### 4.3.1 AOC C-61-002, Subsurface Contamination

#### 4.3.1.1 Site Description and Operational History

AOC C-61-002 is an area of subsurface contamination located in TA-61, approximately 15 ft north of building 61-16, a former storage building (Figure 4.1-7). The subsurface contamination was found in 1995 during a drill rig test. During the drilling test, a petroleum odor was noted, and diesel contamination was detected at 7.0 to 8.0 ft bgs. A tuff sample was collected and submitted for analysis of TPH-DRO. The results showed the presence of diesel contamination. Interviews conducted with site personnel after the drilling was completed indicated the source of the diesel may have been the previous road maintenance work performed in the area (LANL 1995, 049550, p. 2).

#### 4.3.1.2 Previous Investigations

In 2009, 30 samples (19 soil and 11 tuff) were collected from five locations at AOC C-61-002. Previously sampled locations are shown in Figure 4.1-7. Table 4.3-1 presents the samples collected and analyses requested for AOC C-61-002. The sampling results are presented in the investigation report (LANL 2010, 110862.24).

Sampling at AOC C-61-002 consisted of the following activities in 2009:

- Soil and tuff samples were collected at five boreholes from six depth intervals: 3.0–4.0 ft, 5.0–6.0 ft, 7.0–8.0 ft, 9.0–10.0 ft, 11.0–12.0 ft, and 14.0–15.0 ft bgs. All samples were analyzed at off-site fixed laboratories for TAL metals, VOCs, SVOCs, PCBs, TPH-DRO, and cyanide.

Based on the sampling results presented in the investigation report (LANL 2010, 110862.24, pp. 275–278), the lateral and vertical extent of all inorganic chemicals, organic chemicals, and radionuclides are defined at AOC C-61-002, except for the lateral extent of aluminum, antimony, chromium, cobalt, copper, iron, lead, magnesium, mercury, nickel, thallium, vanadium, and TPH-DRO.

The lateral extent of aluminum, chromium, copper, magnesium, mercury, nickel, and vanadium is not defined to the east of the site; the lateral extent of antimony, iron, lead, and thallium is not defined to the east and south of the site; and the lateral extent of cobalt is not defined to the north, west, and east of the site (Plate 13). The lateral extent of TPH-DRO is not defined at the site (Plate 14).

#### 4.3.1.3 Proposed Sampling at AOC C-61-002

Four new sampling locations, C2-1, C2-2, C2-3, and C2-4, will be placed near existing perimeter locations to define the lateral extent of aluminum, antimony, chromium, cobalt, copper, iron, lead, magnesium, mercury, nickel, thallium, vanadium, and TPH-DRO. A new location, C2-1, will be placed to the north of location 03-608429 to define the lateral extent of cobalt and TPH-DRO. Samples from location C2-1 will be analyzed for cobalt and TPH-DRO. A new location, C2-2, will be placed to the west of location 03-608430 to define the lateral extent of cobalt and TPH-DRO. Samples from location C2-2 will be analyzed for cobalt and TPH-DRO. A new location, C2-3, will be placed to the south of location 03-608432 to define the lateral extent of antimony, iron, lead, thallium, and TPH-DRO. Samples from location C2-3 will be analyzed for antimony, iron, lead, thallium, and TPH-DRO. A new location, C2-4, will be placed to the east of location 03-608433 to define the lateral extent of aluminum, chromium, cobalt, copper, iron, lead, magnesium, mercury, nickel, thallium, vanadium, and TPH-DRO. Samples from location C2-4 will be analyzed for TAL metals and TPH-DRO.

The proposed sampling and analyses at AOC C-61-002 are presented in Table 4.3-2, and the proposed sampling locations are shown in Figure 4.1-7.

# 5.0 INVESTIGATION METHODS

A summary of investigation methods to be implemented is presented in Table 5.0-1. The standard operating procedures (SOPs) used to implement these methods are available at http://www.lanl.gov/environment/all/qa/adep.shtml.

Descriptions of the field investigation methods are provided below. Additional procedures may be added as necessary to describe and document quality-affecting activities.

Chemical analyses will be performed in accordance with the current analytical statement of work (LANL 2008, 109962). Accredited non-Laboratory contract analytical laboratories will use the most recent EPA- and industry-accepted extraction and analytical methods for the requested analyses.

## 5.1 Sampling Locations

Proposed sampling locations are identified for each site based on engineering drawings, surveyed locations of existing structures (from the geographic information system database), previous sampling locations, and topography or other features identified in the field (e.g., drainage channels, sediment accumulation areas). Coordinates of the proposed new sampling locations will be obtained by georeferencing the points from the proposed sampling maps. Coordinates will be located and flagged or otherwise marked in the field using a differential global positioning system (GPS) unit. If any proposed sampling locations are moved because of field conditions, utilities, or other unexpected reasons, the new locations will be surveyed immediately following sample collection as described in section 5.2. Surveying and establishing sampling locations will be conducted in accordance with the latest version of standard operating procedure SOP-5028, Coordinating and Evaluating Geodetic Surveys.

## 5.2 Geodetic Surveys

Geodetic surveys will be conducted in accordance with the latest version of SOP-5028, Coordinating and Evaluating Geodetic Surveys, to locate historical structures and previous sampling locations and to document field activities such as sample collection. The surveyors will use a Trimble GeoXT hand-held GPS or equivalent for the surveys. The coordinate values will be expressed in the New Mexico State Plane Coordinate System (transverse Mercator), Central Zone, North American Datum 1983. Elevations will be reported per the National Geodetic Vertical Datum of 1929. All GPS equipment used will meet the accuracy requirements specified in the SOP.

## 5.3 Surface and Shallow Subsurface Sampling

Soil and rock samples will be collected by the most efficient, least invasive method practicable. The methods will be determined by the field team based on site conditions such as topography, the nature of the material to be sampled, the depth intervals sampled, accessibility, and the level of disruption to Laboratory activities. Typically, samples will be collected using spade-and-scoop, hand-auger, or hollow-stem auger drilling methods.

### 5.3.1 Spade-and-Scoop Method

Surface and shallow subsurface samples will be collected in accordance with SOP-06.09, Spade and Scoop Method for the Collection of Soil Samples. Stainless-steel shovels, spades, or scoops will be used to collect sample material in approximately 6-in. increments. If the surface location is at bedrock, an axe or hammer and chisel may be used to collect samples. Samples for VOC analysis will be transferred immediately from the sampler to the sample container to minimize the loss of VOCs during the sample collection process. Containers for VOC samples will be filled as completely as possible, leaving no or minimal headspace, and sealed with a Teflon-lined cap. The remaining sample material will be placed in a stainless-steel bowl, after which it will be transferred to sterile sample collection jars or bags.

### 5.3.2 Sediment Samples

Sediment samples will be collected from areas of sediment accumulation that include sediment that is representative of the historical period of Laboratory operations (i.e., post-1943). Sediment samples will be collected using either spade-and-scoop and/or hand-auger methods. Proposed sediment sampling locations have been identified and are shown in the figures in the preceding sections. The actual sediment sampling locations will be selected in the field based on geomorphic relationships in areas likely to have been affected by discharges from Laboratory operations. Because sediment is dynamic and subject to redistribution by runoff events, some locations may need to be adjusted when this work plan is implemented. In the course of collecting sediment samples, it may be determined, based on field conditions, that the selected location is not appropriate (e.g., the sediment is much shallower than anticipated, the sediment is predominantly coarse grained, or the sediment shows evidence of being older than the target age). Sediment sampling locations will be adjusted as appropriate, any revised locations will be surveyed, and the updated coordinates will be submitted for inclusion in the appropriate database.

## 5.4 Subsurface Sampling

Subsurface sampling is proposed to include surface soil and fill, sediment, and tuff. Any adjustments will be noted on sample collection logs (SCLs) and recorded in the Phase II investigation report as deviations from this investigation work plan. Subsurface samples will be collected following the current version of SOP-06.24, Sample Collection from Split-Spoon Samplers and Shelby-Tube Samplers, and SOP-06.26, Core-Barrel Sampling for Subsurface Earth Materials.

### 5.4.1 Hollow-Stem Auger

A hollow-stem auger may be used to drill holes deeper than approximately 15 ft or to shallower depths where hand-auger refusal is encountered. The hollow-stem auger consists of a hollow steel shaft with a continuous spiraled steel flight welded onto the exterior of the stem. The stem is connected to an auger bit, and when it is rotated, it transports cuttings to the surface. The hollow stem of the auger allows insertion of drill rods, split-spoon core barrels, Shelby tubes, and other samplers through the center of the auger so samples may be retrieved during drilling operations. The hollow stem also acts to case the borehole core temporarily so a well casing (riser) may be inserted down through the center of the auger once the desired depth is reached, thus minimizing the risk of possible collapse of the borehole. A bottom plug or pilot bit can be fastened onto the bottom of the auger to keep out most of the soil and/or water that tends to clog the bottom of augers during drilling. Drilling without a center plug is acceptable if the soil plug, formed in the bottom of the auger, is removed before sampling or installing a well casing. The soil plug can be removed by washing out the plug using a side-discharge rotary bit or auguring out the plug with a solid-stem auger bit sized to fit inside the hollow-stem auger.

During sampling, the auger will be advanced to just above the desired sampling interval. The sample will be collected by driving a split-spoon sampler into undisturbed soil-tuff to the desired depth. Samples will be collected in accordance with SOP-06.26, Core-Barrel Sampling for Subsurface Earth Materials.

If samples are to be collected for VOC analysis, the sampler will be lined with brass sleeves. Immediately upon retrieval of the sampler, it will be opened and a sleeve from the desired depth interval will be collected for VOC analysis. The ends of the sleeve will immediately be covered with Teflon film and capped with plastic caps. Tape will then be used to seal the ends of the cap to the sleeve. Material from the remaining sleeves will then be field screened, visually inspected, and placed in a stainless-steel bowl. Samples for the remaining analysis will then be transferred to sterile sample collection jars or bags.

If the sleeve selected for VOC analysis has insufficient sample recovery, an alternate sleeve with greater recovery will be selected. If no sleeves have sufficient sample recovery, the sample material will be transferred as quickly as possible to a sample jar, filled as completely as possible to minimize headspace, and sealed with a Teflon-lined cap. If necessary, the sample material will be broken into pieces small enough to fit into the sample container using a decontaminated rock hammer or stainless-steel spoon. The sample will be disturbed only to the extent necessary to fit into the container.

### 5.4.2 Hand Auger

Hand augers may be used to drill shallow holes in accordance with SOP-06.10, Hand Auger and Thin-Wall Tube Sampler. The hand auger is advanced by turning the auger into the soil or tuff until the barrel is filled. The auger is removed, and the sample for VOC analysis is transferred immediately from the sampler to the sample container to minimize the loss of VOCs during the sample collection process. Containers for VOC samples are filled as completely as possible, leaving no or minimal headspace, and sealed with a Teflon-lined cap. The remaining sample material is placed in a stainless-steel bowl, after which the sample material is transferred to sterile sample collection jars or bags.

Because the chromium and nickel concentrations at some previously hand-augered sampling locations are suspected of being influenced by the use of stainless-steel auger buckets, carbon-steel auger buckets will be used to collect the proposed samples at locations not accessible to a drill rig and must be sampled by the hand-auger method.

### 5.4.3 Borehole Abandonment

All boreholes will be properly abandoned according to the current version of SOP-5.03, Monitoring Well and RFI Borehole Abandonment.

Shallow boreholes (less than approximately 20 ft deep) will be abandoned by filling the borehole with bentonite chips, which are subsequently hydrated, in 1.0- to 2.0-ft lifts. The borehole will be visually inspected while the bentonite chips are added to ensure bridging does not occur.

Deeper boreholes will be pressure-grouted from the bottom of the borehole to the surface using the tremie pipe method. Acceptable grout materials include cement or bentonite grout, neat cement, or concrete.

The use of backfill materials, such as bentonite and grout, will be documented in a field logbook with regard to volume (calculated and actual), intervals of placement, and additives used to enhance backfilling. All borehole abandonment information will be provided in the Phase II investigation report.

## 5.5 Chain of Custody and Sample Collection Logs

The collection, screening, and transport of samples will be documented on standard forms generated by the Sample Management Office (SMO). These include sample container labels and combined SCL/chain-of-custody (COC) forms. Sample collection portions of the combined forms will be completed at the time of sample collection and signed by the sampler and a reviewer who will verify the logs for completeness and accuracy. The COC portions of the combined forms will be completed and signed to verify the samples are not left unattended. Corresponding labels will be initialed and applied to each sample container, and custody seals will be placed around container lids or openings. Documentation and handling of all samples will be conducted in accordance with WES-EDA-QP-219, Sample Control and Field Documentation, and with SOP-5057, Handling, Packaging, and Transporting Field Samples.

## 5.6 Field-Screening Methods

The primary field-screening methods to be used on samples include radiological screening and organic vapor screening using a photoionization detector (PID). Field screening will be used primarily for health and safety purposes and for determining transportability of samples from the field sites to the SMO and from the SMO to the analytical laboratories. Field-screening results may be used at the discretion of the field personnel to collect additional samples beyond those planned or to extend the depth of sampling as required. Field changes to sampling plans will be approved by the subcontractor technical representative and will be documented on field paperwork and in the Phase II investigation report.

### 5.6.1 Radiological Screening

Based on the results of past sampling, field screening for radioactivity will be conducted primarily to ensure worker health and safety rather than to direct sampling. Radiological screening will target gross-alpha, -beta, and -gamma radiation. Field screening for alpha, beta, and gamma radiation will be conducted within 6 in. from soil and core material using appropriate field instruments as determined by the Laboratory's Health Physics Operations Group. Instruments will be calibrated in accordance with the Health Physics Operations Group procedures or equivalent procedures. All instrument calibration activities will be documented daily in the field logbooks in accordance with SOP-5181, Notebook Documentation for Waste and Environmental Services Technical Field Activities.

### 5.6.2 Organic Vapor Field Screening

Because previous investigations have shown only trace levels of VOCs at the sites being investigated, organic vapor screening will be conducted primarily to ensure worker health and safety rather than to direct sampling. Screening will be conducted using a PID capable of measuring quantities as low as 1 ppm. Vapor screening of soil, sediment, and subsurface core will be conducted using a PID equipped with an 11.7 electron volt lamp. All samples will be screened in headspace gas in accordance with SOP-06.33, Headspace Vapor Screening with a Photo Ionization Detector.

The PID will be calibrated daily to the manufacturer's standard for instrument operation, and the daily calibration results will be documented in the field logbooks. All instrument background checks, background ranges, and calibration procedures will be documented daily in the field logbooks in accordance with SOP-5181, Notebook Documentation for Waste and Environmental Services Technical Field Activities.

## 5.7 Quality Assurance/Quality Control Samples

Quality assurance/quality control samples will include field duplicate, equipment rinsate, and field trip blank samples. Field duplicate samples and field rinsate blanks will be collected at an overall frequency of at least 1 for every 10 regular samples or as directed by the current version of SOP-5059, Field Quality Control Samples. Field trip blanks will be collected at a rate of at least one per day on days when VOC samples are being collected.

## 5.8 Laboratory Analytical Methods

The analytical suites for laboratory analyses and the specific analytical methods to be used are summarized in Table 5.8-1. All analytical methods are presented in the statement of work for analytical laboratories (LANL 2008, 109962). Sample collection and analysis will be coordinated with the SMO.

### 5.9 Health and Safety

The field investigations described in this Phase II investigation work plan will comply with all applicable requirements pertaining to worker health and safety. An integrated work document and a site-specific health and safety plan will be in place before conducting fieldwork.

### 5.10 Equipment Decontamination

Equipment for drilling and sampling will be decontaminated before and after sampling activities to minimize the potential for cross-contamination. All equipment will be decontaminated using dry decontamination methods whenever possible to minimize generating liquid waste. All sampling equipment will be decontaminated using dry decontamination methods if possible, as described in SOP-5061, Field Decontamination of Equipment. If dry decontamination methods are not effective as determined by field screening of the equipment after dry decontamination, drilling/exploration equipment that may come in contact with the borehole will be decontaminated by steam-cleaning, hot-water pressure-washing, or another method before each new borehole is drilled. If wet decontamination is necessary, the equipment will be decontaminated on a high-density polyethylene liner on a temporary decontamination pad. Cleaning solutions and wash water will be collected and contained for proper disposal. Decontamination solutions will be sampled and analyzed to determine the final disposition of the wastewater and the effectiveness of the decontamination procedures.

### 5.11 IDW

The IDW generated during field-investigation activities may include, but is not limited to, drill cuttings; contaminated soil; contaminated personal protective equipment (PPE), sampling supplies, and plastic; fluids from the decontamination of PPE and sampling equipment; and all other waste that has potentially come into contact with contamination.

All IDW generated during field-investigation activities will be managed in accordance with applicable EPA and NMED regulations, DOE orders, and Laboratory requirements. Appendix B presents the IDW management plan.

## 6.0 MONITORING PROGRAMS

SWMUs 03-009i, 03-012(b), 03-021, 03-029, 03-045(b), 03-045(c), 03-052(f), and 60-007(b) and AOCs 03-014(b2), 03-014(c2), and 03-052(b) are subject to the stormwater monitoring requirements of the Laboratory's NPDES individual permit for stormwater discharges from SWMUs and AOCs.

## 7.0 SCHEDULE

Preparation for investigation activities is scheduled to start by February 1, 2012. Fieldwork is expected to start on August 14, 2012, and will take approximately 2.5 mo to complete. Fieldwork is scheduled to be completed by October 24, 2012. A submittal date of no later than April 30, 2013, is proposed for the Phase II investigation report.

## 8.0 REFERENCES AND MAP DATA SOURCES

### 8.1 References

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

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

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### 8.2 Map Data Sources

Data sources used in original figures and/or plates created for this report are described below and identified by legend title.

| Legend Item | Data Source |
|---|---|
| LANL Technical Areas | Technical Area Boundaries; Los Alamos National Laboratory, Site Planning & Project Initiation Group, Infrastructure Planning Office; September 2007; as published 04 December 2008. |
| Paved roads | Paved Road Arcs; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 28 May 2009. |
| Paved parking | Paved Parking; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 28 May 2009. |
| Dirt roads | Dirt Road Arcs; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 28 May 2009. |
| LANL structures | Structures; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 28 May 2009. |
| LANL fence lines | Security and Industrial Fences and Gates; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 28 May 2009. |
| LANL communications lines | Communication Lines; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 08 August 2002; as published 28 May 2009. |
| LANL electric lines | Primary Electric Grid; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 28 May 2009. |
| LANL gas lines | Primary Gas Distribution Lines; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 28 May 2009. |
| LANL sewer lines | Sewer Line System; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 28 May 2009. |
| LANL steam lines | Steam Line Distribution System; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 15 January 2009. |
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