

# **Appendix B**

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## *Field Methods*



## **B-1.0 INTRODUCTION**

This appendix summarizes the field methods used during the 2010 investigation of the Lower Sandia 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 with approved subcontractor procedures that are technically equivalent to Laboratory standard operating procedures (SOPs) listed in Table B-1.0-2 and are available at <http://www.lanl.gov/environment/all/qa.shtml>.

## **B-2.0 EXPLORATORY DRILLING CHARACTERIZATION**

No exploratory drilling characterization was conducted during the 2010 investigation.

## **B-3.0 FIELD-SCREENING METHODS**

This section summarizes the field-screening methods used during the investigation activities. Field screening for organic vapors was performed as necessary for health and safety purposes. Field screening for radioactivity was performed on every sample submitted to the Sample Management Office (SMO). Field-screening results for all investigation activities are described in section 3.2.3 and 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 conducted for all samples at all locations, except when the moisture content of the material exceeded instrument detection limits. Screening was conducted using a MiniRAE 2000 photoionization detector (PID) equipped with an 11.7-electron volt lamp. Screening was performed in accordance with the manufacturer's specifications and SOP-06.33, Headspace Vapor Screening with a Photo Ionization Detector. Screening was performed on each sample collected, and screening measurements were recorded on the field sample collection logs (SCLs) and chain-of-custody (COC) forms, provided on DVD in Appendix F. The field-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 before they were submitted to the SMO, targeting alpha and beta/gamma emitters. A Laboratory radiation 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 in Appendix F on DVD. The screening results are presented in Table 3.2-2 of the investigation report.

### **B-3.3 XRF Survey**

A survey at Area of Concern (AOC) 53-013 was conducted using a field x-ray fluorescence (XRF) instrument to identify areas of elevated lead concentrations. The survey was conducted using a Niton XL3t 600 XRF analyzer having sufficient sensitivity (i.e., 100 mg/kg or less) to identify areas contaminated above the 800 mg/kg industrial soil screening level (SSL). The instrument was operated in accordance with the manufacturer's instructions, including collection and preparation of samples and analysis of standard samples.

The survey areas were separated into two investigation areas: the AOC 53-013 XRF Survey North/South Yard and the AOC 53-013 XRF Survey East/West Yard (see Appendix C, Attachment C-2). Within each area, sampling locations were positioned approximately 20 ft apart. At locations where lead concentrations were detected above the industrial SSL (800 mg/kg) using XRF analysis, higher resolution coverage was completed using 10-ft spacing to determine the extent of excavation activities. Details of the XRF survey and the results are presented in Appendix C.

### **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 MiniRAE 2000 Instrument Calibration**

The MiniRAE 2000 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 MiniRAE 2000 PID 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; the requirements of SOP-5006, Control of Measuring and Test Equipment; and the applicable radiation detection instrument manual. Calibrations were recorded in daily activity logs.

#### **B-4.3 Niton XL3t 600 XRF Analyzer Calibration**

The XRF instrument was calibrated by the manufacturer and provided with a certification of calibration. The instrument was checked for proper function and calibration using standard aliquots of metals, including lead, as provided by the manufacturer.

### **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 approved investigation work plan (LANL 2009, 106660.14; NMED 2009, 106703).

#### **B-5.1 Surface Sampling Methods**

Surface samples were collected in former Technical Area 20 (TA-20) and TA-53 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 were used to collect material in approximately 6-in. increments. Samples for volatile organic chemical (VOC) analysis were transferred immediately from the sampler to the sample container to minimize the loss of VOCs during the sample-collection process. Containers for VOC samples were completely filled as completely as possible, leaving no or minimal headspace, and sealed with a Teflon-lined cap. 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 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 it was transported to the 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 (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-5.2 Borehole Logging**

At all locations, the required sampling depths could be reached by hand augers, and a drill rig with a hollow-stem auger was not used to collect subsurface samples. Therefore, boreholes did not require logging.

## **B-5.3 Subsurface Tuff 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.

Samples for volatile organic compound (VOC) analysis were collected immediately upon retrieval of the split-spoon core barrel or hand auger to minimize the loss of 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. If necessary, pieces small enough to fit into the sample container were removed from the core using a decontaminated rock hammer or stainless-steel spoon. The remaining material was then field screened for radioactivity and visually inspected. After the VOC samples were collected and field screened, the remaining sample material was placed in a stainless-steel bowl, and the material was broken, if necessary, with a decontaminated rock hammer or stainless-steel spoon to fit the material into the sample containers.

A stainless-steel scoop and bowl were used to transfer samples to sterile sample collection jars or bags for transport to the SMO. The sample collection tools were decontaminated immediately before each sample was collected (see section B-5.7) in accordance with an approved subcontractor procedure technically equivalent to SOP-5061, Field Decontamination of Equipment.

## **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 and 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 target analyte list 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 also 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. Trip blanks were analyzed for VOCs only.

## **B-5.5 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. The SCLs and COC forms are provided in Appendix F (on DVD).

#### **B-5.6 Borehole Abandonment**

No boreholes were drilled during the 2010 investigation. However, hand-auger sampling locations deeper than 15 ft below ground surface (bgs) 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 2–3 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 G.

#### **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. 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. Decontaminated equipment was surveyed by an RCT before it was released from the site. Field rinsate blank samples were collected in accordance with an approved procedure technically equivalent to SOP-5059, Field Quality Control Samples.

#### **B-5.8 Site Demobilization and Restoration**

Drilling equipment was not used during the 2010 investigation. All temporary fencing and staging areas were dismantled and returned to preinvestigation conditions. All excavations were filled with base course to stabilize for erosion control and to prevent off-site transport.

#### **B-6.0 GEODETIC SURVEYING**

Geodetic surveys of all sampling 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-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 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 2009, 106660.14; NMED 2009, 106703). Details of IDW management for the Lower Sandia Canyon Aggregate Area investigation are presented in Appendix G.

## **B-8.0 DEVIATIONS FROM THE WORK PLAN**

Deviations from the approved investigation work plan (LANL 2009, 106660.14; NMED 2009, 106703) are summarized below.

*Solid Waste Management Unit (SWMU) 20-001(c)*: Because no anomalies were identified that could be interpreted as buried waste or landfill boundaries, samples were collected from three depths (5–6 ft, 10–11 ft, and 14–15 ft bgs) at each of 10 locations, as specified in the approved work plan. However, tuff was encountered at depths shallower than 5 ft bgs at each of the 10 locations. In that situation, the approved work plan specified that samples were to be collected above the soil-tuff interface and 2–3 ft below the interface. Samples were not collected at those depths, and all samples were collected from tuff. No additional samples will be collected at those locations because the soil-tuff interface is less than 1–2 ft bgs, and samples above the interface would not appropriately characterize the site.

*AOC 20-003(b)*: An additional sample from the depth of 20 to 21 ft bgs was inadvertently collected and analyzed at location 20-612490.

*SWMU 20-005*: Because the depth of the inlet drainline could not be determined, samples should have been collected at depths of 3–4 ft and 6–7 ft bgs at locations 20-612618 and 20-612619. Instead, samples were collected from 0–1 ft and 3–4 ft bgs. Additional samples will be collected from 6–7 ft bgs at these locations during the Phase II investigation.

*SWMU 53-005*: The VOC field-screening result for the deepest sample collected at location 53-612484 was elevated (25.1 ppm), but the borehole was not extended to collect a deeper sample. Additional samples will be collected at this location during the Phase II investigation. The depth of the drainline could not be determined. Therefore, the sampling depths for location 53-612486 could not be determined relative to the depth of the drainline, as required by the approved work plan. Samples were collected at depths of 0–1 ft and 4–5 ft bgs. An additional sample will be collected from 7–8 ft bgs at this location during the Phase II investigation.

*SWMU 53-012(e)*: Samples were not collected at the pipe elbow of the drainline as required. An engineering drawing located subsequent to approval of the investigation work plan indicates the drainline elbow is likely not where it was indicated in Figure 4.2-4 of the work plan (planned location M12e-1), and the elbow was not physically located in the field. Therefore, the sampled location (53-612539) was placed approximately 25 ft from the likely actual location. Samples will be collected at the actual drainline elbow during the Phase II investigation by trenching, digging potholes, or using another appropriate method to physically identify the elbow location.

## **B-9.0 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. 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.*

LANL (Los Alamos National Laboratory), July 2009. "Investigation Work Plan for Lower Sandia Canyon Aggregate Area, Revision 1," Los Alamos National Laboratory document LA-UR-09-4329, Los Alamos, New Mexico. (LANL 2009, 106660.14)

NMED (New Mexico Environment Department), August 6, 2009. "Notice of Approval for the Response to the Notice of Disapproval for the Investigation Work Plan for Lower Sandia Canyon Aggregate Area and 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 2009, 106703)

**Table B-1.0-1  
Summary of Field Investigation Methods**

Method	Summary
Spade and Scoop Collection of Soil Samples	This method was used to collect shallow (i.e., approximately 0-12 in.) soil or sediment samples. The spade-and-scoop method involved digging a hole to the desired depth, as prescribed in the approved work plan, and collecting a discrete grab sample. Samples for VOC analysis were transferred immediately into sample containers. Containers for VOC analysis were filled as completely as possible and sealed with Teflon-lined caps. Remaining sample material was 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 sampling depth. When the desired depth was reached, the auger was decontaminated before advancing the hole through the sampling depth. Samples for VOC analysis were transferred immediately into sample containers. Containers for VOC analysis were filled as completely as possible and sealed with Teflon-lined caps. The remaining 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	A stainless-steel core barrel was advanced using a hollow-stem auger drilling rig. The core barrel extracted a continuous length of soil and/or rock. The split-spoon core barrel is a cylindrical barrel split length-wise so the two halves can be separated to expose the core sample. Once the core barrel was extracted and opened, a sample for VOC analysis was transferred immediately to a sample container. If necessary, pieces small enough to fit into the sample container were removed from the core using a decontaminated rock hammer or stainless-steel spoon. Containers for VOC analysis were filled as completely as possible and sealed with Teflon-lined caps. The section of core in the core barrel was then 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 for remaining analyses.
Handling, Packaging, and Shipping of Samples	<p>Field team members sealed and labeled samples before packing to ensure the sample and the transport containers were free of external contamination.</p> <p>Field team members packaged all samples to minimize the possibility of breakage during transport.</p> <p>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.</p>
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	<p>Field QC samples were collected as follows:</p> <p><i>Field Duplicates:</i> At a frequency of 10%; collected at the same time as a regular sample and submitted for the same analyses</p> <p><i>Equipment Rinse Blank:</i> 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</p> <p><i>Trip Blanks:</i> Required for all field events that include the collection of samples for VOC analysis. Trip blank containers of certified clean sand were opened and kept with the other sample containers during the sampling process</p>

**Table B-1.0-1 (continued)**

Method	Summary
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.
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, or polyethylene]). All samples were preserved by placing them in insulated containers with ice 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 Spatial Reference System, and IA-D802, Geospatial Positioning Accuracy Standards for A/E/C/ and Facility Management. All coordinates were expressed as State Plane 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 was 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 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 G.

**Table B-1.0-2**  
**SOPs Used for Investigation Activities Conducted at Lower Sandia Canyon Aggregate Area**

SOP-5018, Integrated Fieldwork Planning and Authorization
SOP-5028, Coordinating and Evaluating Geodetic Surveys
SOP-5034, Monitor Well and RFI Borehole Abandonment
SOP-5238, Characterization and Management of Environmental Program Waste
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-5181, Notebook and Logbook Documentation for Environmental Directorate Technical and Field Activities
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
SOP-06.33, Headspace Vapor Screening with a Photo Ionization Detector
EP-DIR-QAP-0001, Quality Assurance Plan for the Environmental Programs

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