed in accordance with SOP-10021, Characterization and Management of Environmental Program Waste. This procedure incorporates the requirements of all applicable U.S. Environmental Protection Agency (EPA) and New Mexico Environment Department (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 2012, 214550; NMED 2012, 520936). Details of IDW management for the TA-57 Aggregate Area investigation are presented in Appendix C.

B-9.0 DEVIATIONS FROM THE WORK PLAN

Several proposed sampling locations identified in the approved investigation work plan (LANL 2012, 214550; NMED 2012, 520936) were moved as a result of site conditions encountered during implementation of the field activities at Area of Concern (AOC) 57-007. These locations were moved because they were positioned atop, or next to, underground utilities. When locations were moved, the new locations were sited as close as possible to the planned locations. Additional deviations to the approved work plan scope are discussed below:

- The investigation work plan stated hollow-stem augers would be used to collect subsurface samples where hand-augering was impractical because of the depth of the material being sampled. All samples were collected using hand-auger and spade-and-scoop methods.
- The investigation work plan proposed collecting samples from ~~0.0–1.0 ft~~ three intervals below the drainline at AOC 57-007: 0.0–1.0 ft below the drainline; 1 ft above tuff; and 2.0–3.0 ft into tuff. Because the bottom of the drainline was determined to be 1 ft bgs and the top of tuff 2 ft bgs, the first two intervals were both 1.0–2.0 ft bgs. Rather than sample only two depths (1.0–2.0 ft bgs and 4.0–5.0 ft bgs), the interval 0.0–1.0 ft bgs was also sampled to encompass the depth where the former drainline was located. ~~The drainline was not located and samples were collected from 0.0–1.0 ft bgs at locations 57-4011, 57-4012, and 57-4013.~~

- Location 57-4012 was moved 5 ft downslope/downgradient of marked utility lines.
- Location 57-4015 was moved 6 ft northwest of marked utility and remained within the leach field.
- The investigation work plan proposed collecting samples at 0.0−1.0 below the leach field. However, the leach field was not present at locations 57-4016, 57-4017, and 57-4018 and samples were collected from 0.0−1.0 ft bgs. To be consistent with the sampling depth intervals where the leach field was present, additional samples were collected from 2.5−3.5 ft bgs at locations 57-4016, 57-4017, and 57-4018. This depth interval was selected because it was equivalent to 0.0−1.0 ft below the visible leach field at sampling location 57-4015.
- The investigation work plan proposed collecting samples at locations 7-10 and 7-11; however, to avoid disturbance to undeveloped core habitat for the Jemez Mountain salamander, these two locations were moved to new locations 57-4019 and 57-4021, respectively. These locations are shown in the map presented in Attachment G-4 of this report.
- At location 57-4021, a sample was inadvertently collected from 1.0−2.0 ft into tuff instead of 2.0−3.0 ft into tuff.
- Arsenic-contaminated soil was removed at locations 57-4011 and 57-4020 within AOC 57-007. A 2-ft radius was removed around locations 57-4011 and 57-4020 to a depth of 2.0 ft and 2.5 ft bgs, respectively.
- Additional samples were collected at AOC 57-007. Four samples were collected from locations 57-4026 and 57-4027 situated southwest and downgradient of location 57-4011. At each location, samples were collected from 1.0 ft above tuff, and 2.0−3.0 ft into tuff to define the lateral extent of arsenic.

B-10.0 REFERENCES

The following list includes all documents cited in this appendix. Parenthetical information following each reference provides the author(s), publication date, and ER ID or ESH ID. This information is also included in text citations. ER IDs were assigned by the Environmental Programs Directorate's Records Processing Facility (IDs through 599999), and ESH IDs are assigned by the Environment, Safety, and Health (ESH) Directorate (IDs 600000 and above). IDs are used to locate documents in the Laboratory's Electronic Document Management System and, where applicable, in the master reference set.

Copies of the master reference set are maintained at the NMED Hazardous Waste Bureau and the ESH 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.

LANL (Los Alamos National Laboratory), April 2012. "Investigation Work Plan for Technical Area 57 Aggregate Area (Fenton Hill)," Los Alamos National Laboratory document LA-UR-12-20545, Los Alamos, New Mexico. (LANL 2012, 214550)

NMED (New Mexico Environment Department), July 11, 2012. "Approval with Modifications, Investigation Work Plan for Technical Area 57 Aggregate Area (Fenton Hill)," New Mexico Environment Department letter to P. Maggiore (DOE-LASO) and M.J. Graham (LANL) from J.E. Kieling (NMED-HWB), Santa Fe, New Mexico. (NMED 2012, 520936)

Table B-1.0-1
Brief Description of Field Investigation Methods

Method	Summary
Spade and Scoop Collection of Soil Samples	This method is typically used to collect shallow (i.e., approximately 0.0–1.0 ft.) soil 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 at depths of less than 10.0–15.0 ft but may in some cases 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), creating a vertical hole that can be advanced to the desired sampling depth. When the desired depth was reached during the investigation, the auger was decontaminated before the hole was advanced 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.
Headspace Vapor Screening	Individual soil, rock, or sediment samples were field-screened for organic vapors by placing a portion of the sample in a plastic sample bag or in a glass container with a foil-sealed cover. The container was sealed and gently shaken and allowed to equilibrate for 5 min. The sample was then screened by inserting a PID probe into the container and measuring and recording any detected vapors.
Handling, Packaging, and Shipping of Samples	Field team members sealed and labeled samples before packing them to ensure the sample containers and the containers used for transport 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 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. *Rinsate Blank*: At a frequency of 10%; collected by rinsing sampling equipment with deionized water that 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 Remediation 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 with ice in insulated containers to maintain a temperature of 4°C.
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. Waste characterization complied with on- or off-site waste acceptance criteria. All stored IDW was marked with appropriate signage and labels and contained within an area of contamination. A waste storage area was established before waste was generated. Waste storage areas were located in controlled areas of the Laboratory to prevent unauthorized personnel from inadvertently adding or managing wastes. 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 C.

Table B-1.0-2
SOPs Used for Investigation Activities Conducted at TA-57 Aggregate Area

P101-17, R1, Excavation/Fill/Soil Disturbance Permit Process
P101-18, R2, Procedure for Pause/Stop Work
P315, R3, Conduct of Operations Manual
P409, R4, Waste Management
SOP-5181, R1, Notebook and Logbook Documentation for Environmental Directorate Technical and Field Activities
SOP-06.09, Spade and Scoop Method for the Collection of Soil Samples
SOP-06.10, Hand Auger and Thin-Wall Tube Sampler
SOP-06.33, Headspace Vapor Screening with a Photo Ionization Detector
SOP-5028, Coordinating and Evaluating Geodetic Surveys
SOP-5056, Sample Containers and Preservation
SOP-5057, Handling, Packaging, and Transporting Field Samples
WES-EDA-QP-219, Sample Control and Field Documentation
SOP-5059, Field Quality Control Samples
SOP-5061, Field Decontamination of Equipment
EP-DIR-SOP-10021, R0, Characterization and Management of Environmental Program Waste

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