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Investigation Report for Middle Cañada del Buey Aggregate Area

Los Alamos
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Prepared by the Environmental Programs Directorate

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EXECUTIVE SUMMARY

The Middle Cañada del Buey Aggregate Area, located in the central portion of Cañada del Buey and Mesita del Buey, incorporates parts of Technical Area 51 (TA-51) and TA-54 at Los Alamos National Laboratory (the Laboratory) and includes 23 solid waste management units (SWMUs) and areas of concern (AOCs). Of the 23 sites, 11 have been approved for no further action, 4 are Resource Conservation and Recovery Act-permitted storage units, 1 is a Toxic Substances Control Act–permitted storage unit, 1 (Material Disposal Area [MDA] J) was closed under New Mexico Environment Department (NMED) solid waste regulations, and 2 (MDAs H and L) were investigated under separate work plans; none of these sites is discussed in this investigation report. For the remaining four AOCs, one is located within TA-51 and three are located within TA-54 West. Two of the sites are located in a portion of TA-54 West that was previously part of TA-18 and have TA-18 identifiers. The four sites include two former septic systems (AOCs 51-001 and 54-007[d]) and two former high explosives storage magazines (AOCs 18-005[b] and 18-005[c]).

The objectives of the investigations are to define the nature and extent of contamination at the four sites and, if the nature and extent of contamination are defined, to determine whether contamination at any of the sites poses a potential unacceptable risk to human health or the environment. This investigation report presents the results of site characterization activities conducted in 2008, as specified in the investigation work plan, which was submitted to NMED in December 2007.

The investigation activities conducted in 2008, as presented in this report, included collecting 64 surface and shallow subsurface soil, fill, and rock samples from 32 locations, from the surface to a maximum depth of 60 ft below ground surface. Data from samples collected in 2008 were combined with data collected before 2008, which meet current Laboratory data quality requirements.

The nature and extent of contamination is defined at the four Middle Cañada del Buey Aggregate Area sites presented in this investigation report. Furthermore, these sites do not pose potential unacceptable risks or doses to human and ecological receptors and, as such, no further remediation or investigation is required.

The estimated total excess cancer risks from chemical exposures are below the NMED target risk level of 1×10^{-5} for the construction worker and residential scenarios for all four Middle Cañada del Buey Aggregate Area sites.

The hazard indices (HIs) for the construction worker, residential, and, as appropriate, industrial scenarios were less than the NMED target HI of 1.0 for all sites. Similarly, the radiation dose for the construction worker and residential scenarios was less than the U.S. Department of Energy's (DOE's) target of 15 mrem/yr for AOC 51-001.

Potential ecological risks were evaluated for several receptors using minimum ecological screening level comparisons, HI analyses, comparisons to background, the relative toxicity, the infrequency of detection, and comparison to previous field and laboratory canyon investigations. The lines of evidence for each receptor support the conclusion that no potential ecological risk exists within the Middle Cañada del Buey Aggregate Area.

The following recommendations are made for AOCs 18-005(b), 18-005(c), 51-001, and 54-007(d) based on the results of sampling, analysis, evaluation of nature and extent of contamination, and the assessment of potential risk and dose.

- AOC 18-005(b)—The nature and extent of contamination are defined, and no cleanup or additional sampling is warranted; therefore, AOC 18-005(b) is proposed as corrective actions complete without controls.
- AOC 18-005(c)—The nature and extent of contamination are defined, and no cleanup or additional sampling is warranted; therefore, AOC 18-005(c) is proposed as corrective actions complete without controls.
- AOC 51-001—The nature and extent of contamination are defined, and no cleanup or additional sampling is warranted; therefore, AOC 51-001 is proposed as corrective actions complete without controls.
- AOC 54-007(d)—The nature and extent of contamination are defined, and no cleanup or additional sampling is warranted; therefore, AOC 54-007(d) is proposed as corrective actions complete without controls.

Because these sites do not pose a potential unacceptable risk to human health under a residential scenario and no potential risk to the environment, neither site controls nor future actions are necessary. Therefore, the Laboratory is requesting a Certificate of Completion (corrective action complete without controls) from NMED for AOCs 18-005(b), 18-005(c), 51-001, and 54-007(d).

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1.0 INTRODUCTION

Los Alamos National Laboratory (LANL or the Laboratory) is a multidisciplinary research facility owned by the U.S. Department of Energy (DOE) and managed by Los Alamos National Security, LLC. The Laboratory is located in north-central New Mexico, approximately 60 mi northeast of Albuquerque and 20 mi northwest of Santa Fe. The Laboratory site covers 40 mi^2 of the Pajarito Plateau, which consists of a series of finger-like mesas separated by deep canyons containing perennial and intermittent streams running from west to east. Mesa tops range in elevation from approximately 6200 to 7800 ft above sea level. The location of the Middle Cañada del Buey Aggregate Area with respect to the Laboratory technical areas (TAs) and surrounding land holdings is shown in Figure 1.0-1. Sites within the aggregate area are shown in Figure 1.0-2.

The Laboratory's Environmental Programs (EP) Directorate (which includes the former Environmental Restoration [ER] Project) is participating in a national effort by DOE to clean up sites and facilities formerly involved in weapons research and development. The goal of the EP Directorate is to ensure that past operations do not threaten human or environmental health and safety in and around Los Alamos County, New Mexico. To achieve this goal, the EP Directorate is investigating and, as necessary, remediating sites potentially contaminated by past Laboratory operations. The sites under investigation are designated as either solid waste management units (SWMUs) or areas of concern (AOCs).

This investigation report describes the characterization activities conducted in 2008 to complete the investigation of four AOCs in TA-51 and TA-54 West within the Middle Cañada del Buey Aggregate Area at the Laboratory (part of TA-54 West was formerly in TA-18, and two of the four AOCs have TA-18 identification numbers). The EP Directorate evaluated the existing data, assessed potential impacts, and defined additional data needs for the sites, which were documented in the investigation work plan (LANL 2007, 102622). The investigation work plan was submitted to the New Mexico Environment Department (NMED), and NMED issued directions to modify the work plan to include additional investigation activities (NMED 2008, 099819; NMED 2008, 099816).

Corrective actions at the Laboratory are subject to the March 1, 2005, Compliance Order on Consent (the Consent Order). The Consent Order was issued pursuant to the New Mexico Hazardous Waste Act, New Mexico Statutes Annotated (NMSA) 1978, § 74-4-10, and the New Mexico Solid Waste Act, NMSA 1978, § 74-9-36(D). Radionuclides are regulated under DOE Order 5400.5, "Radiation Protection of the Public and the Environment," and DOE Order 435.1, "Radioactive Waste Management."

Two of the four AOCs addressed in this investigation report are potentially contaminated with both hazardous and radioactive components. The NMED regulates cleanup of hazardous wastes and hazardous constituents and DOE regulates cleanup of radioactive contamination. Information on radioactive materials and radionuclides, including the results of sampling and analysis of radioactive constituents, is voluntarily provided to NMED in accordance with DOE policy.

1.1 Investigation Objectives

Two of the four AOCs addressed by this report, AOCs 18-005(b) and 18-005(c), have not been previously investigated. AOCs 51-001 and 54-007(d) were previously investigated and remediated. The investigation objectives are to determine the nature and extent of any releases from these sites and whether contamination at any of the sites poses a potential unacceptable risk to human health or the environment. This investigation report includes the results of historical and 2008 site characterization activities, including collection and analysis of surface, shallow subsurface, and subsurface samples.

2.0 BACKGROUND

This section presents background information related to the Middle Cañada del Buey Aggregate Area. This information includes the operational history of the TAs, land use, relationships to other SWMUs and AOCs, potential contaminant transport and receptors, waste inventories, and summaries of the results of previous investigations.

2.1 Site Description and Operational History

The Middle Cañada del Buey Aggregate Area is located in the central portion of Cañada del Buey and Mesita del Buey and incorporates parts of TA-51 and TA-54. The aggregate area consists of the canyon bottom and the portion of the mesa top and canyon slope that drains to the north into the canyon. All SWMUs and AOCs within the Middle Cañada del Buey Aggregate Area are located on the mesa top. Mesita del Buey is a finger-shaped mesa between Pajarito Canyon and Cañada del Buey that trends southeast. The southern boundary of the aggregate area along Mesita del Buey is approximated by Pajarito Road from the west boundary of the aggregate area to the intersection of Pajarito Road and Mesita del Buey Road east of this intersection.

Middle Cañada del Buey Aggregate Area consists of 23 SWMUs and AOCs (also referred to as sites). The sites are categorized on the basis of their regulatory status as follows.

- Four sites were investigated in accordance with the work plan and NMED directions to modify and are presented in this investigation report.
- Eleven sites have previously been approved for no further action (NFA) by NMED or the U.S. Environmental Protection Agency (EPA), do not require additional investigation, and are not discussed in this report.
- Five sites are active waste management units regulated under the Resource Conservation and Recovery Act (RCRA) or Toxic Substances Control Act (TSCA). These sites will be closed in accordance with RCRA and/or TSCA requirements and are not discussed in this report.
- Three sites have been addressed by other investigations or other regulatory programs, do not require further investigation, and are not discussed in this report.

The 23 SWMUs and AOCs in Middle Cañada del Buey Aggregate Area and their status are presented in Table 2.1-1.

The four sites investigated in accordance with the work plan are located in portions of TA-51 and TA-54 West. Information on the operational history of these TAs is provided below.

2.1.1 TA-51

The first operations in the current TA-51 began in 1980 with construction of the Experimental Engineering Test Facility (EETF). This facility was constructed to support research to develop effective isolation techniques for burial of waste in semiarid climates. Experimental facilities include buried caissons used to conduct flow and transport studies [AOCs 51-002(a) and 51-002(b)]. Support offices were constructed on site in 1986. TA-51 is currently used for research and experimental studies on the long-term impacts of radioactive materials on the environment, including the effectiveness of waste isolation barriers (LANL 1992, 007669, pp. 2-1–2-4).

AOC 51-001 was an inactive/abandoned septic system that served the EETF (buildings 51-0011 and 51-0012) and the transportable office buildings 51-0025, 51-0026, and 51-0027 (Figure 2.1-1). The septic system consisted of a 1000-gal. concrete septic tank (structure 51-0030), drainlines, and a 4-ft-wide by 50-ft-deep seepage pit (structure 51-0031). The septic system was left in place in 1992 when the buildings it served were tied to a new sewer line installed as part of the Laboratory's Sanitary Wastewater System Consolidation (SWSC). During a 2001 voluntary corrective action (VCA), the septic tank was removed and the inlet and outlet drainlines were plugged (LANL 2001, 071473).

2.1.2 TA-54 West

The western part of TA-54 on Mesita del Buey associated with the Middle Cañada del Buey Aggregate Area houses the former radiation exposure facility that was used to conduct biomedical research on animal exposure to radiation. This facility was operated from 1962 to the mid-1970s. A holding facility housed animals used in biomedical research until the late 1980s. TA-54 West is now used to conduct waste characterization and packaging operations associated with shipment of transuranic wastes from the Laboratory to the Waste Isolation Pilot Plant in Carlsbad, New Mexico (LANL 1992, 007669). Before it was designated TA-54, a portion of TA-54 West was included in TA-18. The first structures located at this site were constructed in 1944 and 1945 and consisted of two explosives magazines [AOCs 18-005(b) and 18-005(c)], an assembly building, a carpenter shop, and a lumber storage building. In the mid-1940s, these structures were associated with explosives testing performed at TA-18 and TA-27. By the early 1960s, these structures had been removed or destroyed (LANL 1993, 015310, p. 2-4), and the site was incorporated as part of TA-54 (LANL 1993, 015310). The 1990 SWMU report incorrectly lists the two former explosives magazines as being located within TA-51 (LANL 1990, 007512).

AOC 18-005(b) (structure 18-11) and AOC 18-005(c) (structure 18-12) were wood structures with dimensions of 11 ft by 9 ft by 8 ft tall (Figure 2.1-2). These structures were surrounded by earthen berms on three sides and on top. AOC 18-005(b) was located approximately 200 ft north of current structure 54-1014. AOC 18-005(c) was located approximately 200 ft north of a Laboratory water-supply storage tank (structure 54-1006) (LANL 1990, 007512).

AOC 54-007(d) was an inactive/abandoned septic system that served the Radiation Exposure Facility located in buildings 54-1001, 54-1002, 54-1003, and 54-1004 at TA-54 West. The septic system consisted of a 1500-gal. concrete septic tank (structure 54-1016), drainlines, a distribution box, and a split drain field (Figure 2.1-3). A 4-in. drainline from the septic tank connected to a reinforced concrete distribution box, which diverted the effluent east and west into the drain field. The drain field consists of two 60-ft-long, 4-in.-diameter tile drainlines running east and west from the distribution box. The septic system was left in place in 1992 when the building it served was tied to a new sewer line installed as part of the SWSC. During a 2001 VCA, the septic tank was removed and the inlet and outlet drainlines were plugged (LANL 2001, 071473).

2.2 Summary of Historical Investigations

2.2.1 AOC 18-005(b), Former Storage Area

AOC 18-005(b) was not previously investigated.

2.2.2 AOC 18-005(c), Former Storage Area

AOC 18-005(c) was not previously investigated.

2.2.3 AOC 51-001, Former Septic System

The septic tank contents and seepage pit were sampled during the 1995 Phase I RCRA facility investigation (RFI) (LANL 1992, 007669). The analytical suite for the sludge and tuff samples included pesticides/polychlorinated biphenyls (PCBs), cyanide, volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), and target analyte list (TAL) metals. Lead was detected above its background value (BV) but was eliminated as a chemical of potential concern (COPC) because the detected concentration was within the range of the background data set. Antimony, cyanide, mercury, selenium, and silver were not detected but were retained as COPCs because their detection limits were greater than BVs in tuff. No organic chemicals were detected. Waste characterization data for samples collected from the septic tank contents in 2000 showed low concentrations of inorganic chemicals, isotopes of uranium and plutonium, tritium, nitrate, and three organic chemicals (LANL 2001, 071473).

In 2001, a VCA to remove the septic system was conducted at AOC 51-001 and involved removing the septic tank contents and the septic tank and plugging the drainlines. Confirmation samples were collected from six locations within the septic tank excavation, beneath the inlet drainline connection, and next to the seepage pit. The analytical suites for the VCA confirmation samples included isotopic plutonium, isotopic uranium, gamma-emitting radionuclides, tritium, strontium-90, pH, VOCs, and SVOCs (LANL 2000, 070658). The sampling locations are shown in Figure 2.2-1, and the samples collected and analyses requested are summarized in Table 2.2-1. In accordance with the approved VCA plan, confirmation samples were not analyzed for inorganic chemicals because they were not detected above BVs in the 1995 RFI samples (LANL 2000, 070658). Organic chemicals detected in these samples are presented in Table 2.2-2 and Figure 2.2-2. Two VOCs (2-butanone and trichlorofluoromethane) were detected at low concentrations at two locations below estimated quantitation limits (EQLs). Bromomethane was detected at a concentration below the EQL in the deepest sample collected at location 51-10001. No SVOCs, pesticides or PCBs were detected. All VCA confirmation samples from AOC 51-001 were analyzed by gamma spectroscopy and for isotopic plutonium, isotopic uranium, tritium, and strontium-90. Cesium-137 was detected in one fill sample at 0.0761 pCi/g at location 51-0002 at a depth of 5.5 to 6.5 ft below ground surface (bgs).

2.2.4 AOC 54-007(d), Former Septic System

The septic system was investigated during the 1995 Phase I RFI (LANL 1992, 007669). Phase I RFI data were summarized in the VCA plan (LANL 2000, 070658). Low concentrations of Aroclor-1254 (0.25 mg/kg), DDE ([dichlorodiphenyltrichloroethylene] 0.0053 mg/kg), and DDT ([dichlorodiphenyltrichloroethane] 0.0046 mg/kg) were detected in a single near-surface soil sample collected at the eastern edge of the drain field. Analytical data from the 1995 RFI presented in the 2001 VCA completion report (LANL 2001, 071473) were reevaluated and determined to be screening-level data. As part of the RFI, the contents of the septic tank were sampled and analyzed. At that time, between 3 and 3.5 ft of liquid and sludge remained in the tank. Waste characterization data for samples collected from the septic tank contents in 2000 showed low concentrations of inorganic chemicals, organic chemicals, nitrate, and isotopes of uranium; however, pesticides/PCBs were not detected (LANL 2001, 071473).

In 2001, a VCA was conducted at AOC 54-007(d) to remove the septic tank contents and the septic tank and to plug the drainlines. Confirmation samples were collected from six locations within the septic tank excavation, beneath the inlet drainline connection, and from the drain field. The sampling locations are shown in Figure 2.2-3, and the samples collected and analyses requested are provided in Table 2.2-3. Organic chemicals detected in drain field samples are presented in Table 2.2-4 and Figure 2.2-4. Detected organic chemicals include benzene; bis(2-ethylhexyl) phthalate; bromomethane; 2-butanone;

isopropylbenzene; 4-isopropyltoluene; 4-methyl-2-pentanone; toluene; trichlorofluoromethane; and trimethylbenzene[1,2,4-]. These organic chemicals were detected at concentrations less than or slightly above their respective EQLs in one or more samples. None of these organic chemicals were detected in the contents of the septic tank (LANL 2001, 071473). At most locations, the concentrations of organic chemicals decreased slightly with depth or remained unchanged (Table 2.2-4 and Figure 2.2-4).

2.3 Relationship to Other SWMUs and AOCs

To develop an approach for investigating the AOCs in the Middle Cañada del Buey Aggregate Area, it is important to understand, at least qualitatively, the potential impact of nearby SWMUs and AOCs on the area. In terms of contaminant inventory and physical size, the most significant SWMUs/AOCs near Middle Cañada del Buey Aggregate Area are those comprising Material Disposal Area (MDA) G, which is located near the eastern end of Mesita del Buey, in the Lower Pajarito Canyon Aggregate Area, approximately 1 mi east of MDA L. From 1959 to 1997, MDA G was the Laboratory's primary radioactive waste disposal facility. MDA G is located in Area G, which occupies 63 acres and is the Laboratory's current low-level-waste-disposal area. Investigations to date have revealed a subsurface contamination consisting of vapor-phase VOCs and tritium in subsurface pore water (LANL 2005, 090513). Surface contamination in Area G runs off to either Cañada del Buey or Pajarito Canyon downstream of Middle Cañada del Buey Aggregate Area and does not impact the aggregate area.

To the west, the nearest SWMUs and AOCs are located in TA-46, on Mesita del Buey, in the Upper Cañada del Buey Aggregate Area, less than 1 mi northwest of TA-51. Releases from SWMUs and AOCs in TA-46 do not impact the Middle Cañada del Buey Aggregate Area because of the distance between these sites. Although TA-46 is topographically higher than Middle Cañada del Buey Aggregate Area, runoff from TA-46 flows into Cañada del Buey rather than along the mesa top.

No SWMUs or AOCs are in close proximity to AOC 51-001. AOC 54-007(d) is located approximately 400 ft northwest of AOCs 18-005(b) and 18-005(c) but is not associated with these AOCs. AOCs 18-005(b) and 18-005(c) are located approximately 160 ft apart and both were explosives storage magazines. No other SWMUs or AOCs not previously approved for NFA are in close proximity to, or associated with AOCs 18-005(b), 18-005(c), and 54-007(d).

2.4 Contaminant Transport and Potential Receptors

The inventory of hazardous constituents present at AOCs within the Middle Cañada del Buey Aggregate Area includes inorganic chemicals, organic chemicals, and radionuclides. The relevant release and transport processes associated with these materials are a function of chemical-specific properties, physical form, and the nature of the transport process. The transport of VOCs, for example, occurs primarily in the gas phase and by diffusion or advection in air. Relatively water-soluble contaminants are susceptible to release and transport through water infiltration.

The primary potential release and transport mechanisms for contaminants at the sites in Middle Cañada del Buey Aggregate Area investigated under the work plan (LANL 2007, 102622) include the following.

Volatilization, diffusion, and dispersion in air. Low concentrations of VOCs were detected in subsurface samples at AOCs 51-001 and 54-007(d). Gas or vapor-phase contaminants diffuse from contaminated media through the air-filled pores in the subsurface rock. Migration of gas or vapor-phase contaminants from the tuff into ambient air may occur by diffusion or by advection driven by changes in barometric pressure.

Dissolution and advective transport in water. Inorganic and organic chemicals were detected in subsurface samples at AOCs 51-001 and 54-007(d), and inorganic chemicals were detected in soil at AOCs 18-005(b) and 18-005(c). Infiltrating precipitation may dissolve contaminants and slowly transport them through the subsurface rock. Transport in tuff may be facilitated by the presence of fractures, especially when they have coatings with low conductivity or when sufficient liquid saturates the matrix adjacent to the fracture where a flow is occurring.

Erosion and transport in surface water. Inorganic chemicals are present in surface soil at AOCs 18-005(b) and 18-005(c). Contaminated soil particles may be eroded by stormwater and transported by surface runoff into Cañada del Buey. Contaminated sediment in the canyon may then be transported farther downstream by ephemeral surface water flow.

Wind erosion and dispersion. Inorganic chemicals are present in surface soil at AOCs 18-005(b) and 18-005(c). Contaminated soil particles may be eroded by wind and transported downwind.

Potential receptors include Laboratory workers, who could potentially be exposed to contaminants in soil by direct contact, ingestion, or inhalation. Ecological receptors may also be exposed to soil contaminants. Industrial workers and ecological receptors could also be exposed to contaminated sediment in Cañada del Buey. The canyon is not accessible for recreational use, and exposure of recreational users is not expected. Because of the low infiltration rate on Mesita del Buey, transport to groundwater is not likely, and exposure by ingestion of groundwater is not expected.

2.5 Waste Inventory

The four AOCs investigated in accordance with the work plan have small waste inventories. AOCs 18-005(b) and 18-005(c) consist of former explosives magazines that were destroyed by burning. The inventory for these sites was expected to be limited to residue remaining from combustion of the structures. AOCs 51-001 and 54-007(c) consist of former septic systems. Both AOCs underwent VCAs in 2001 to remove the septic tanks and plug drainlines, and any remaining inventory was expected be limited to contaminants discharged to the subsurface.

3.0 SITE CONDITIONS

This section discusses aspects of the environmental setting within the Middle Cañada del Buey Aggregate Area that are important to assessing the potential impacts of contaminated surface and subsurface media, including

- the semiarid climate with low precipitation and a high evapotranspiration rate, which limits the amount of moisture percolating into wastes or areas of contamination and thus limits the amount of moisture available to leach radionuclides or hazardous waste constituents;
- the thick, relatively dry unsaturated zone, which greatly restricts or prevents downward migration of contaminants in the liquid phase through the vadose zone to the regional aquifer; and
- the canyon-mesa terrain, which affects atmospheric conditions and ecological habitats.

3.1 Surface Conditions

Middle Cañada del Buey Aggregate Area is located in the central portion of Cañada del Buey and Mesita del Buey and incorporates parts of TA-51 and TA-54. The aggregate area consists of the canyon bottom and that portion of the mesa top and canyon slope that drain to the north into the canyon. All SWMUs and

AOCs within the Middle Cañada del Buey Aggregate Area are located on the mesa top. The width of the mesa top within the aggregate area ranges from approximately 150 ft to the west of Area L in TA-54 to approximately 1200 ft at TA-51. The elevation of Mesita del Buey within the aggregate area ranges from approximately 6740 to 7050 ft above sea level. The topography on the mesa top slopes gently from west to northeast, gradually steepening in the northeast towards Cañada del Buey. The elevation of the canyon bottom ranges from approximately 6740 ft at the east end of the aggregate area to 6870 ft at the west end. The developed portions of the aggregate area are covered with buildings and asphalt, and the remainder is covered with native vegetation.

3.1.1 Soil

The soil of Mesita del Buey is derived from the weathering of the Tshirege Member tuff (phenocrysts and phenocryst fragments, devitrified glass, and minor lithic fragments) and from wind-blown sources. Soil on the flanks of the mesa is developed on Tshirege Member tuff and colluvium with additions from wind-blown and water-transported sources. Native soil has been disturbed by Laboratory operations over much of the surface of Mesita del Buey within TA-51 and TA-54. When present, native soil is generally thickest near the center of the mesa and thinner toward the edges.

In general, soil on the mesa surface is thin and poorly developed; it tends to be sandy near the surface and more clay-like beneath the surface. More highly developed soil profiles exist on the north-facing slopes; it tends to be richer in organic matter. Soil profiles on the south-facing slopes tend to be poorly developed. Soil-forming processes have been identified along fractures in the upper part of the mesa, and the translocation of clay minerals from surface soil into fractures has been described at Mesita del Buey. A discussion of soil in the Los Alamos area can be found in the approved ER Project installation work plan (LANL 1998, 062060, pp. 2-6–2-21).

Soil on Mesita del Buey is poorly developed, as is typical of soil derived from Bandelier Tuff and formed under semiarid climate conditions (Nyhan et al. 1978, 005702). In general, undisturbed soil on the mesa tops consists of the Carjo loam, the Hackroy loam, and the Seaby loam. Canyon bottoms are covered with colluvium and alluvium that has eroded from the tuff and soil on the mesa top and canyon walls. The canyon rims and slopes are composed of soil from the Hackroy-Rock outcrop complex; the canyon bottoms are composed of the Tocal, a very fine, sandy loam. Since Laboratory operations began on Mesita del Buey, Cañada del Buey has experienced a period of accretion, and eroded soil from the mesa top has been deposited on the canyon bottom and stream banks. Potentially, this soil may be redistributed downstream during storm runoff events (LANL 2004, 087624, p. 16).

3.1.2 Surface Water

No streams flow on Mesita del Buey; water flows only as stormwater and snowmelt runoff on the mesa and in small drainages off the mesa to the north and the south. As a result of runoff, surface erosion occurs primarily as shallow sheet erosion on the relatively flat parts of the mesa and as channel erosion in major drainages from the mesa top. Runoff from summer storms reaches a maximum in less than 2 h and lasts less than 24 h. By contrast, runoff from spring snowmelt occurs over a period of several weeks at a low discharge rate. The amount of eroded material transported in waters is generally higher during summer rainfall events than during snowmelt (Hollis et al. 1997, 063131, pp. 2–33).

The primary source of water in Cañada del Buey is runoff from the surrounding mesa tops. The amount of runoff is insufficient to support continuous flow in any part of the canyon and Cañada del Buey is entirely ephemeral on Laboratory property (LANL 1999, 064617, p. 3-103). Water in the stream channel may be present for short periods during runoff from summer thundershowers.

Stream flow in Cañada del Buey has been monitored by several gauging stations installed in the canyon. None of the gauging stations is located within the aggregate area. Station E218, installed in 1997, is located approximately 2600 ft upstream of the aggregate area boundary, and Station E225, installed in 1993, is located approximately 1100 ft downstream of the aggregate area boundary. These gauging stations rarely measure flow. Station E218 measured flow on 20 d for a period of record from October 2002 to September 2003. Station E225 measured flow on 2 d for the same period of record (Shaull et al. 2004, 093737, pp. 46, 48).

3.2 Subsurface Conditions

3.2.1 Stratigraphy

The stratigraphy at Middle Cañada del Buey Aggregate Area has been characterized by investigations conducted at MDAs H and L and the installation of regional wells around TA-54. The stratigraphy beneath Mesita del Buey includes the Bandelier Tuff and the Cerros del Rio basalt. The regional aquifer is primarily in the Santa Fe Group, Puye Formation, and Cerros del Rio basalts.

Bandelier Tuff

With reference to the Bandelier Tuff, the term *welding* is used to distinguish between tuffs that are uncompacted and porous (nonwelded) and those that are more compacted and dense (welded). In the field, the degree of welding in tuff is quantified by the degree of flattening of pumice fragments (a higher degree of flattening and elongation equals a higher degree of welding). Petrographically, welded tuffs show adhesion (welding) of grains, but nonwelded tuffs do not. The term *devitrified* is applied to tuff whose volcanic glass has crystallized. Figure 3.2-1 shows the generalized stratigraphy of the Bandelier Tuff.

Tshirege Member

The Tshirege Member of the Bandelier Tuff is a compound-cooling unit that resulted from several successive ash-flow deposits separated by periods of inactivity, which allowed for partial cooling of each unit. Properties related to water flow and contaminant migration (e.g., density, porosity, degree of welding, fracture content, and mineralogy) vary both vertically and laterally as a result of localized emplacement temperature, thickness, gas content, and composition.

Unit 2 of the Tshirege Member

Unit 2 of the Tshirege Member of the Bandelier Tuff (Qbt 2) is a competent, resistant unit that forms the surface of Mesita del Buey. Its thickness varies from 35 ft (10.7 m) to 40 ft (12.2 m) at MDA L (LANL 2004, 087624, Appendix F). Where it is exposed, unit 2 forms nearly vertical cliffs on the sides of the mesa. The rock is described as a moderately welded ash-flow tuff composed of crystal-rich, devitrified pumice fragments in a matrix of ash, shards, and phenocrysts (primarily potassium feldspar [sanidine] and quartz).

Unit 2 is extensively fractured as a result of contraction during postdepositional cooling. The cooling-joint fractures are visible on mesa edges and on the walls of pits. In general, the fractures dissipate at the bottom of unit 2. On average, fractures in unit 2 are nearly vertical. The mean spacing between fractures ranges between 1.9 ft and 2.6 ft (0.6 m and 8.8 m), and the fracture width ranges between less than 0.03 in. and 0.51 in. (1 mm and 13 mm), with a median width of 0.12 in. (3 mm). The fractures are typically filled with clays to a depth of about 9.9 ft (3 m); smectites are the dominant clay minerals present.

Smectites are known for their tendency to swell when water is present and for their ability to strongly bind certain elements. Opal and calcite can be found throughout the fractured length, usually in the presence of tree and plant roots (live and decomposed); the presence of both the minerals and the roots indicates some water at depth in fractures. At the base of unit 2 is a series of thin, less than 3.9-in.-thick (10-cm-thick), discontinuous, crystal-rich, fine- to coarse-grained surge deposits. Bedding structures are often observed in these deposits. The surge beds mark the base of unit 2 (LANL 2004, 087624).

Unit 3 of the Tshirege Member

Unit 3 of the Tshirege Member is a nonwelded to partially welded, vapor-phase-altered tuff that forms the upper cliffs. Its base consists of a purple-gray, unconsolidated, porous, and crystal-rich nonwelded tuff that forms a broad, gently sloping bench developed on top of Qbt 2. Abundant fractures extend through the upper units of the Bandelier Tuff, including the ignimbrite of the unit 3 of the Tshirege Member. The origin of the fractures has not been fully determined, but the most probable cause is brittle failure of the tuff caused by cooling contraction soon after initial emplacement (Vaniman 1991, 009995.1; Wohletz 1995, 054404).

Unit 1v of the Tshirege Member

Unit 1v of the Tshirege Member (Qbt 1v) is a vapor-phase-altered cooling unit underlying unit 2. This unit forms sloping outcrops, which contrast with the near-vertical cliffs of unit 2. Unit 1v is further subdivided into units 1vu and 1vc.

Unit 1vu. The uppermost portion of unit 1v is devitrified and vapor-phase-altered ash-fall and ash-flow tuff; it has been designated unit 1vu, where *u* signifies upper. Its thickness varies from 60 ft (18.3 m) to 75 ft (22.9 m) at MDA L (LANL 2004, 087624, p. 18). Unit 1vu is unconsolidated at its base and becomes moderately welded nearer the overlying unit 2. Only the more prominent cooling fractures originating in unit 2 continue into the more welded upper section of unit 1vu but die out in the lower, less consolidated section. More typically, fractures in unit 2 do not extend into unit 1vu.

Unit 1vc. Beneath unit 1vu is unit 1vc, where *c* stands for colonnade, named for the columnar jointing visible in cliffs formed from this unit. Unit 1vc is a poorly welded, devitrified ash-flow tuff at its base and top, and becomes more welded in its interior. Unit 1vc is approximately 25 ft (7.6 m) thick at MDA L (LANL 2004, 087624, p. 18).

Unit 1g of the Tshirege Member

The basal contact of unit 1vc is marked by a rapid change (within 0.7 ft [0.2 m] vertical) from devitrified (crystallized) matrix in unit 1vc to vitric (glassy) matrix in the underlying unit 1g (Qbt 1g). Vitric pumices in unit 1g stand out in relief on weathered outcrops, but devitrified pumices above this interval are weathered out. In outcrop, this devitrification interval forms a prominent erosional recess termed the *vapor-phase notch*. No depositional break is associated with the vapor-phase notch; the abrupt transition indicates this feature is the base of the devitrification that occurred in the hot interior of the cooling ash-flow sheet after emplacement.

Unit 1g is a vitric, pumiceous, nonwelded ash-flow tuff underlying the devitrified unit 1vc. It is about 140 ft (42.7 m) thick at MDA L (LANL 2004, 087624, p. 18). Few fractures are observed in the visible outcrops of this unit, and weathered cliff faces have a distinctive Swiss-cheese appearance because of the softness of the tuff. The uppermost 5 ft to 20 ft (1.5 m to 6.1 m) of unit 1g are iron-stained and slightly

welded. This portion of unit 1g is resistant to erosion, helping to preserve the vapor-phase notch in the outcrops. A distinctive pumice-poor surge deposit forms the base of unit 1g.

Tsankawi Pumice Bed

The Tsankawi Pumice Bed is the basal air-fall deposit of the Tshirege Member of the Bandelier Tuff. It is a thin bed of gravel-sized vitric pumice. It is about 3 ft (1 m) thick at MDA L (LANL 2004, 087624, p. 18).

Cerro Toledo Interval

The Cerro Toledo interval consists of thin beds of tuffaceous sandstones, paleosols, siltstones, ash, and pumice falls; it separates the Tshirege and Otowi Members of the Bandelier Tuff. The Cerro Toledo interval also includes localized gravel- and cobble-rich fluvial deposits predominantly derived from intermediate composition lavas eroded from the Jemez Mountains west of the Pajarito Plateau. This interval varies in thickness between 15 ft (4.6 m) to 30 ft (9.1 m) at MDA L (LANL 2004, 087624, p. 18).

Otowi Member

The Otowi Member tuff is about 80 ft (24.4 m) thick at MDA L (LANL 2004, 087624, p. 18). The tuff is a massive, nonwelded, pumice-rich, and mostly vitric ash flow. The pumices are fully inflated, supporting tubular structures that have not collapsed as a result of welding. The matrix is an unsorted mix of glass shards, phenocrysts, perlite clasts, and minute, broken pumice fragments.

The Guaje Pumice Bed is the basal air-fall deposit of the Otowi Member of the Bandelier Tuff. The thickness of the unit has been measured at 10 ft (3.1 m) beneath MDA L (LANL 2004, 087624, p. 18). The pumice bed is nonwelded but brittle. Pumice tubes are partially filled with silica cement.

Cerros del Rio Basalts (Tb 4)

In the vicinity of the Middle Cañada del Buey Aggregate Area, the Cerros del Rio basalts lie directly beneath the Otowi Member of the Bandelier Tuff (LANL 2004, 087624). In regional well R-32, which is near the southeast corner of the aggregate area, the basalts are 636 ft (193.9 m) thick. In regional well R-22, which is approximately .75 mi east of the aggregate area, the basalts are 983 ft (299.6 m) thick. In both wells, the regional water table occurs within these basalts (LANL 2004, 087624). Local borehole cores at MDA L show that the basalts consist of both angular rubble and dense, fractured masses, with zones of moderately to very porous lavas (LANL 2004, 087624, p. 18). Deeper drilling at regional well R-22 showed a wide variety of lithologies within the basalts, including massive flows, interflow rubble or scoria zones, sediments, and paleosols (LANL 2004, 087624).

Puye Formation (Tpf, Tpp) and Older Fanglomerate

The Puye Formation is a conglomerate deposit derived primarily from volcanic rocks to the west, with varying lithologies, including stream channel and overbank deposits, ash and pumice beds, debris flows and lahar deposits. Well tests on the plateau confirm that the unit is very heterogeneous with both high- and low-permeability zones present (Nylander et al. 2003, 076059.49). The formation is poorly lithified and as such is unlikely to sustain open fractures.

The Puye Formation thins from west to east in the vicinity of the aggregate area. At supply well PM-2, which is just south of the aggregate area, the Puye Formation (including fanglomerate, pumiceous units and ancestral Rio Grande deposits) is approximately 800 ft (243.8 m) thick. At regional well R-23, which is

approximately 1.25 mi east of the aggregate area, it is completely absent. Recent drilling across the plateau indicates that the Puye Formation is frequently underlain by alluvial fan deposits similar in lithology to the Puye but considerably older (LANL 2004, 087624). These deposits are of considerable thickness at supply well PM-2, were penetrated at regional well R-22 (approximately 80 ft [24.4 m] thick), and were absent at regional well R-23.

Totavi Lentil Deposits (Tpt)

The Totavi Lentil is an ancestral Rio Grande deposit and consists of coarse gravels and sands with abundant quartzite. The deposit has been alternatively conceptualized as a series of distinct north-south trending ribbons as well as a continuous thin sheet at the base of the Puye Formation. Like the overlying Puye Formation, it has both high- and low-permeability zones (Nylander et al. 2003, 076059.49).

Santa Fe Group (Tsf, Tf, and Ts) and Santa Fe-Age Basalts (Tb 1 and Tb 2)

The Santa Fe Group is an alluvial-fan deposit comprised of medium to fine sands and clays. Numerous north-south trending faults are present in the Santa Fe Group. Santa Fe Group rocks are deep below Pajarito Canyon to the south of Mesita del Buey (1500 ft [457.2 m] bgs at supply well PM-2) and were not penetrated by regional wells R-20 (which is just south of the aggregate area east of PM-2), R-32, or R-22 (LANL 2004, 087624). Most water supply wells on the eastern edge of the Pajarito Plateau and elsewhere in the basin are completed in these rocks. The Santa Fe Group units are characterized as having the lowest permeability compared with the other units in the regional aquifer.

Basaltic lava flows occurred at the time the Santa Fe Group was deposited; these basalts occur both within the Santa Fe Group and within the pre-Puye sands, gravels, and conglomerates that were penetrated by regional wells R-20 and R-22. These old basalts appear to have fewer open fractures than the younger Cerros del Rio basalts.

3.2.2 Hydrogeology

The proposed hydrogeologic conceptual model for the Pajarito Plateau (LANL 1998, 059599) is presented in Figure 3.2-2. The model predicts that infiltration of water into the subsurface and subsequent transport of water, vapor, and solutes through the upper regions of the vadose zone is heavily influenced by surface conditions such as topography, surface water flow, and microclimate. According to model predictions, movement through deeper layers, including the regional aquifer, is only weakly influenced by surface conditions and is influenced more by the hydraulic characteristics of aquifer rocks, regional groundwater flow patterns, and stresses induced by water-supply production. The following sections provide an overview of infiltration rates and groundwater occurrences near the Middle Cañada del Buey Aggregate Area.

Infiltration

Surface and near-surface conditions (topography, precipitation, surface runoff) control water infiltration to the subsurface and the transport of contaminants into the shallow subsurface. In this respect, the climate behavior of mesas and canyons forming the plateau differ from one another (LANL 1998, 059599). Mesas are generally dry, both on the surface and within the rock forming the mesa. Canyons range from wet to relatively dry; the wettest canyons contain continuous streams and perennial groundwater in the canyon-bottom alluvium. Dry canyons have only occasional stream flow and may lack alluvial groundwater.

Relatively small volumes of water move beneath mesa tops under natural conditions because of low rainfall, runoff into canyons, high evaporation, and efficient water use by vegetation. Liquid water generally infiltrates the mesa, and water vapor generally moves upward, undergoing evapotranspiration along the top and sides of the mesa. Air circulates through the mesa-top units because of the relatively dry pore spaces and the topographic relief. Air circulation may be driven by temperature variations, barometric pumping, or surface winds. This process promotes atmospheric evaporation, which may extend deep within the mesa and further inhibit the downward liquid-water flow.

Mesita del Buey is one of the drier mesas at the Laboratory and the Pajarito Plateau. Infiltration into the mesa appears to be very low, possibly only 0.04 in./yr (Hollis et al. 1997, 063131, p. 2-51) and occurs during snowmelts or intense summer thunderstorms, which leads to slightly higher moisture content within the uppermost few meters of the mesa surface. During dry periods, evapotranspiration removes moisture from the surface of the mesa; permeable zones such as fractures and surge beds act as conduits for air and aid in drying the mesa.

3.2.3 Groundwater

Groundwater beneath the Laboratory occurs in the regional aquifer (at depths ranging from 600 to 1200 ft bgs) and in perched, intermediate, and shallow aquifers. With the exception of TA-16, perched groundwater has been detected only in wells beneath relatively wet canyons (e.g., Los Alamos Canyon) as (1) shallow alluvial aquifers that occur in some wet canyons (generally at depths less than 100 ft), and (2) deeper “intermediate” perched aquifers that occur in zones separated from both alluvial and regional aquifers by unsaturated rock. To date, data indicate that dry mesas such as Mesita del Buey show no evidence of perched groundwater beneath the mesa. However, alluvial and intermediate perched aquifers in adjacent canyons may cause increased moisture content within the vadose zone at the base of the mesa.

Alluvial/Groundwater

Several shallow monitoring wells have been installed in Cañada del Buey within the Middle Cañada del Buey Aggregate Area. These wells include CdBO-1 and CdBO-2, installed in the south fork of Cañada del Buey downstream from MDA J; CdBO-3, installed in the lower South Fork of Cañada del Buey next to MDA L; and CdBO-6, CdBO-7, CdBO-8, and CdBO-9, installed in the main channel of Middle Cañada del Buey downstream from TA-46 (Figure 3.2-3). After the SWSC treatment plant was constructed at TA-46 in 1992, the latter four wells were installed to monitor alluvial groundwater in the event that effluent from the plant was discharged to a tributary of Cañada del Buey. To date, this effluent has been transferred to TA-03 for reuse or discharge.

Water was not detected in wells CdBO-1, CdBO-2, CdBO-3, CdBO-8, or CdBO-9 during or after drilling. A 10-ft-thick perched water zone was encountered at a depth of 34 to 44 ft bgs during drilling of CdBO-6, and this well has yielded enough water for sampling every year since 1992. Similarly, a 1- to 2-ft-thick zone of perched water was encountered during drilling of well CdBO-7, located approximately 2000 ft downstream from well CdBO-6. This well has contained enough water for sampling each year since 1993. Well CdBO-5, located approximately 3300 ft upstream of well CdBO-6 just north of the Middle Cañada del Buey Aggregate Area boundary, has never contained water. Alluvial groundwater within middle Cañada del Buey appears to extend from approximately the location of well CdBO-6 downstream for a distance of at least 2000 ft to well CdBO-7 and probably for some distance farther downstream (LANL 1999, 064617, p. 3-116).

The principal source of the alluvial groundwater observed in wells CdBO-6 and CdBO-7 appears to be municipal supply well PM-4, which is located on a ledge of the south canyon wall adjacent to well CdBO-6. When supply well PM-4 is taken out of service, it must be purged during startup and purge water is discharged through a National Pollutant Discharge Elimination System-permitted outfall into Cañada del Buey at the approximate location of well CdBO-6. Other sources may include runoff infiltration from the upper canyon reaches, supplemented by infiltration of local precipitation (LANL 1999, 064617, p. 3-116).

Perched Intermediate Waters

Observations of perched intermediate water are rare on the Pajarito Plateau. Perched intermediate waters are thought to form mainly at horizons where medium properties change dramatically, such as at paleosol horizons containing clay or caliche. It is not known whether perched intermediate water bodies are isolated or connected and to what degree they may influence travel times and pathways for contaminants in the vadose zone. Although perched intermediate groundwater has been observed in some locations on the plateau, none has been observed in the regional wells in the vicinity of Mesita del Buey (regional wells R-22, R-21, R-20) (LANL 1998, 059599).

Perched intermediate groundwater was not encountered, nor is it suspected beneath Mesita del Buey at Middle Cañada del Buey Aggregate Area. No perched groundwater was observed in 660 ft of drilling in the deepest vertical borehole drilled to date at MDA L (LANL 2005, 092591).

Regional Aquifer

The regional aquifer of the Pajarito Plateau is the only aquifer capable of supplying large-scale municipal water (Purtymun 1984, 006513). The regional aquifer extends throughout the Española Basin (an area roughly 2300 mi^2) and reaches its maximum thickness beneath the Pajarito Plateau (over 9800 ft thick [Cordell 1979, 076049]).

Depths to the regional aquifer range between about 1200 ft along the western edge of the plateau and about 600 ft along the eastern edge. Beneath Mesita del Buey within Middle Cañada del Buey Aggregate Area, the water table elevation is approximately 5800 ft. Figure 3.2-4 shows water-table elevations across the plateau (i.e., a cross-section of hydraulic head data [water-table elevations] collected in the regional aquifer).

Groundwater flow in the regional aquifer between Middle Cañada del Buey Aggregate Area and the Rio Grande (approximately 4 mi) occurs primarily in the Santa Fe Group. Pump tests in individual water-supply wells throughout the plateau indicate that the hydraulic conductivity (K) of the Santa Fe Group along the eastern edge of the plateau is the lowest of any aquifer unit ([average K for Los Alamos well field = 0.7 ft/d]; Purtymun 1995, 045344). More recent analyses of water-level trends over a 55-yr period indicate that these K estimates, although accurate locally, may be higher than the large-scale effective permeability of the Santa Fe Group (0.2 ft/d) because of the flow impedance of north-south trending faults (LANL 2004, 087624). Assuming a porosity of 0.2 (typical of sedimentary rocks [Freeze and Cherry 1979, 088742]) and the measured gradient of 0.02, pore water velocities in this portion of the regional aquifer would be slow (approximately 0.02 to 0.07 m/yr [Nylander et al. 2003, 076059.49, p. 5-2]). This result indicates that travel times within the regional aquifer (Santa Fe Group rocks) from TA-54 to the Rio Grande would be, on an average, more than 1000 yr.

Vadose Zone

The region beneath the ground surface and above the regional aquifer is called the vadose (unsaturated) zone. The source of moisture in the vadose zone beneath Mesita del Buey is infiltrating precipitation, but most of the precipitation is removed as runoff or evapotranspiration in the upper region of the vadose zone (Hollis et al. 1997, 063131, p. 2-33). The subsurface movement of the remaining water (often referred to as recharge) is predominantly vertical in direction and is influenced by properties and conditions of the vadose zone. Characteristics of infiltration in the vadose zone are described above (see "Perched Intermediate Waters").

The geologic property of the Bandelier Tuff that most influences the fluid flow in the unsaturated zone is the degree of welding. Welded tuffs tend to have less matrix porosity and more fractures than nonwelded tuffs. Fractures in welded tuff may include relatively close-spaced cooling joints as well as tectonic fractures. Although nonwelded tuffs also have fractures, they are generally less abundant than in welded tuffs.

Several competing effects determine moisture content and fluid flux in welded, devitrified tuff. Although water moves slowly through the unsaturated tuff matrix, it can move relatively rapidly through fractures if saturated or nearly saturated conditions exist (Hollis et al. 1997, 063131). The moisture levels measured within the aggregate area at MDA L are relatively low (1% to 13% gravimetric moisture content [Daniel B. Stephens & Associates Inc. 1994, 076071]). At these moisture levels, most of the fractures beneath MDA L are completely dry, and water is found only in the tuff matrix. In situations when substantial infiltration occurs from the ground surface, the fractures become wet and conduct water. However, modeling studies at MDA G to the east of the aggregate area predict that if fractures disappear at contacts between stratigraphic subunits, if fracture fills are encountered, or if coatings are interrupted, fracture moisture is absorbed into the tuff matrix (Hollis et al. 1997, 063131, p. SD2C-1).

4.0 SCOPE OF ACTIVITIES

This section presents an overview of the field activities performed during the implementation of the Middle Cañada del Buey Aggregate Area investigation. The scope of activities for the 2008 investigations included geodetic surveys; surface and shallow-subsurface sampling; borehole drilling, core sampling, and borehole abandonment; health and safety monitoring; and waste-management activities. The standard operating procedures (SOPs) used during the investigation are listed in Table 4.0-1, and field methods are described in Appendix C.

4.1 Geodetic Surveys

A geodetic survey was conducted during the 2008 investigation to identify historical sampling and borehole locations and the locations of the two former explosives magazines [AOCs 18-005(b) and 18-005(c)]. Geodetic surveys were conducted at the completion of the drilling and sampling campaign to establish the spatial coordinates for all sampling locations and boreholes. Geodetic surveys were conducted using a Trimble 5700 differential global positioning system (DGPS). The survey data conform 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." Horizontal accuracy of the monumented control points was accurate to within 0.1 ft.

During sampling, if the planned location was offset because of surface or subsurface obstructions, the actual sampling location was resurveyed. The surveyed sampling locations are expressed as State Plane Coordinate System 83, New Mexico Central, U.S. ft coordinates and are presented in Appendix D.

4.2 Collection of Soil and Tuff Samples

Surface and shallow subsurface samples were collected on December 9, 11, and 12, 2008, using either a spade or scoop in accordance with SOP-06.09, "Spade and Scoop Method for Collection of Soil Sample," or a hand auger according to SOP-06.10, "Hand Auger and Thin-Wall Tube Sampler." Field quality assurance (QA)/quality control (QC) samples (e.g., field duplicates) were collected at a minimum frequency of 10% of total samples collected (EP-ERSS-SOP-5059, "Field Quality Control Samples"). A stainless-steel scoop and bowl were used to homogenize the samples, which were transferred to sterile sample collection jars or bags for transport to the Laboratory's Sample Management Office (SMO).

Boreholes were drilled and subsurface samples collected from December 8 to 11, 2008. A Construction Mine Equipment 85 hollow-stem auger (HSA) drill rig was employed for all drilling using 4.25-in.-inside-diameter (I.D.) and nominal 8.25-in.-outside-diameter (O.D.) augers. A hex-rod core retrieval system and 4-in.-O.D. stainless-steel core barrels were used for sampling following SOP-06.26, "Core-Barrel Sampling for Subsurface Earth Materials." A nominal 9-in.-diameter drill bit was used for all borings. During HSA drilling, continuous core was recovered from the specified sampling intervals using stainless-steel core barrels through the center of the 4.25-in. drill string. At the surface, cuttings and core were screened for VOCs (as described in section 4.3) and drill cuttings and sample material was visually inspected and lithologically logged by a qualified geologist. The boreholes drilled during the investigation and their depths are presented in Table 4.2-1. The borehole logs are presented in Appendix D.

The QA/QC samples included field duplicate samples for evaluating the reproducibility of the sampling technique and trip blanks (for VOCs) for evaluating contamination during transport to the analytical laboratories. These samples were collected following the procedures and the frequency described in EP-ERSS-SOP-5059, "Field Quality Control Samples." Field documentation of subsurface samples included a detailed physical description of the rock matrix sampled following SOP-12.01, "Field Logging, Handling, and Documentation of Borehole Materials," and in general accordance with American Society for Testing and Materials or American Geological Institute methods.

Pertinent information regarding each sample was recorded in sample collection logs (Appendix F) in accordance with EP-ERSS-SOP-5058, "Sample Control and Field Documentation." Field-screening data for borehole samples were also recorded in borehole logs or in field notebooks. Samples were maintained under chain of custody (Appendix F) in accordance with EP-ERSS-SOP-5058 and preserved according to the requirements for each sample type and analysis following EP-ERSS-SOP-5056, "Sample Containers and Preservation," until they were delivered to the SMO for processing.

All samples were shipped through the SMO to off-site fixed analytical laboratories on the approved suppliers' list.

4.3 Field Screening

Hand-auger samples, core samples, and cuttings were screened for gross-alpha and gross-beta radiation before they were submitted to the SMO. Screening was performed using an Eberline E600 with either a 380AB or SHP360 probe (or equivalent) and an ESP-1 rate meter with a 210 probe (or equivalent) in accordance with subcontractor procedures. A radiation control technician (RCT) collected and recorded background measurements for gross-alpha and gross-beta radiation daily. Field screening for radioactivity produced no elevated readings above background for any samples collected for this investigation.

Organic vapor screening of surface and subsurface samples was performed using a MiniRae 2000, Model PGM-7600 photoionization detector (PID) with an 11.7-eV bulb immediately after sample retrieval.

In addition, headspace vapor screening for VOCs was performed on recovered surface and subsurface media in accordance with SOP-06.33, "Headspace Vapor Screening with a Photoionization Detector." Samples were placed in a glass container and covered with aluminum foil. The container was sealed, gently shaken, and allowed to equilibrate for 5 min. The sample was screened by inserting the PID detector probe into the container and measuring and recording any detected vapors.

Field-screening results for VOCs were recorded in a field-screening log. Organic vapors were detected at several surface sample locations where the media were slightly moist and/or contained root material or other organic matter. Detected organic vapor headspace concentrations ranged from 0.0 to 20.0 parts per million (ppm) in soil, fill, and tuff samples. The BV of the PID ranged from 0.1 to 2.0 ppm. VOC field-screening results for all samples collected during this investigation are presented in Table 4.3-1.

Samples collected at AOCs 18-005(b) and 18-005(c) were field screened for high explosives by analyzing for RDX (hexahydro-1,3,5-trinitro-1,3,5-triazine) and TNT (2,4,6-trinitrotoluene) using D TECH test kits. The detection limit of both the RDX and TNT test kits is 0.5 mg/kg. No RDX or TNT was detected in the samples collected from AOCs 18-005(b) and 18-005(c). The RDX and TNT field-screening results are presented in Table 4.3-1.

4.4 Borehole Abandonment

Boreholes were abandoned in accordance with SOP-5034, "Monitoring Well and Borehole Abandonment." All boreholes were abandoned within 24 h of completion with bentonite grout by filling upward from the bottom via tremie pipe to within 2 ft of the surface. After 24 to 48 h, the backfilled level was checked for settling, and additional grout was added as necessary. The remainder of each boring was filled with Portland type I/II cement to surface grade.

4.5 Equipment Decontamination

Augers and core barrels were decontaminated using a dry method after each use and before they were used in a new borehole. After decontamination, the augers were stored away from drilling and decontamination activities. All equipment was screened for radiological contamination and released by an RCT before it was removed from each site. All drilling equipment was field screened by an RCT before demobilizing from the Middle Cañada del Buey Aggregate Area investigation area.

The nondisposable sampling equipment used during drilling and surface sampling was decontaminated between sample intervals/sample locations by cleaning with Fantastik and disposable paper towels, as appropriate.

4.6 Waste Management

The investigation-derived waste (IDW) resulting from the 2008 investigation activities included drill cuttings and core materials, contact IDW, and spent acetone from RDX and TNT D TECH field-screening test kits. The IDW was characterized using direct sampling of the waste streams and acceptable knowledge.

Available waste documentation, including the waste characterization strategy form (WCSF), is provided in Appendix G.

4.7 Deviations

The only deviation from the scope of activities, as defined in the investigation work plan and NMED directions to modify (LANL 2007, 102622; NMED 2008, 099819) was the moving of one sampling location. Location 2 at AOC 51-001 (location CB-604309) was moved approximately 3 ft to the west because a large container blocked drill rig access.

5.0 REGULATORY CRITERIA

This section describes the criteria used for screening COPCs to evaluate the potential risk or dose to ecological and human receptors. Regulatory criteria identified by medium in the Consent Order include cleanup standards, risk-based screening levels, and risk-based cleanup goals. Applicable soil screening levels (SSLs) for inorganic and organic COPCs and screening action levels (SALs) for radionuclide COPCs associated with the four Middle Cañada del Buey Aggregate Area sites are included in the section 6.0 data tables and in Appendix B.

The objectives of the current investigations are to complete the characterization of the nature and extent of contamination and to determine whether contamination at any of the sites poses a potential unacceptable risk to human health or the environment. For each AOC, the regulatory criteria and the data gathered during the investigation are used to identify COPCs (Appendix B), their distribution in the environment (section 6.0 and Appendix B), and the resulting potential human and ecological risks (section 7.0 and Appendix H). The results of the data assessment and the screening-level risk evaluations help to confirm the physical location and extent of specific sites, the nature and extent of contamination, and the need for additional corrective actions at the site(s).

All analytical results obtained from samples collected during the 2008 investigation as well as relevant historical investigations are reviewed for quality (Appendix E) and all data found to be validated to current standards for data usability are regarded as “qualified data.” Only qualified data are included in the final data set used to characterize the nature and extent and evaluate potential risk associated with the Middle Cañada del Buey Aggregate Area sites. Risk-screening evaluations are based on applicable exposure scenarios, as discussed below; thus, for the four Middle Cañada del Buey Aggregate Area sites, only qualified data obtained from samples collected from 0–1 ft, 0–5 ft, and 0–10 ft are used in the human health or ecological risk screening evaluations.

Human health risk screening evaluations were conducted for the Middle Cañada del Buey Aggregate Area using the NMED and EPA regional guidance (NMED 2006, 092513; EPA 2007, 099314). Ecological screening assessments were performed using the Laboratory’s ecological screening methods (LANL 2004, 087630).

5.1 Current and Future Land Use

The four AOCs in the Middle Cañada del Buey Aggregate Area are located within TA-51 and TA-54 West. Land use at both TAs is industrial, although not all parts of both TAs are currently developed. TA-51 is the location of research facilities, and TA-54 is currently the Laboratory’s primary site for waste management activities. The Laboratory does not anticipate the land use at TA-51 and TA-54 West will change in the reasonably foreseeable future. Public access to both sites is controlled by restricted entry onto Pajarito Road.

The areas for each of the four sites are entirely industrial and the industrial scenario is the current and reasonably foreseeable future land use. However, the industrial scenario was evaluated only for AOCs

18-005(b) and 18-005(c) because these sites have a surface exposure (0–1 ft), while AOCs 51-001 and 54-007(d) have only a subsurface exposure. All four sites were evaluated using the construction worker scenario. The residential scenario was also evaluated for each site, as required by the Consent Order.

5.2 Screening Levels

Human health and ecological risk-screening evaluations were conducted for the solid media collected from the four Middle Cañada del Buey Aggregate Area sites. The human health screening assessments (Appendix H) were performed on inorganic and organic COPCs using NMED SSLs (NMED 2006, 092513) for the industrial, construction worker, and residential scenarios. Radionuclides were assessed using the Laboratory SALs (LANL 2005, 088493). When an NMED SSL was not available for a COPC, the EPA regional screening level was used (adjusted to a risk level of 10^{-5} for carcinogens) (http://www.epa.gov/region09/superfund/prg/pdf/composite_sl_table_run_12SEP2008.pdf). If an SSL was not available, a surrogate based on structural similarity was used.

The Laboratory's ecological screening guidance (LANL 2004, 087630) and ecological screening levels (ESLs) from the ECORISK Database, Version 2.3 (LANL 2008, 103352), were used to evaluate potential ecological risk. Ecological risks are assessed in Appendix H.

5.3 Cleanup Levels

The cleanup goals specified in Section VIII of the Consent Order are a target risk of 10^{-5} for carcinogens or a hazard index (HI) of 1 for noncarcinogens. The screening levels described in section 5.2 are based on these cleanup levels and a dose of 15 mrem/yr for radionuclides. As specified in Section VIII.B.1 of the Consent Order, the screening levels will be used as cleanup levels unless they are determined to be impracticable or unless SSLs do not exist for current and reasonably foreseeable future land use.

6.0 FIELD INVESTIGATION RESULTS AND SITE CONTAMINATION

This section summarizes the results of the 2008 field investigation conducted at AOCs 18-005(b), 18-005(c), 51-001, and 54-007(d). As detailed above, the overall scope of field activities included geodetic surveys, surface and near-surface soil sampling, and subsurface soil and tuff sampling. The sampling results presented in this section include samples collected during the 2008 investigation as well as historical results meeting current data quality requirements.

6.1 AOCs 18-005(b) and 18-005(c)

6.1.1 Sampling at AOCs 18-005(b) and 18-005(c)

Surface soil and near-surface soil and tuff samples were collected in 2008 at AOCs 18-005(b) and 18-005(c), as directed by the investigation work plan (LANL 2007, 102622). Samples were collected using either the spade-or-scoop or the hand-auger method. All samples were screened for organic vapors and for alpha and beta/gamma radioactivity at the time they were collected. All samples were submitted through the SMO for analysis at off-site contract laboratories. Sampling locations were surveyed using DGPS (Appendix D). Sample collection and screening methods are described in Appendix C.

The sampling locations at AOCs 18-005(b) and 18-005(c) are shown in Figure 6.1-1. Eight samples were collected from four locations in/around the footprint of each former high explosives magazine. Samples were collected from 0 to 1.0 ft and 2.0 to 3.0 ft at each location and analyzed for TAL metals, explosive

compounds, cyanide, SVOCs, perchlorate, and nitrates. Table 6.1-1 provides a summary of the sampling locations, sampling depths, and analytical suites requested.

6.1.2 Analytical Results for AOC 18-005(b)

Inorganic Chemicals

Inorganic chemicals were detected above BVs, had detection limits (DLs) above BVs, or were detected but have no BVs at AOC 18-005(b). Table 6.1-2 lists, by sample, the concentrations of inorganic chemicals detected above BVs, detected with no BVs, or with DLs above their BVs. Figure 6.1-2 shows the sampling locations where inorganic chemicals were detected or were detected above BVs.

The inorganic COPCs for AOC 18-005(b) are identified in Appendix B, section B-3.1, and include antimony, barium, nitrate, and perchlorate.

Organic Chemicals

No organic chemicals were detected in samples collected from AOC 18-005(b).

Radionuclides

Samples were not analyzed for radionuclides at AOC 18-005(b).

6.1.3 Analytical Results for AOC 18-005(c)

Inorganic Chemicals

Inorganic chemicals were detected above BVs, had DLs above BVs, or were detected but have no BVs at AOC 18-005(c). Table 6.1-3 lists, by sample, the concentrations of inorganic chemicals detected above BVs, detected with no BVs, or with DLs above BVs. Figure 6.1-3 shows the sampling locations where inorganic chemicals were detected or were detected above BVs.

The inorganic COPCs for AOC 18-005(c) are identified in Appendix B, section B-4.1, and include antimony, arsenic, barium, chromium, nitrate, and perchlorate.

Organic Chemicals

No organic chemicals were detected in samples collected from AOC 18-005(c).

Radionuclides

Samples were not analyzed for radionuclides at AOC 18-005(c).

6.2 AOC 51-001

6.2.1 Sampling at AOC 51-001

Subsurface soil, fill, and tuff samples were collected in 2008 at AOC 51-001, as directed by the investigation work plan (LANL 2007, 102622). Samples were collected either by hand-auger or by core-barrel sampling with a drill rig. All samples were screened for organic vapors and for alpha and beta/gamma radioactivity at the time they were collected. The samples were submitted through the SMO

for analysis at off-site contract laboratories, and the sampling locations were surveyed using DGPS (Appendix D). The sample collection and screening methods are described in Appendix C.

The sampling locations at AOC 51-001 are shown in Figure 6.2-1. Four samples were collected from two locations beneath the former inlet and outlet drainline connections to the former septic tank. Samples were collected from 0 to 1.0 ft and 2.0 to 3.0 ft beneath the former inlet and outlet drainline connections to the septic tank. Six samples were collected at three locations from two depth intervals beneath the septic tank footprint. Four tuff samples were collected from two boreholes next to the seepage pit and analyzed for VOCs, SVOCs, TAL metals, cyanide, nitrates, isotopic plutonium, tritium, and isotopic uranium. Table 6.1-1 provides a summary of the sampling locations, sampling depths, and analytical suites requested.

6.2.2 Analytical Results for AOC 51-001

Inorganic Chemicals

Inorganic chemicals were detected above BVs, had DLs above BVs, or were detected but have no BVs at AOC 51-001 (Figure 6.2-2). Table 6.2-1 lists, by sample, the concentrations of inorganic chemicals detected above BVs, detected with no BVs, or with DLs above BVs. Figure 6.2-2 shows the sampling locations where inorganic chemicals were detected or detected above BVs.

The inorganic COPCs for AOC 51-001 are identified in Appendix B, section B-5.1, and include antimony, arsenic, barium, cadmium, chromium, mercury, nitrate, selenium, and silver.

Organic Chemicals

No organic chemicals were detected in the samples collected at AOC 51-001 in 2008; however, organic chemicals were detected in samples collected during the 2001 VCA. Table 6.2-2 lists, by sample, the concentrations of detected organic chemicals. Figure 2.2-2 shows sampling locations where organic chemicals were detected.

The organic COPCs for AOC 51-001 are identified in Appendix B, section B-5.2, and include bromomethane, butanone[-2], and trichlorofluoromethane.

Radionuclides

Radionuclides were detected or detected above BVs/fallout values (FVs) at AOC 51-001. Table 6.2-3 lists, by sample, the concentrations of radionuclides either detected or detected above BVs/FVs. Figure 6.2-3 shows sampling locations where radionuclides were detected or detected above BVs/FVs.

The radionuclide COPCs for AOC 51-001 are identified in Appendix B, section B-5.3, and include cesium-137, tritium, and uranium-235/236.

6.3 AOC 54-007(d)

6.3.1 Sampling at AOC 54-007(d)

Subsurface soil, fill, and tuff samples were collected in 2008 at AOC 54-007(d), as directed by the investigation work plan (LANL 2007, 102622). Samples were collected either by hand-auger or by core-barrel sampling with a drill rig. All samples were screened for organic vapors and for alpha and beta/gamma radioactivity at the time they were collected. The samples were submitted through the SMO

for analysis at off-site contract laboratories, and the sampling locations were surveyed using DGPS (Appendix D). The sample collection and screening methods are described in Appendix C.

The sampling locations at AOC 54-007(d) are shown in Figure 6.3-1. Four samples were collected from two locations beneath the former inlet and outlet drainline connections to the former septic tank. Samples were collected from 0 to 1.0 ft and 2.0 to 3.0 ft beneath the former inlet and outlet drainline connections to the septic tank. Six samples were collected at three locations from two depth intervals beneath the septic tank footprint. Twenty-four samples were collected from 12 locations beneath the drain field. The samples were analyzed for VOCs, SVOCs, TAL metals, cyanide, nitrates, and isotopic uranium. Table 6.1-1 provides a summary of the sampling locations, sampling depths, and analytical suites requested.

6.3.2 Analytical Results for AOC 54-007(d)

Inorganic Chemicals

Inorganic chemicals were detected above BVs, had DLs above BVs, or were detected but have no BVs at AOC 54-007(d). Table 6.3-1 lists, by sample, the concentrations of inorganic chemicals detected above BVs, detected with no BVs, or with DLs above BVs. Figure 6.3-2 shows the sampling locations where inorganic chemicals were detected or detected above BVs.

The inorganic COPCs for AOC 54-007(d) are identified in Appendix B, section B-6.1, and include antimony, arsenic, nitrate, and zinc.

Organic Chemicals

Organic chemicals were detected at AOC 54-007(d). Table 6.3-2 lists, by sample, the concentrations of detected organic chemicals. Figure 6.3-3 shows the sampling locations where organic chemicals were detected.

The organic COPCs for AOC 54-007(d) are identified in Appendix B, section B-6.2, and include Aroclor-1242, Aroclor-1254, Aroclor-1260, benzene, bis(2-ethylhexyl)phthalate, bromomethane, butanone[2-], isopropylbenzene, isopropyltoluene[4-], methyl-2-pentanone[4-], methylene chloride, toluene, trichlorofluoromethane, and trimethylbenzene[1,2,4-].

Radionuclides

Isotopic uranium was not detected above BVs at AOC 54-007(d).

7.0 CONCLUSIONS

All data used to support site decisions included in the final reporting data sets meet current quality requirements. Analytical data collected during 1995 RFIs and 2001 VCAs conducted at AOCs 51-001 and 54-007(d) were revalidated to present data-quality standards, and those data meeting current standards were combined with data from the 2008 investigation. Conclusions from the investigations are presented first, followed by the conclusions from the risk screening assessments.

Screening-level human health and ecological risk assessments were performed to support decisions for the four Middle Cañada del Buey Aggregate Area sites. The potential risks associated with COPCs were assessed under the construction worker scenario for all sites and the industrial scenario for AOCs 18-005(b) and 18-005(c). All sites were also assessed under a residential scenario as required by

the Consent Order. The screening assessment results indicate no additional investigation or remediation is required. Details of the risk assessment methods, scenario parameters, supporting data, risk calculations, and results are presented in Appendix H.

7.1 AOC 18-005(b)

7.1.1 Nature and Extent of Soil Contamination at AOC 18-005(b)

Four locations were sampled at AOC 18-005(b). The nature and extent of the COPCs identified in section 6.1.3 above have been defined for the site (Appendix B). No additional sampling is required. The data indicate that the concentrations of inorganic COPCs are not indicative of a release and may be attributed to localized natural variability. No organic chemicals were detected.

7.1.2 Summary of Human Health Risk Screening for AOC 18-005(b)

A human health risk screening assessment was conducted to determine if COPCs at AOC 18-005(b) pose a potential unacceptable risk to human receptors.

A hazard quotient (HQ) was generated for each noncarcinogenic COPC by dividing the exposure point concentration (EPC) by the appropriate SSL. The HQs were summed to generate an HI, which was compared with the NMED target HI of 1.0 (NMED 2006, 092513). There were no carcinogenic or radionuclide COPCs at AOC 18-005(b).

The EPCs for noncarcinogenic COPCs did not exceed industrial SSLs. The industrial HI is 0.004, which is less than the NMED target HI of 1.0 (NMED 2006, 092513).

The EPCs for noncarcinogenic COPCs did not exceed construction worker SSLs. The construction worker HI is 0.01, which is less than the NMED target HI of 1.0 (NMED 2006, 092513).

The EPCs for noncarcinogenic COPCs did not exceed their respective residential SSLs. The residential HI is 0.05, which is less than the NMED target HI of 1.0 (NMED 2006, 092513).

7.1.3 Summary of Ecological Risk Screening Assessment

An ecological screening assessment was conducted to determine whether chemicals of potential ecological concern (COPECs) at AOC 18-005(b) pose a potential unacceptable risk to ecological receptors. Based on the ecological screening assessment, two COPECs (antimony and barium) were identified at AOC 18-005(b). Receptors were evaluated for potential risk using the following lines of evidence: minimum ESL comparisons, HI analyses, comparison to background, relative toxicity, infrequency of detection, and comparisons to previous field and laboratory canyon investigations. The results of the ecological risk screening assessment indicate no potential risk to ecological receptors at the site.

7.2 AOC 18-005(c)

7.2.1 Nature and Extent of Soil Contamination at AOC 18-005(c)

Four locations were sampled at AOC 18-005(c). The nature and extent of the COPCs identified in section 6.1.4 above have been defined for the site (Appendix B). No additional sampling is required. The data indicate that the concentrations of inorganic COPCs are not indicative of a release and may be attributed to localized natural variability. No organic chemicals were detected.

7.2.2 Summary of Human Health Risk Screening for AOC 18-005(c)

A human health screening assessment was conducted to determine if COPCs at AOC 18-005(c) pose a potential unacceptable risk to human receptors.

The EPCs for carcinogenic COPCs were divided by the appropriate SSL and multiplied by 1×10^{-5} to estimate the excess lifetime excess cancer risk. The total excess cancer risk was compared to the NMED target risk level of 1×10^{-5} (NMED 2006, 092513). An HQ was generated for each noncarcinogenic COPC by dividing the EPC by the appropriate SSL. The HQs were summed to generate an HI, which was compared with the NMED target HI of 1.0 (NMED 2006, 092513). There were no radionuclide COPCs at AOC 18-005(c).

There were no carcinogenic COPCs for the industrial scenario, and carcinogenic risk was not evaluated. The EPCs for noncarcinogenic COPCs did not exceed industrial SSLs. The industrial HI is 0.004, which is less than the NMED target HI of 1.0 (NMED 2006, 092513).

The EPCs for carcinogenic and noncarcinogenic COPCs did not exceed construction worker SSLs. The total excess cancer risk for the construction worker scenario is 9×10^{-9}, which is less than the NMED target risk of 1×10^{-5} (NMED 2006, 092513). The construction worker HI is 0.09, which is less than the NMED target HI of 1.0 (NMED 2006, 092513).

The EPCs for carcinogenic and noncarcinogenic COPCs did not exceed residential SSLs, except for arsenic. The total excess cancer risk for the residential scenario is 2×10^{-5}, which is slightly above the NMED target risk of 1×10^{-5} (NMED 2006, 092513). Although the risk is primarily from arsenic, the arsenic concentrations and EPC are similar to background. The total excess cancer risk for the residential scenario without arsenic is 4×10^{-8}. The residential HI is 0.05, which is less than the NMED target HI of 1.0 (NMED 2006, 092513).

7.2.3 Summary of Ecological Risk Screening Assessment

An ecological screening assessment was conducted to determine whether COPECs at AOC 18-005(c) pose a potential unacceptable risk to ecological receptors. Based on the ecological screening assessment, several COPECs (antimony, arsenic, barium, and chromium) were identified at AOC 18-005(c). Receptors were evaluated for potential risk using the following lines of evidence: minimum ESL comparisons, HI analyses, comparison to background, relative toxicity, infrequency of detection, and comparisons to previous field and laboratory canyon investigations. The results of the ecological risk screening assessment indicate no potential risk to ecological receptors at the site.

7.3 AOC 51-001

7.3.1 Nature and Extent of Soil Contamination at AOC 51-001

Eight locations were sampled at AOC 51-001. The nature and extent of the COPCs identified in section 6.2.3 above have been defined for the site (Appendix B). No additional sampling is required. The data indicate that the concentrations of inorganic COPCs are not indicative of a release and may be attributed to localized natural variability. Three VOCs were detected at concentrations below EQLs at two locations. None of the VOCs were detected in the samples collected from the same sampling locations in 2008. No SVOCs, pesticides, or PCBs were detected. Radionuclides were detected or detected slightly above BV in four samples at four locations. Concentrations are not indicative of a release and decreased with depth at two locations.

7.3.2 Summary of Human Health Risk Screening for AOC 51-001

A human health screening assessment was conducted to determine if COPCs at AOC 51-001 pose a potential unacceptable risk to human receptors.

A HQ was generated for each noncarcinogenic COPC by dividing the EPC by the appropriate SSL. The HQs were summed to generate an HI, which was compared with the NMED target HI of 1.0 (NMED 2006, 092513). The dose for each radionuclide COPC was estimated by dividing the EPC by the appropriate SAL and multiplying by 15 mrem/yr. Doses from individual COPCs were summed to estimate total dose.

There were no carcinogenic COPCs for the construction worker scenario, and carcinogenic risk was not evaluated. The EPCs for noncarcinogenic COPCs did not exceed construction worker SSLs. The construction worker HI is approximately 0.009, which is below NMED's target level of 1.0 (NMED 2006, 092513). The construction worker dose is approximately 0.1 mrem/yr, which is below DOE's target dose of 15 mrem/yr (DOE 2000, 067489). This dose corresponds to a radiological risk of 1×10^{-7} based on a comparison to EPA radionuclide preliminary remediation goals (PRGs) for an outdoor worker (http://epa-prgs.ornl.gov/radionuclides/download/rad_master_prg_table_pci.xls).

There were no carcinogenic COPCs for the residential scenario, and carcinogenic risk was not evaluated. The EPCs for noncarcinogenic COPCs did not exceed residential SSLs. The residential HI is approximately 0.03, which is below NMED's target level of 1.0 (NMED 2006, 092513). The residential dose is approximately 0.3 mrem/yr, which is below DOE's target of 15 mrem/yr (DOE 2000, 067489). This dose corresponds to a radiological risk of 5×10^{-7} based on a comparison to EPA radionuclide PRGs for a resident (http://epa-prgs.ornl.gov/radionuclides/download/rad_master_prg_table_pci.xls).

7.3.3 Summary of Ecological Risk Screening Assessment

No COPCs were detected or were above background within the depth interval of 0 to 5 ft bgs used to evaluate potential ecological risk. Therefore, no complete pathways exist for exposure of ecological receptors at AOC 51-001, and no screening evaluation was conducted.

7.4 AOC 54-007(d)

7.4.1 Nature and Extent of Soil Contamination at AOC 54-007(d)

Seventeen locations were sampled at AOC 54-007(d). The nature and extent of the COPCs identified in section 6.3.3 above have been defined for the site (Appendix B). No additional sampling is required. The data indicate the concentrations of inorganic COPCs are not indicative of a release and may be attributed to localized natural variability. PCBs were detected at trace concentrations that decreased with depth at a majority of the sample locations. The distribution of trace PCB concentrations is not indicative of a release from this AOC because PCBs were not detected in the septic tank contents (LANL 2001, 071473). The PCBs may have been present in the fill material at the site. The other organic COPCs at the site were detected at concentrations below the EQLs and decreased with depth at most locations; the majority of these detects were not duplicated in the 2008 investigation samples. No radionuclides were detected above BV.

7.4.2 Summary of Human Health Risk Screening for AOC 54-007(d)

A human health screening assessment was conducted to determine if COPCs at AOC 54-007(d) pose a potential unacceptable risk to human receptors.

The EPCs for carcinogenic COPCs were divided by the appropriate SSL and multiplied by 1×10^{-5} to estimate the excess lifetime cancer risk. The total excess cancer risk was compared to the NMED target risk level of 1×10^{-5} (NMED 2006, 092513). An HQ was generated for each noncarcinogenic COPC by dividing the EPC by the appropriate SSL. The HQs were summed to generate an HI, which was compared with the NMED target HI of 1.0 (NMED 2006, 092513). There were no radionuclide COPCs for AOC 54-007(d).

The EPCs for carcinogenic and noncarcinogenic COPCs did not exceed their respective construction worker SSLs. The total excess cancer risk under the construction-worker scenario is approximately 2×10^{-7}, which is below the NMED target risk of 1×10^{-5} (NMED 2006, 092513). The construction worker HI is approximately 0.2, which is below NMED's target level of 1.0 (NMED 2006, 092513).

The EPCs for carcinogenic and noncarcinogenic COPCs did not exceed their respective residential SSLs, except for arsenic. The total excess cancer risk for the residential scenario is 2×10^{-5}, which is slightly above the NMED target risk of 1×10^{-5} (NMED 2006, 092513). Although the risk is primarily from arsenic, the arsenic concentrations and EPC are similar to background. The total excess cancer risk for the residential scenario without arsenic is 6×10^{-7}. The residential HI is 0.2, which is less than the NMED target HI of 1.0 (NMED 2006, 092513).

7.4.3 Summary of Ecological Risk Screening Assessment

An ecological screening assessment was conducted to determine whether COPECs at AOC 54-007(d) pose a potential unacceptable risk to ecological receptors. Based on the ecological screening assessment, no COPECs were identified for AOC 54-007(d), and there is no potential unacceptable risk to ecological receptors.

8.0 RECOMMENDATIONS

The determination of site status is, in part, based on the results of the risk-screening assessments. The residential scenario is the only scenario for which corrective action complete without controls is applicable; that is, no additional corrective action or controls are necessary. Other scenarios (i.e., industrial, construction worker, and recreational) are evaluated to determine whether a site's status is corrective action complete with controls (that is, some type of institutional controls must be in place to ensure that the land use remains consistent with the site cleanup levels).

Based on information and data presented in this investigation report, remediation and characterization activities are recommended as complete at the four Middle Cañada del Buey Aggregate Area sites. The following recommendations are made for AOCs 18-005(b), 18-005(c), 51-001, and 54-007(d).

- AOC 18-005(b)—The nature and extent of contamination are defined, and there is no unacceptable risk or dose under a residential scenario. Therefore, AOC 18-005(b) is recommended for corrective actions complete without controls.
- AOC 18-005(c)—The nature and extent of contamination are defined, and there is no unacceptable risk or dose under a residential scenario. Therefore, AOC 18-005(c) is recommended for corrective actions complete without controls.
- AOC 51-001—The nature and extent of contamination are defined, and there is no unacceptable risk or dose under a residential scenario. Therefore, AOC 51-001 is recommended for corrective actions complete without controls.

- AOC 54-007(d)—The nature and extent of contamination are defined, and there is no unacceptable risk or dose under a residential scenario. Therefore, AOC 54-007(d) is recommended for corrective actions complete without controls.

The Laboratory is requesting a Certificate of Completion (corrective action complete without controls) from NMED for the above sites. Because these sites do not pose a potential unacceptable risk to human health under a residential scenario and no potential risk to the environment, neither site controls nor future actions are necessary.

9.0 REFERENCES AND MAP DATA SOURCES

9.1 References

The following list includes all documents cited in this report. Parenthetical information following each reference provides the author(s), publication date, and ER ID number. This information is also included in text citations. ER ID numbers 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; the U.S. Department of Energy–Los Alamos Site Office; the U.S. Environmental Protection Agency, Region 6; 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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NMED (New Mexico Environment Department), April 11, 2003. "Approval of RCRA Facility Investigation Report for Material Disposal Area H," New Mexico Environment Department letter to P. Nanos (LANL Interim Director), and D. Gregory (DOE-OLASO) from J. Young (NMED), Santa Fe, New Mexico. (NMED 2003, 075939)

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9.2 Map Data Sources

Communication Lines; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating, and Mapping Section; 08 August 2002; Development Edition of 05 January 2005.

Dirt Road Arcs; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating, and Mapping Section; Development Edition of 06 January 2005.

Hypsography, 20 and 100 Foot Contour Intervals; Los Alamos National Laboratory, ENV-Environmental Remediation and Surveillance Program; 1991.

LANL Technical Areas; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating, and Mapping Section; Development Edition of 05 January 2005.

Materials Disposal Areas; Los Alamos National Laboratory, ENV-Environmental Remediation and Surveillance Program; ER2004-0221; 1:2,500 Scale Data; 23 April 2004

Modeled Surface Drainage; Los Alamos National Laboratory, Environmental Restoration Project, ER2002-0591; 1:24,000 Scale Data; 23 August 2002.

Paved Road Arcs; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating, and Mapping Section; Development Edition of 06 January 2005.

Point Feature Locations of the Environmental Restoration Project Database; Los Alamos National Laboratory, ENV-Environmental Remediation and Surveillance Program, ER2005-0401; 16 June 2005.

Primary Electric Grid; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating, and Mapping Section; 06 January 2004; Development Edition of 05 January 2005.

Security and Industrial Fences and Gates; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating, and Mapping Section; 06 January 2004; Development Edition of 06 January 2005.

Sewer Line System; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating, and Mapping Section; Development Edition of 05 January 2005.

Structures, line feature data; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating, and Mapping Section; Development Edition of 22 June 2005.

Waste Storage Features; Los Alamos National Laboratory, ENV-Environmental Remediation and Surveillance Program, ER2005-0322; 1:2,500 Scale Data; 10 August 2005.

Water Lines; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating, and Mapping Section; Development Edition of 05 January 2005.

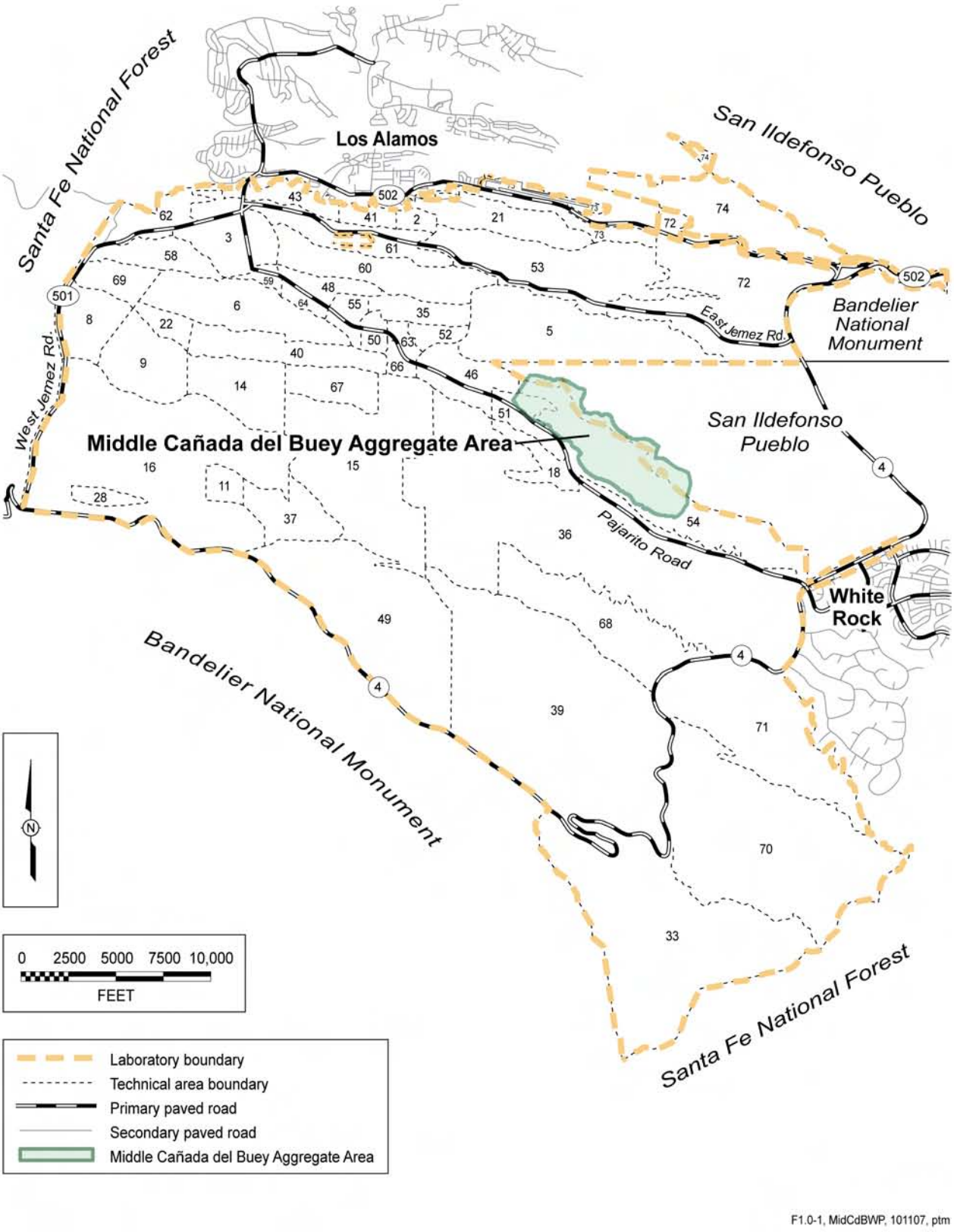


Figure 1.0-1 Middle Cañada del Buey Aggregate Area with respect to Laboratory TAs and surrounding land holdings

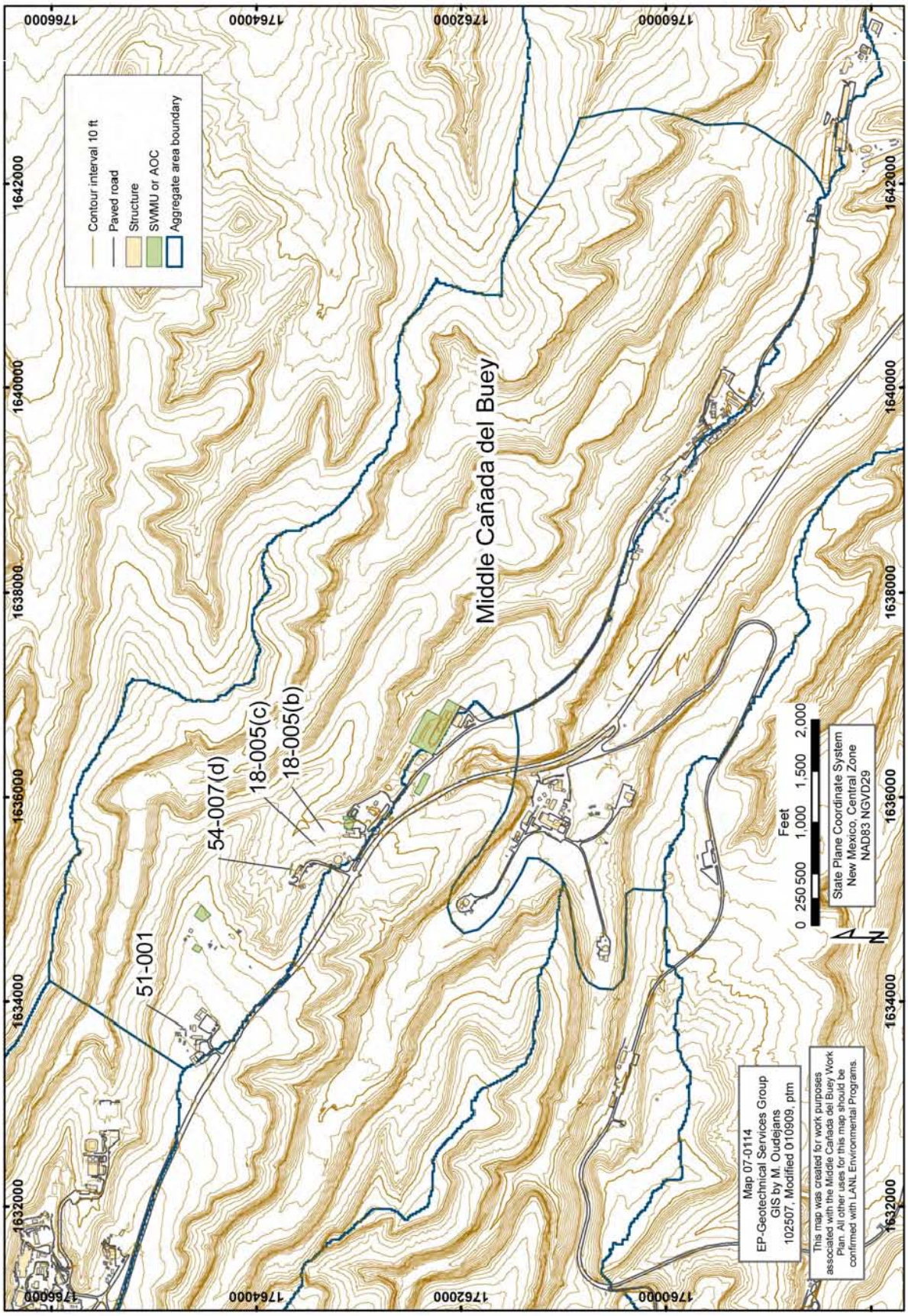


Figure 1.0-2 Locations of AOCs 18-005(b), 18-005(c), 51-001, and 54-007(d) within the Middle Cañada del Buey Aggregate Area

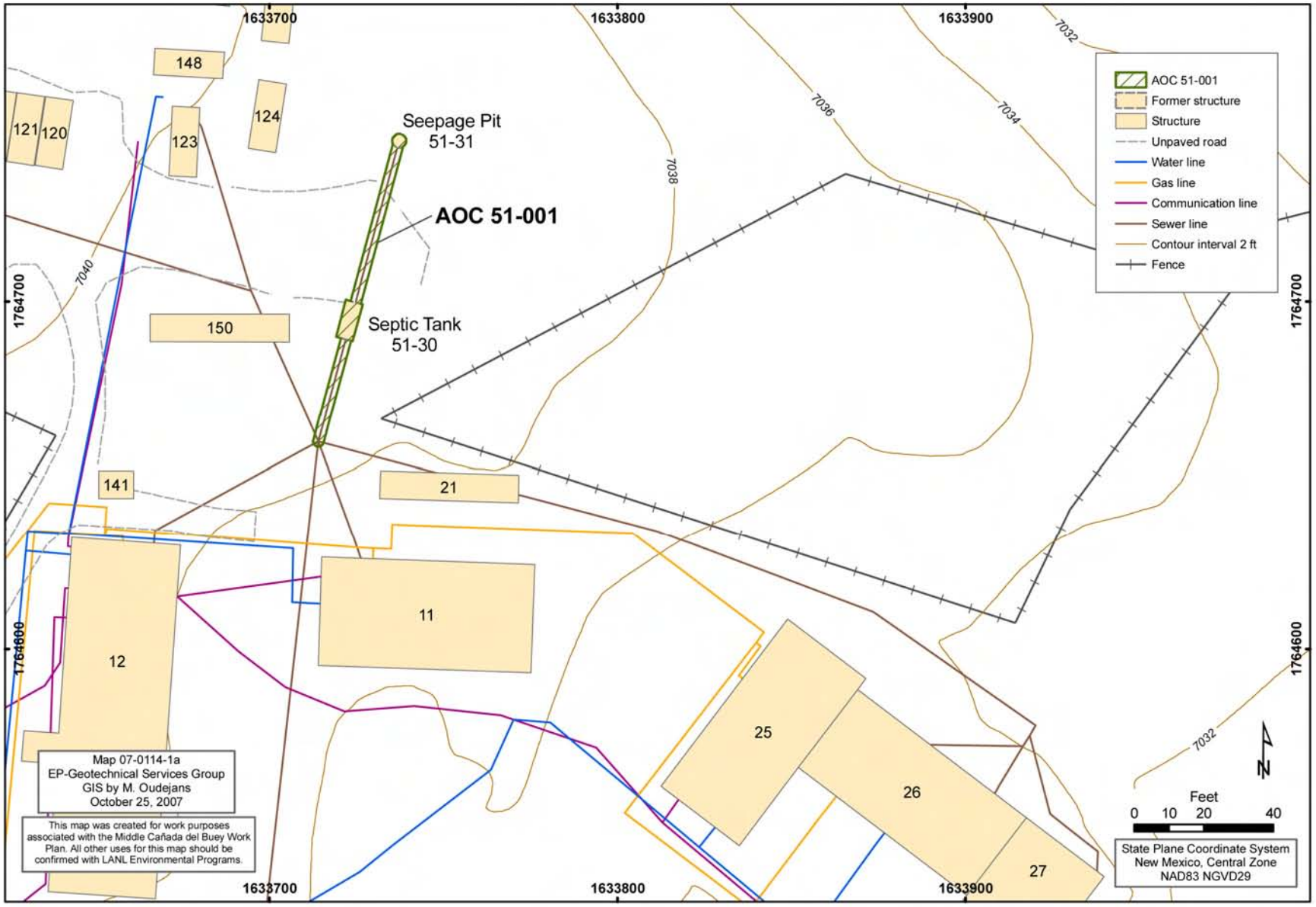


Figure 2.1-1 Location of AOC 51-001

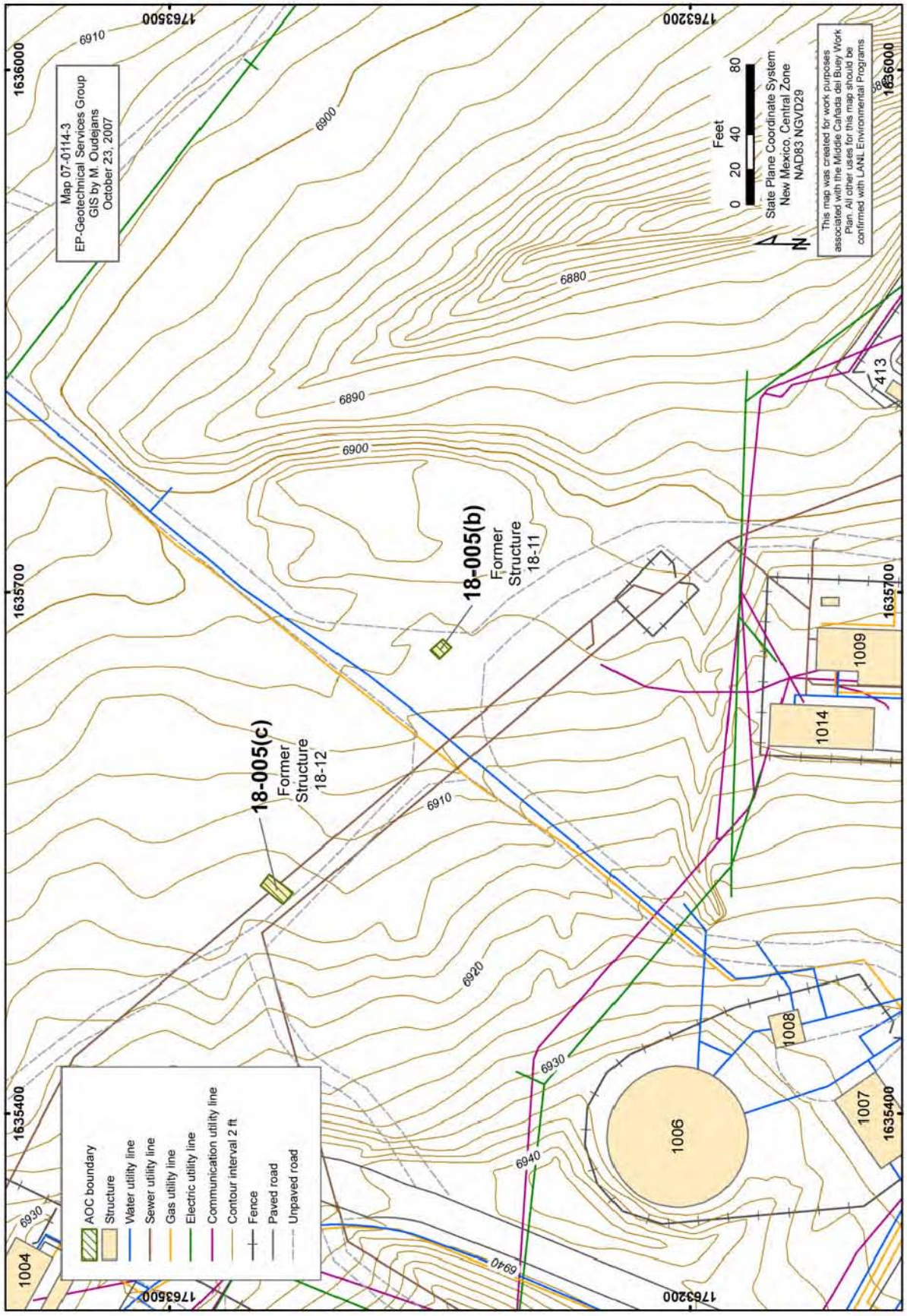


Figure 2.1-2 Locations of AOCs 18-005(b) and 18-005(c)

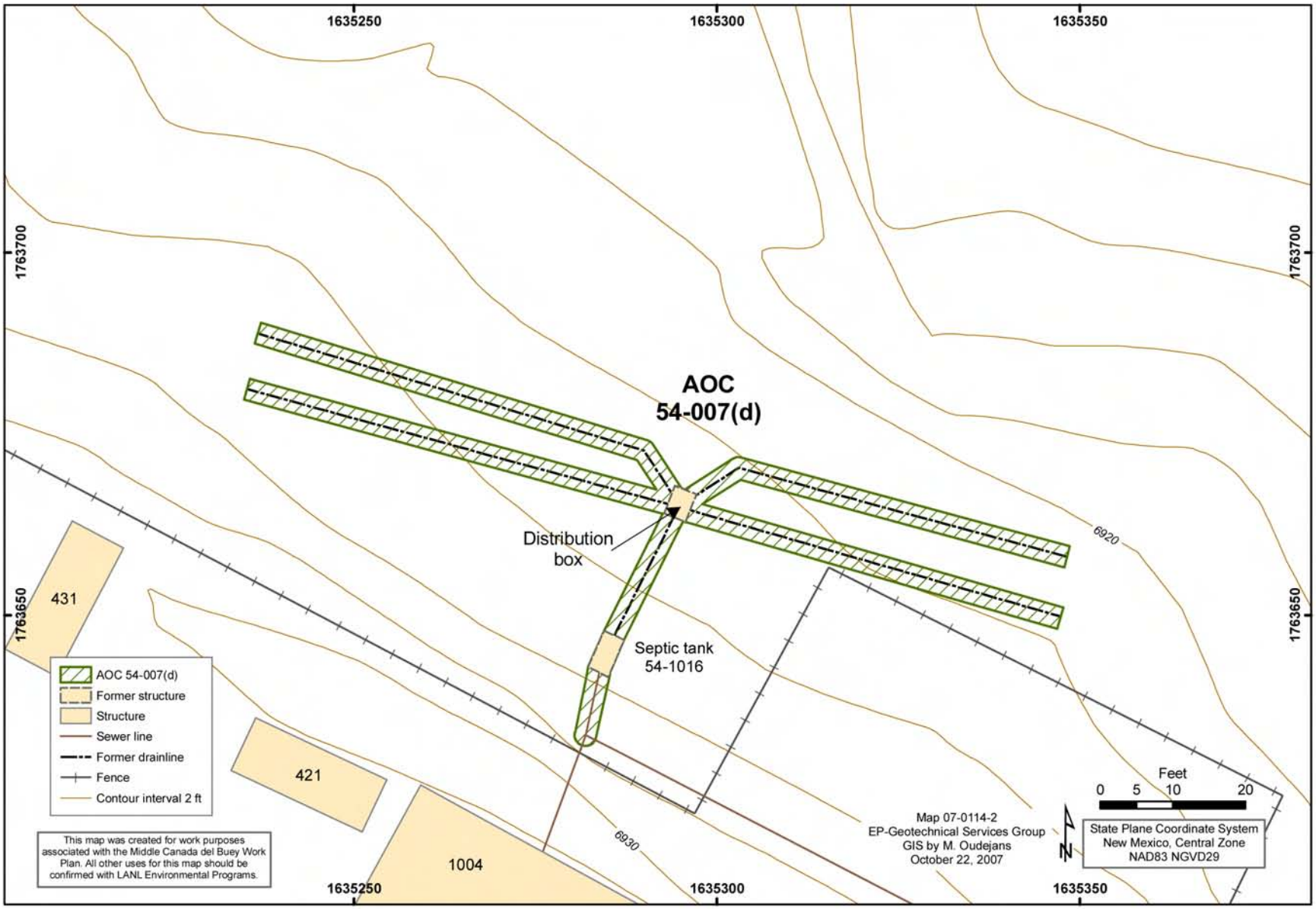


Figure 2.1-3 Location of AOC 54-007(d)

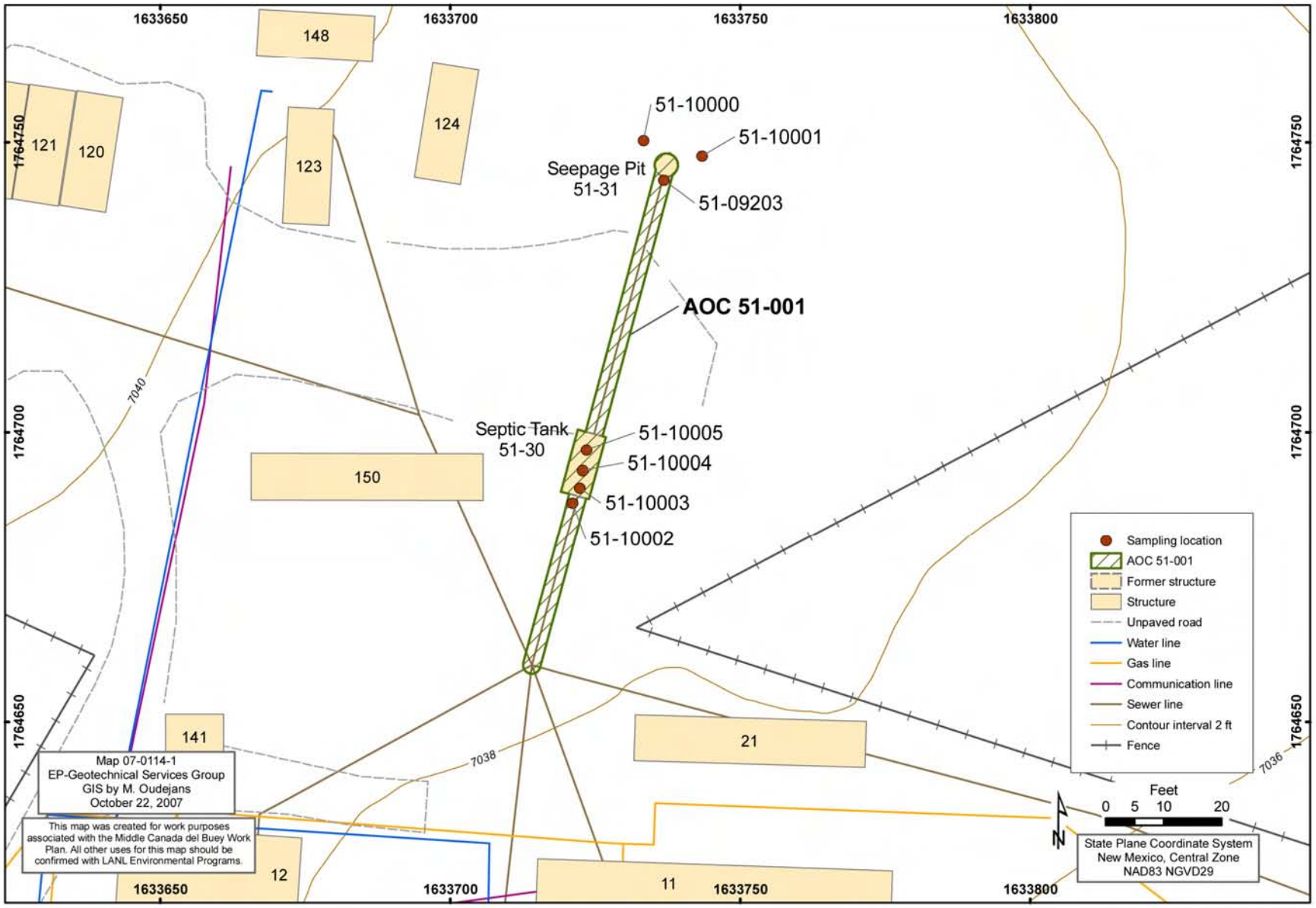


Figure 2.2-1 VCA sampling locations at AOC 51-001

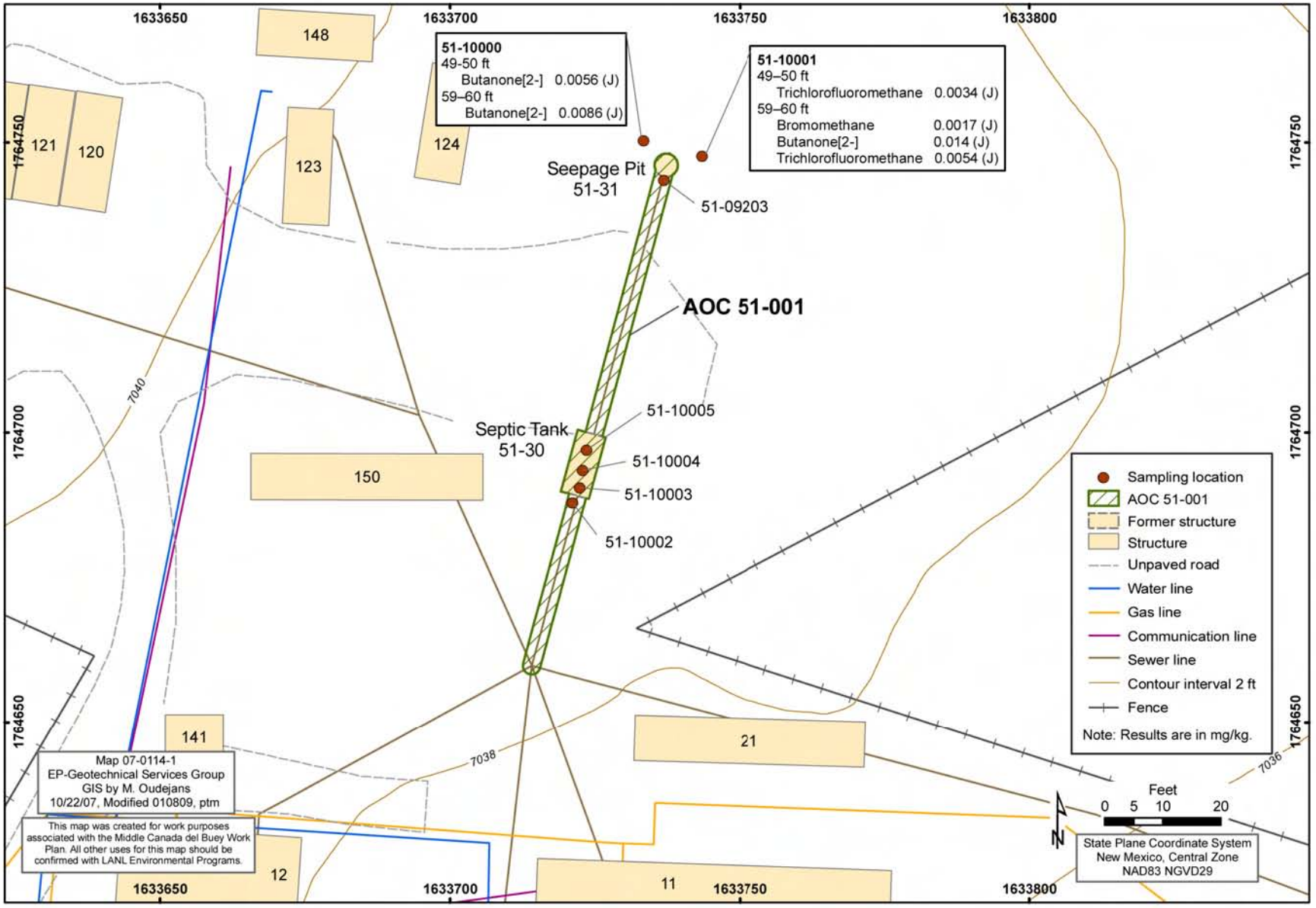


Figure 2.2-2 Organic chemicals detected at AOC 51-001 during VCA

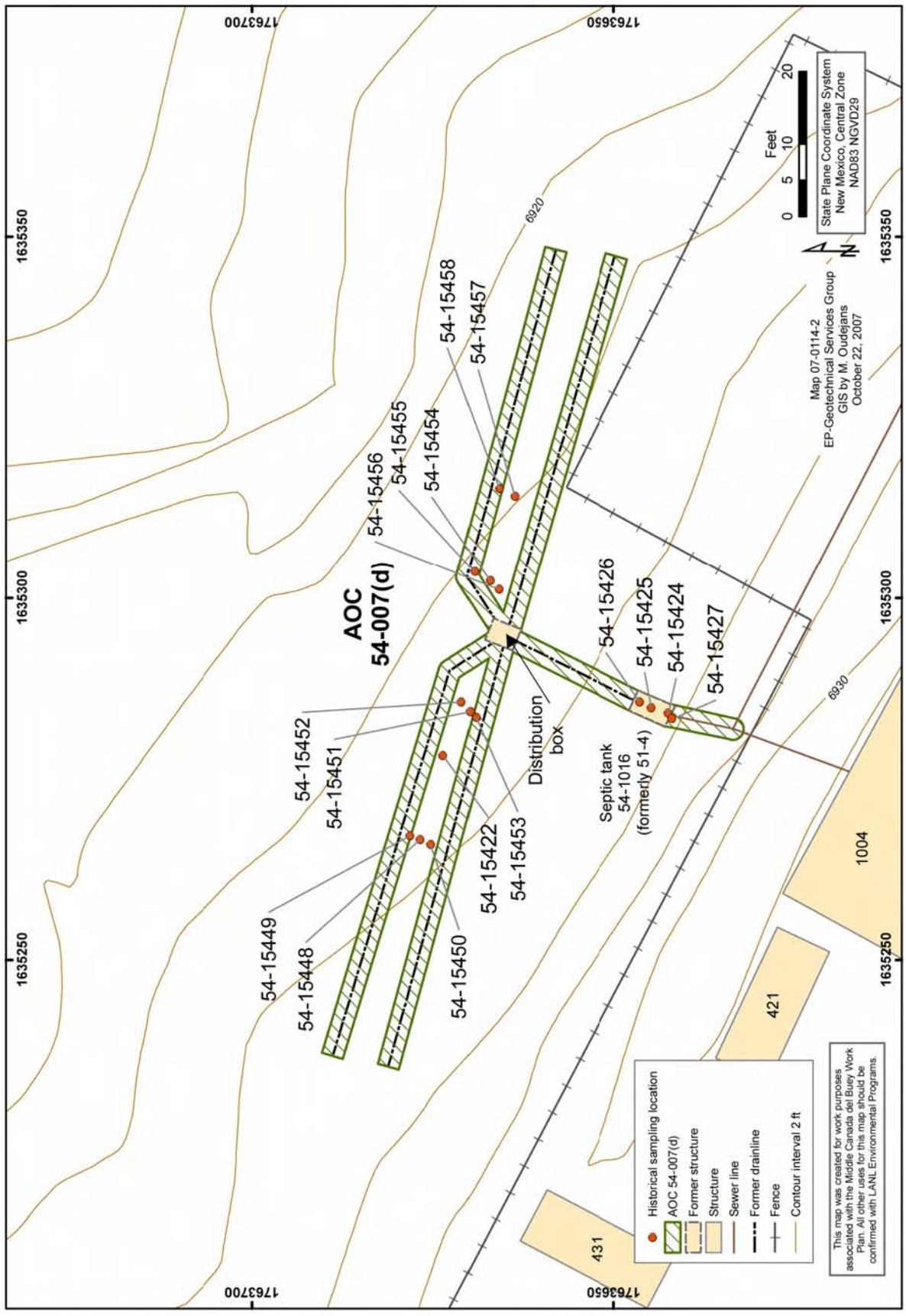


Figure 2.2-3 VCA sampling locations at AOC 54-007(d)

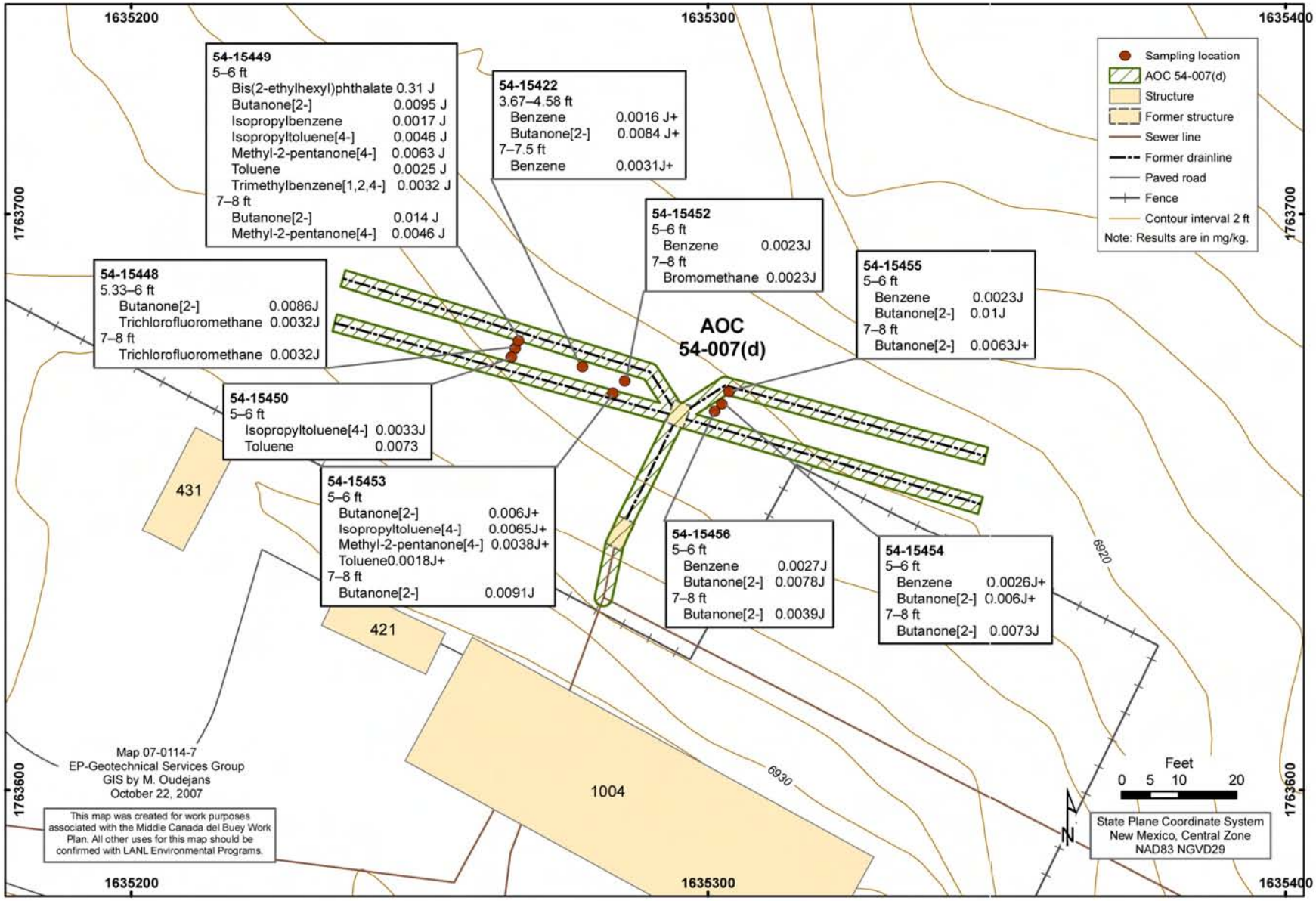


Figure 2.2-4 Organic chemicals detected at AOC 54-007(d) during VCA

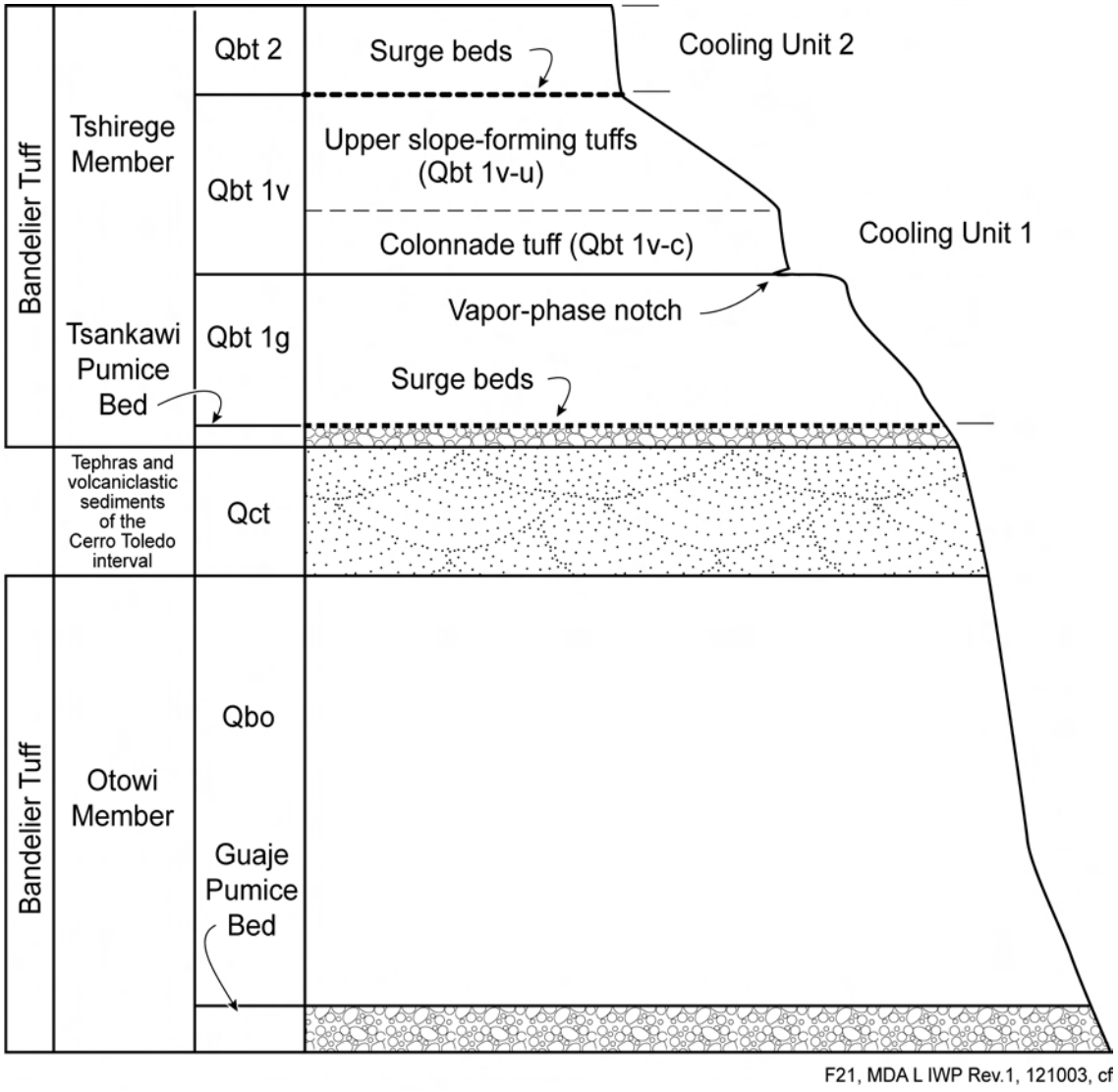


Figure 3.2-1 Generalized stratigraphy of Bandelier Tuff near TA-54

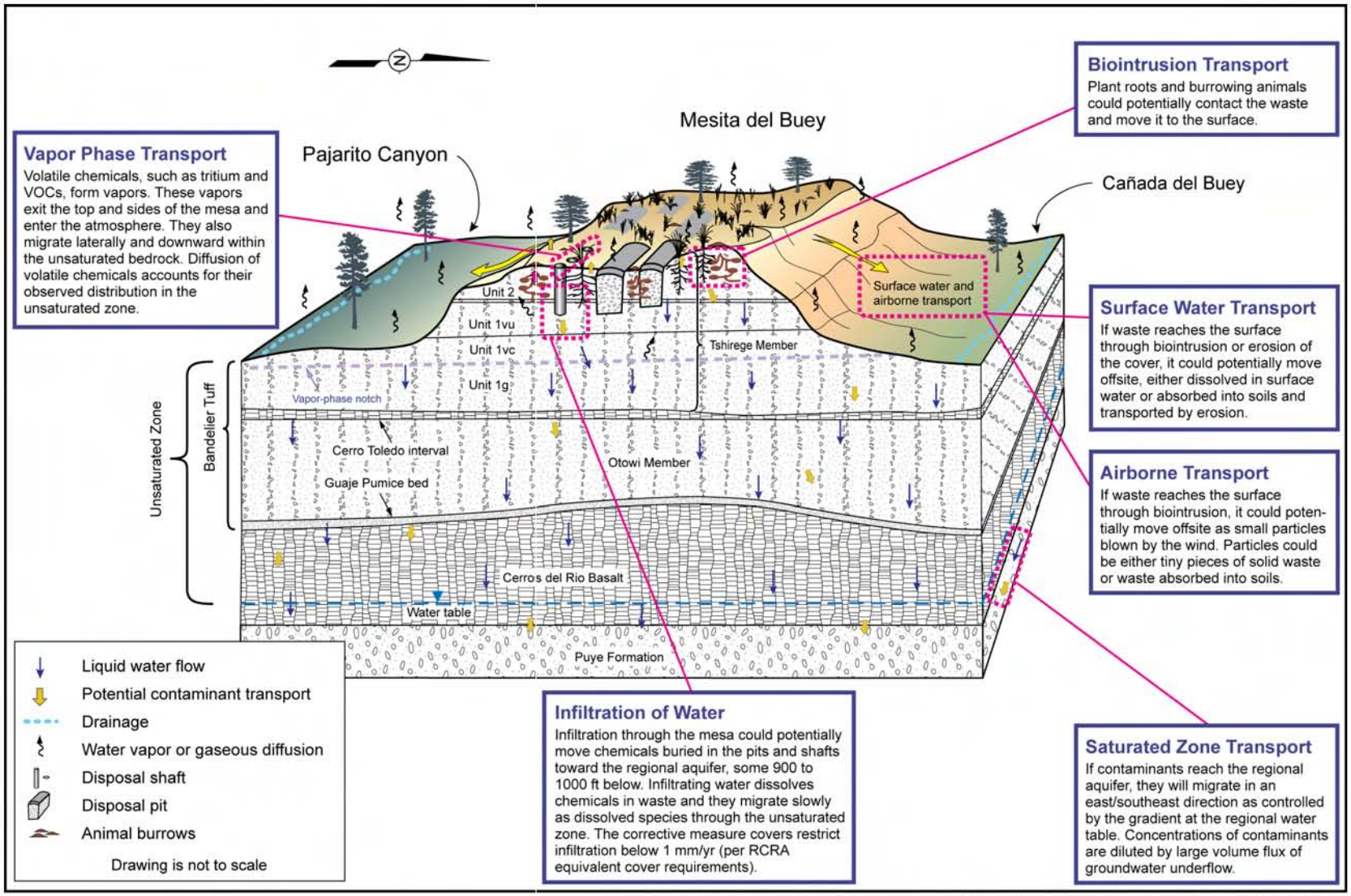


Figure 3.2-2 Hydrogeologic conceptual model

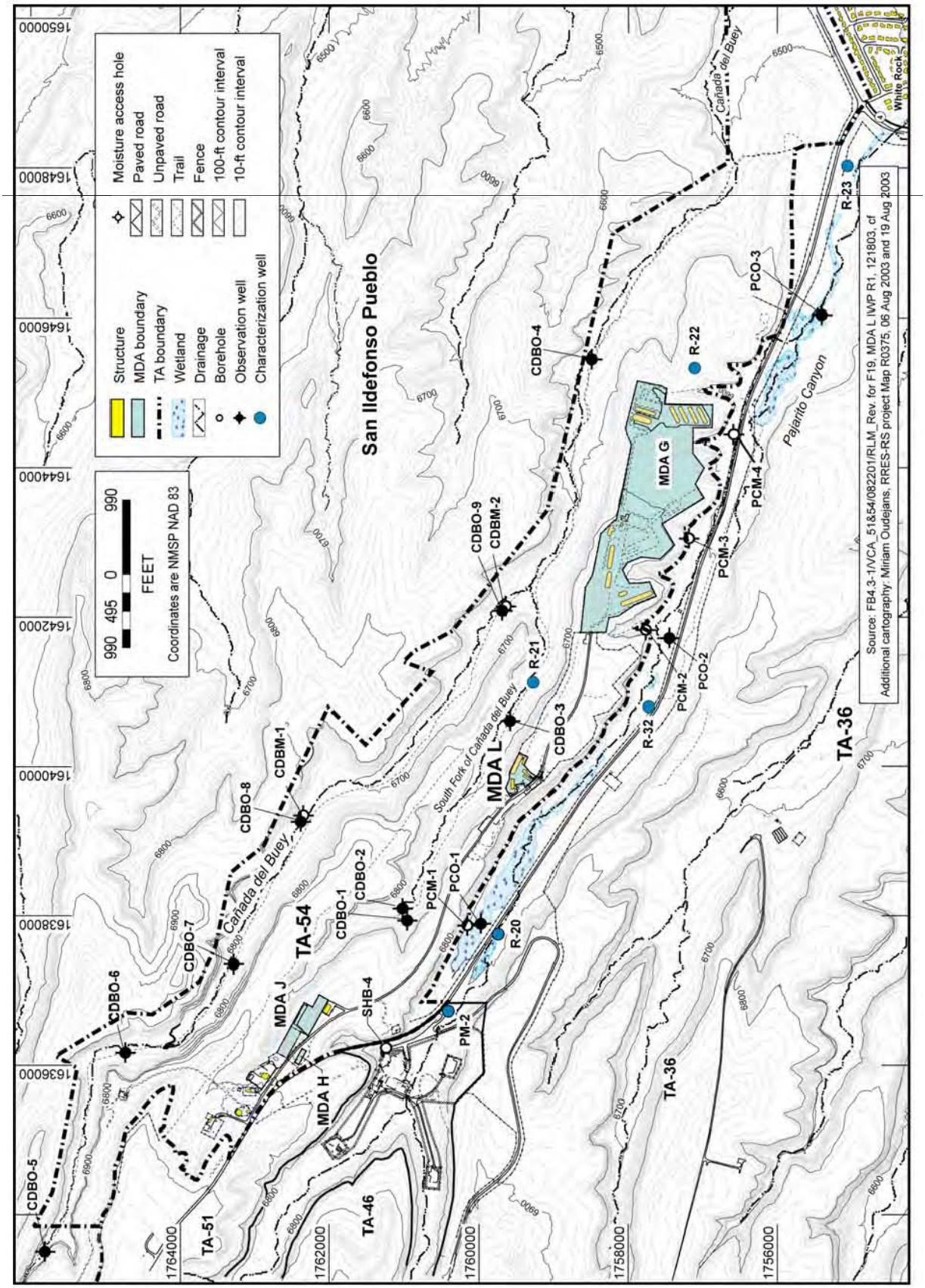
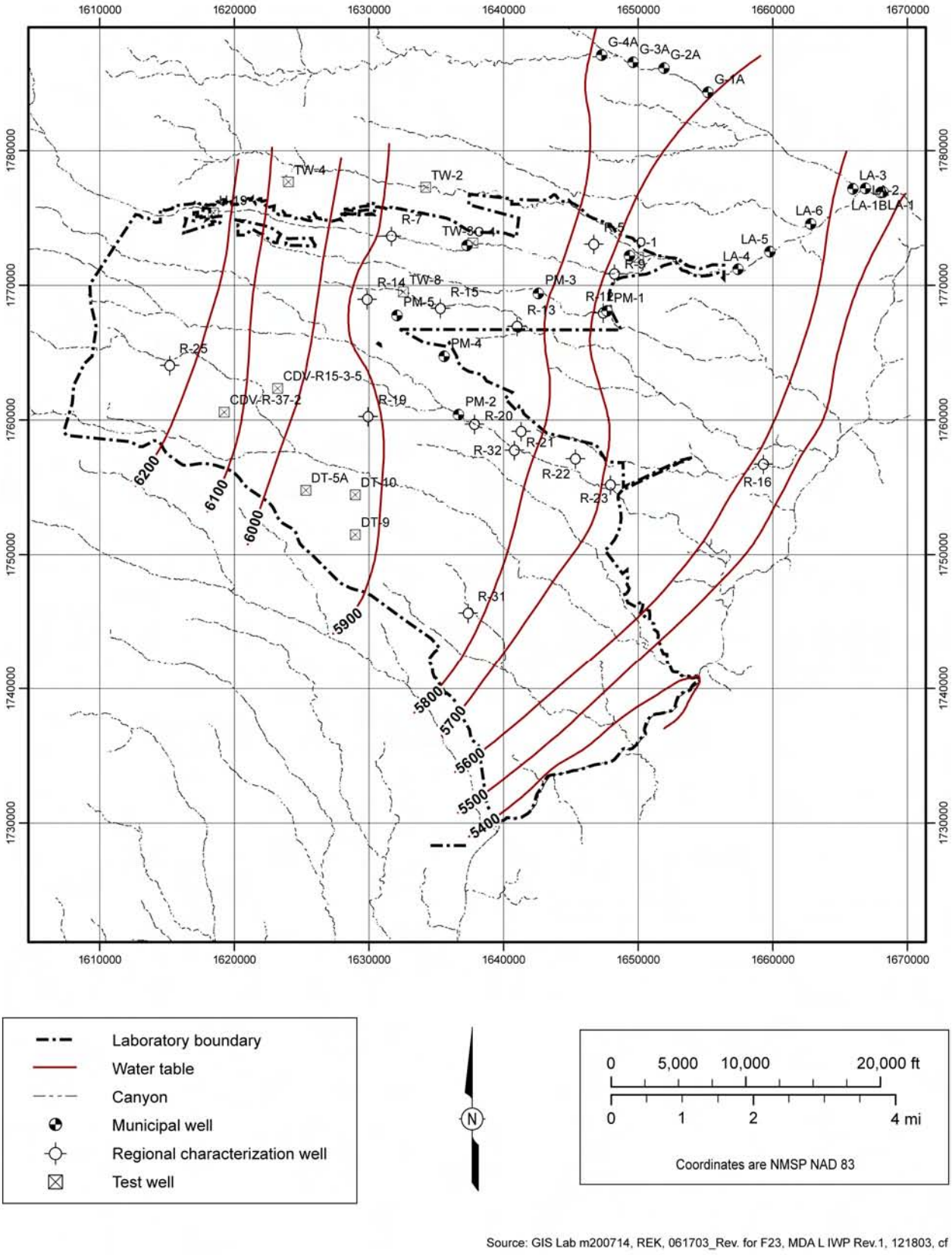


Figure 3.2-3 Locations of wells and boreholes near Middle Cañada del Buey Aggregate Area



Source: GIS Lab m200714, REK, 061703_Rev. for F23, MDA L IWP Rev.1, 121803, cf

Figure 3.2-4 Water table elevations at the Laboratory

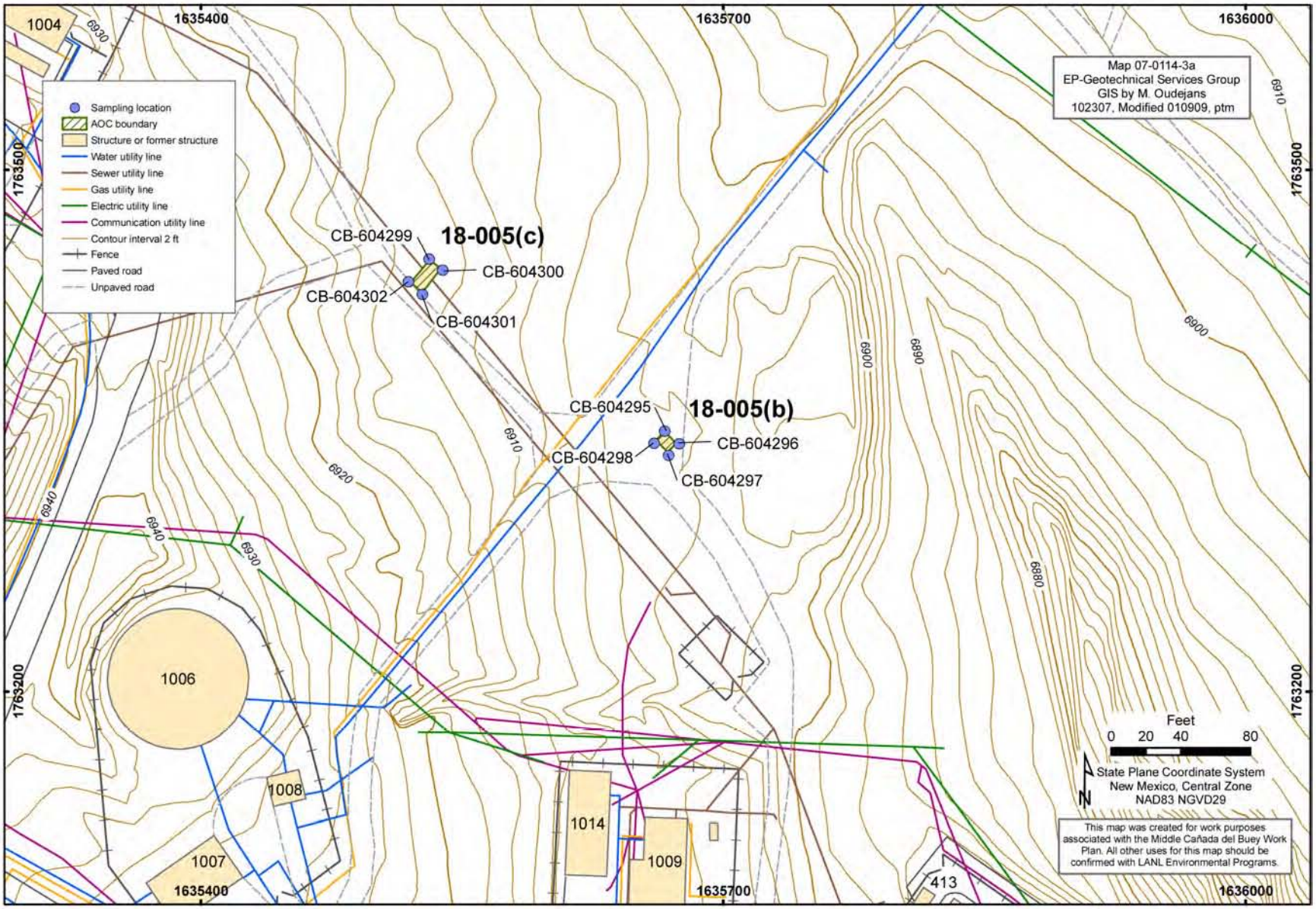


Figure 6.1-1 Sampling locations at AOCs 18-005(b) and 18-005(c)

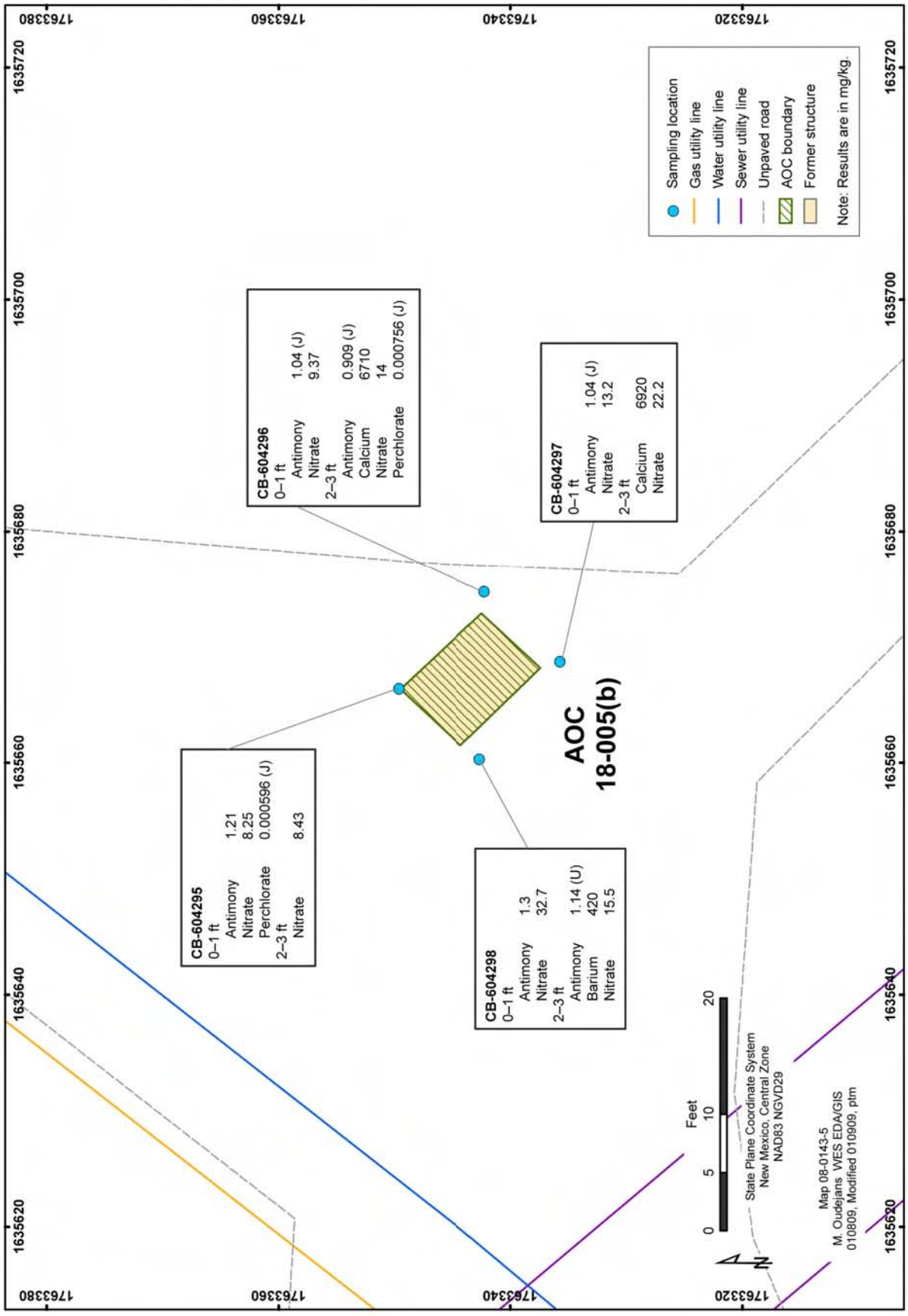


Figure 6.1-2 Inorganic chemicals above BVs at AOC 18-005(b)

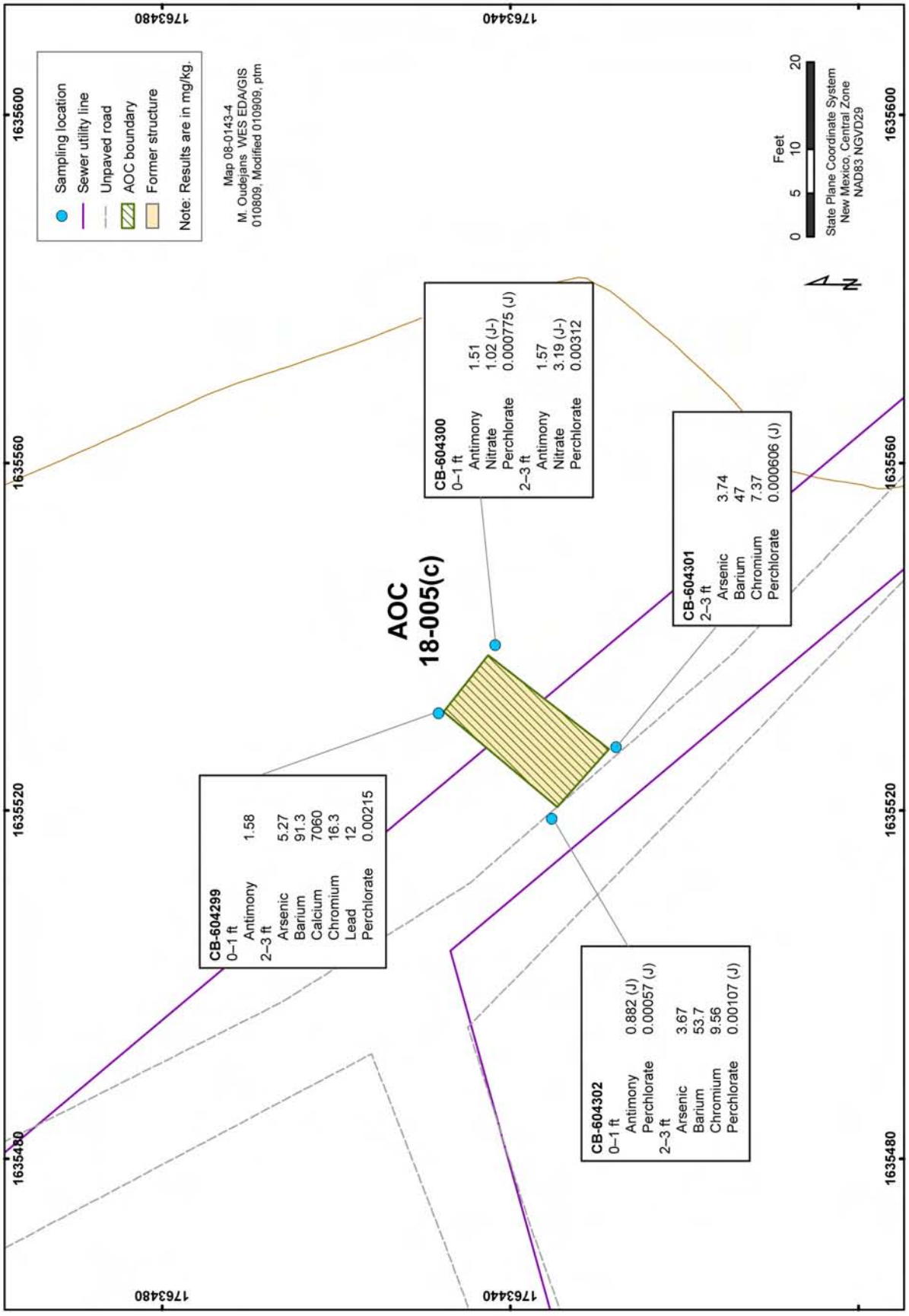


Figure 6.1-3 Inorganic chemicals above BVs at AOC 18-005(c)

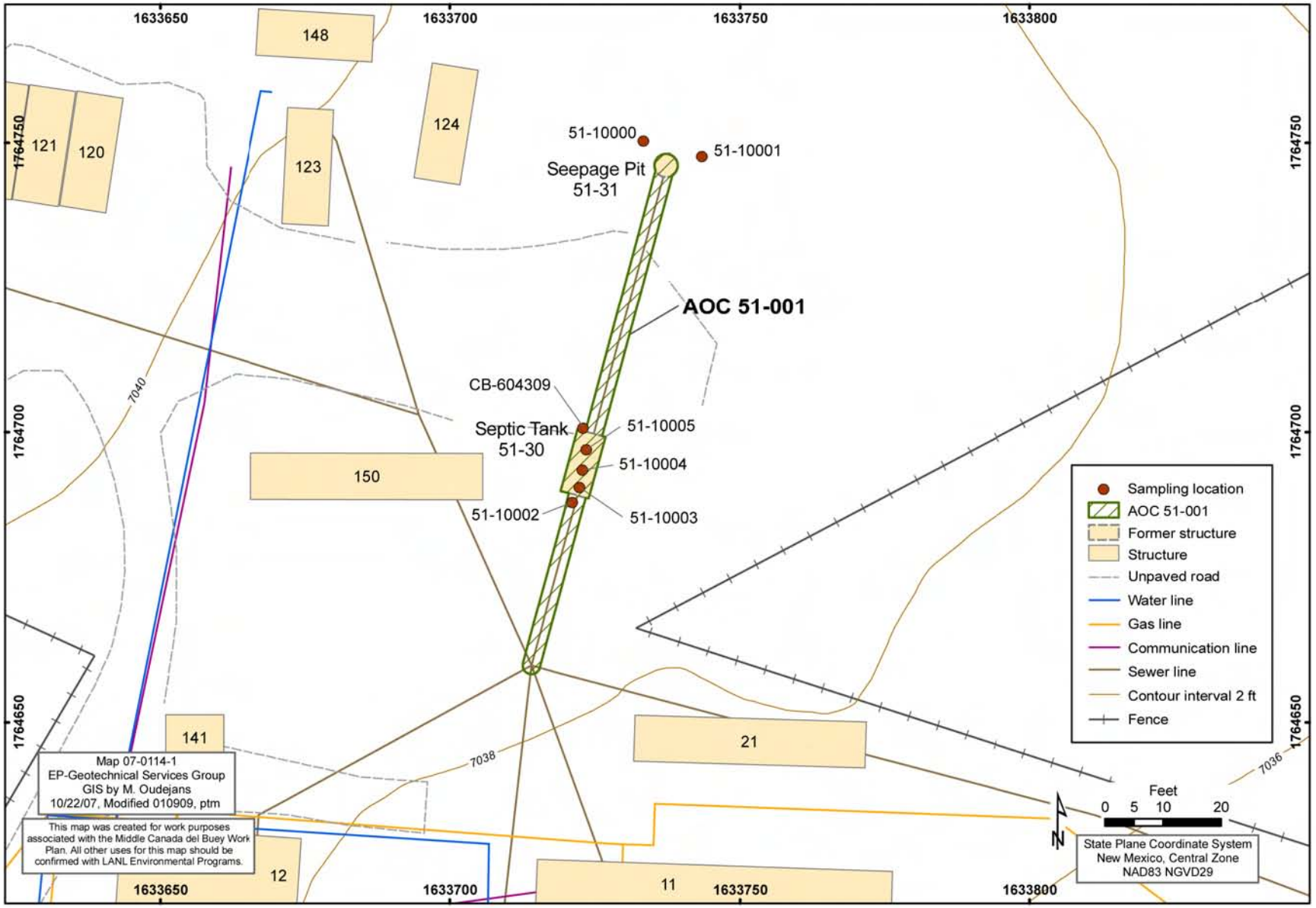


Figure 6.2-1 Sampling locations at AOC 51-001

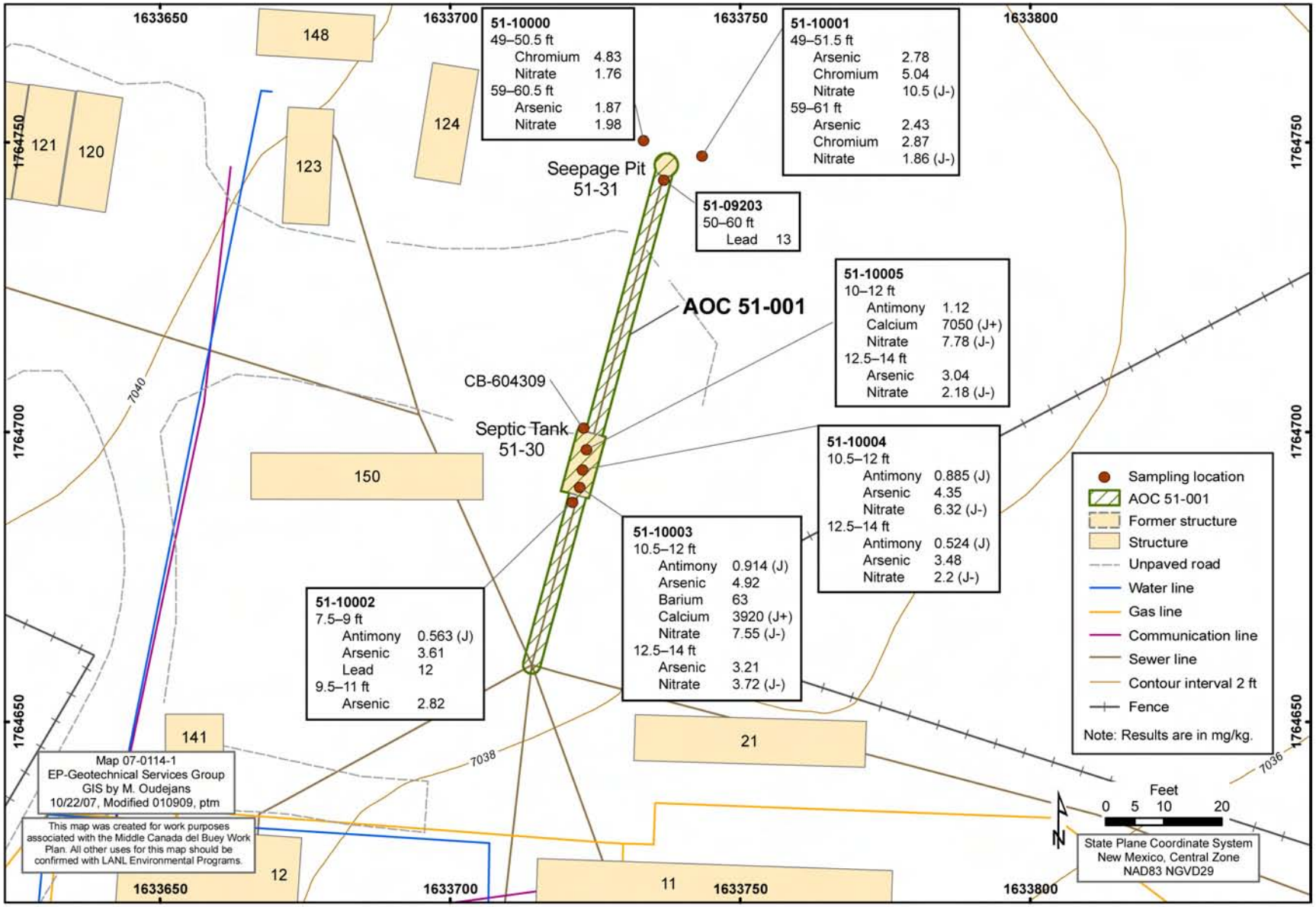


Figure 6.2-2 Inorganic chemicals above BVs at AOC 51-001

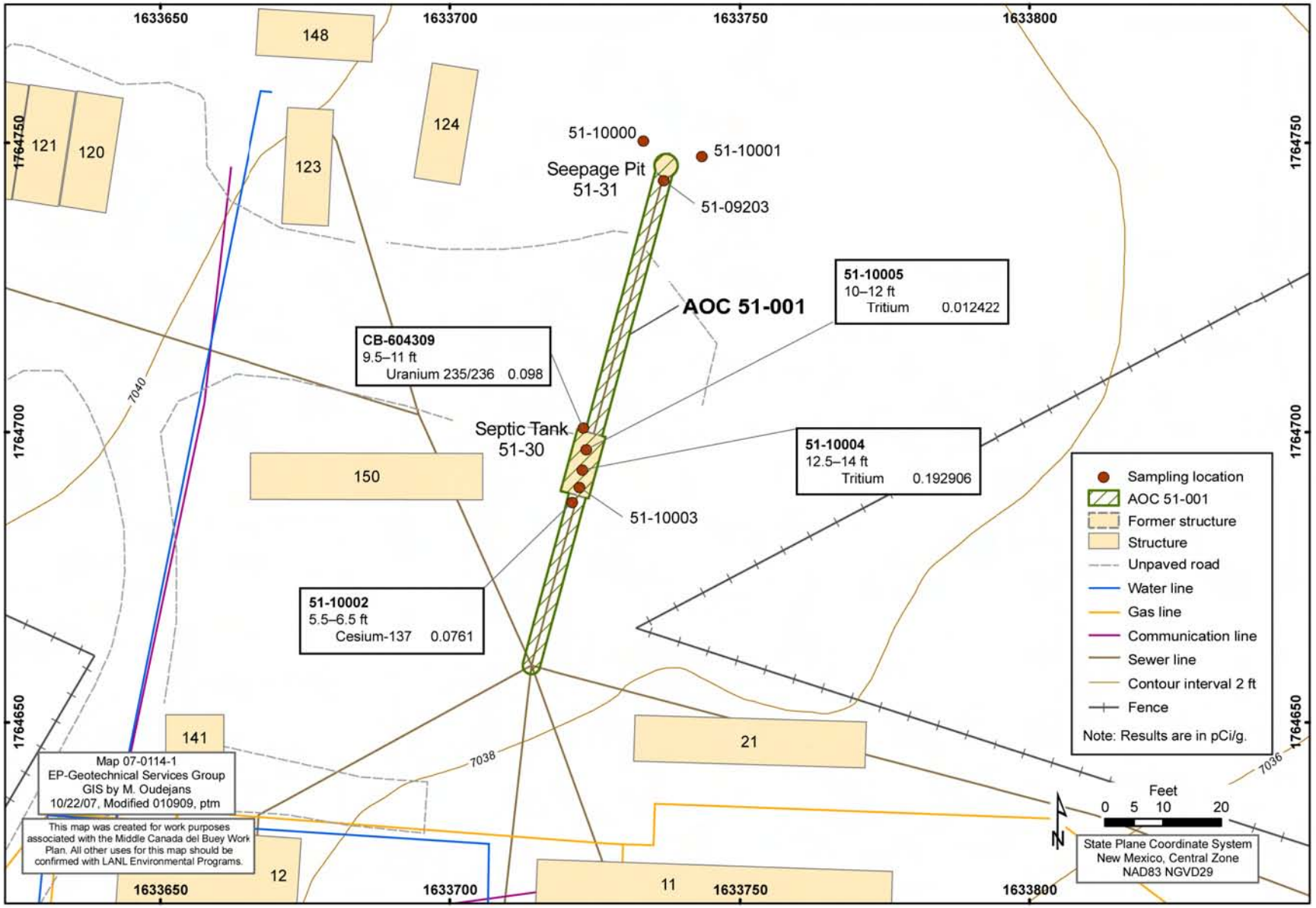


Figure 6.2-3 Radionuclides detected above BVs/FVs at AOC 51-001

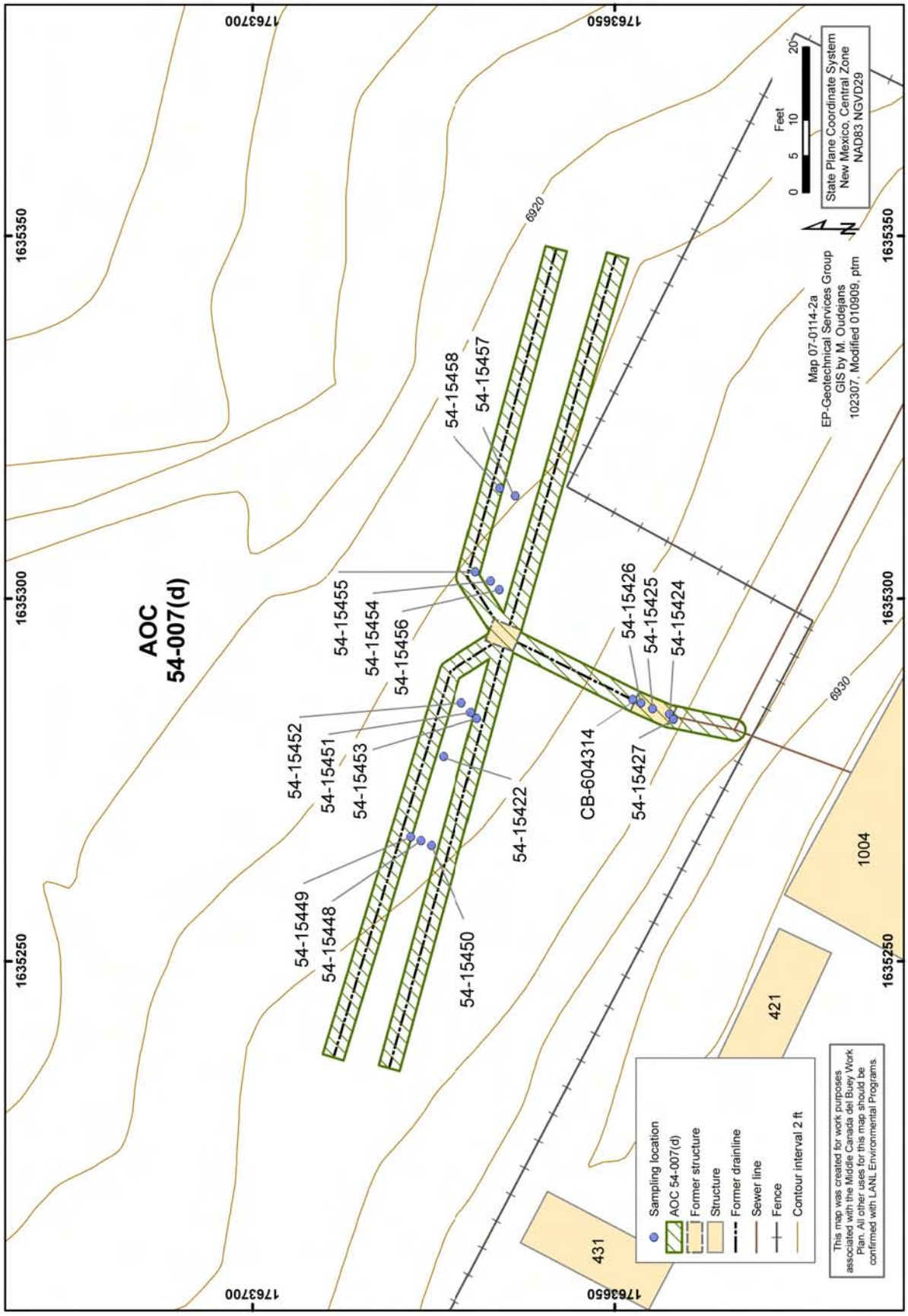


Figure 6.3-1 Sampling locations at AOC 54-007(d)

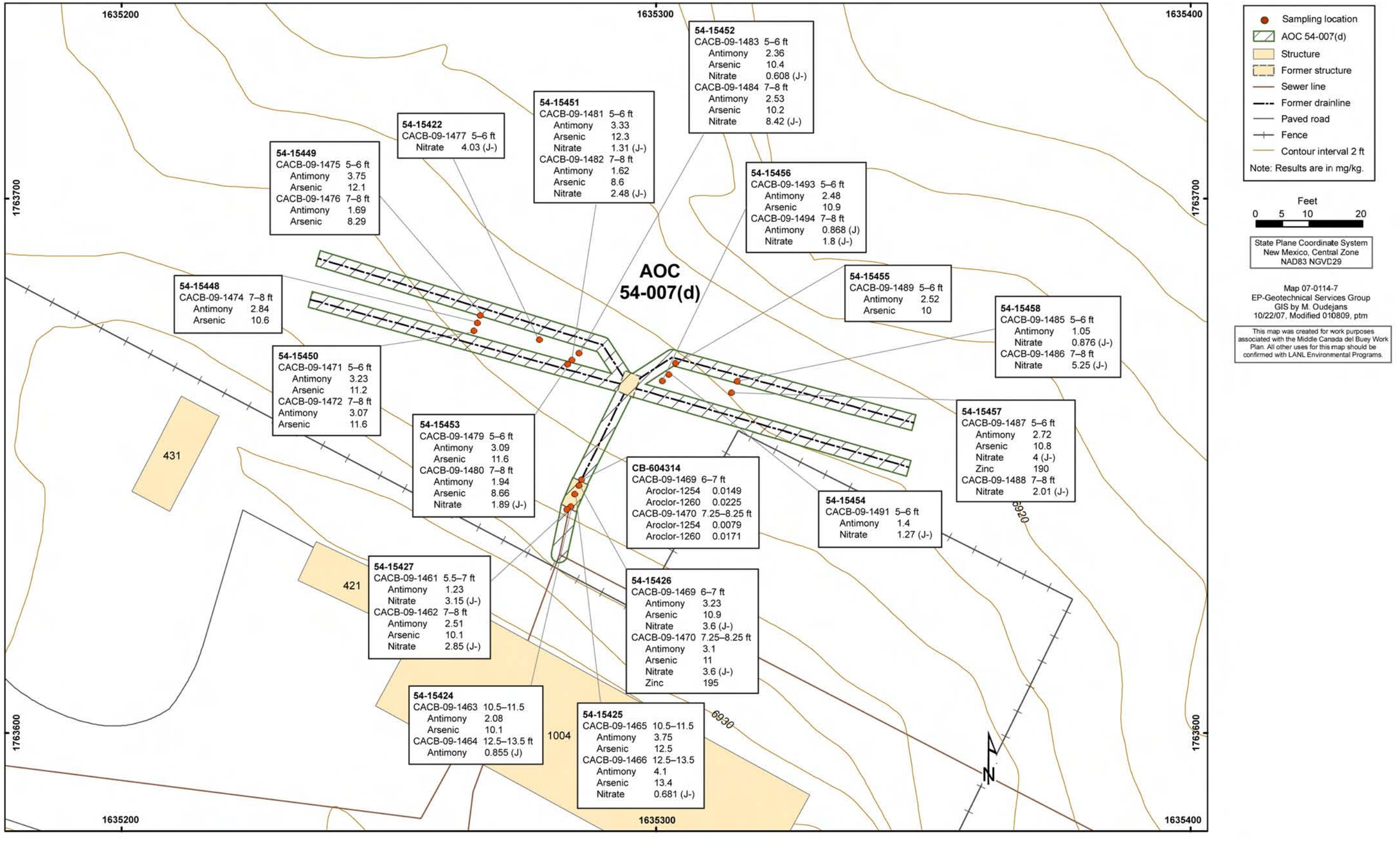


Figure 6.3-2 Inorganic chemicals above BVs at AOC 54-007(d)

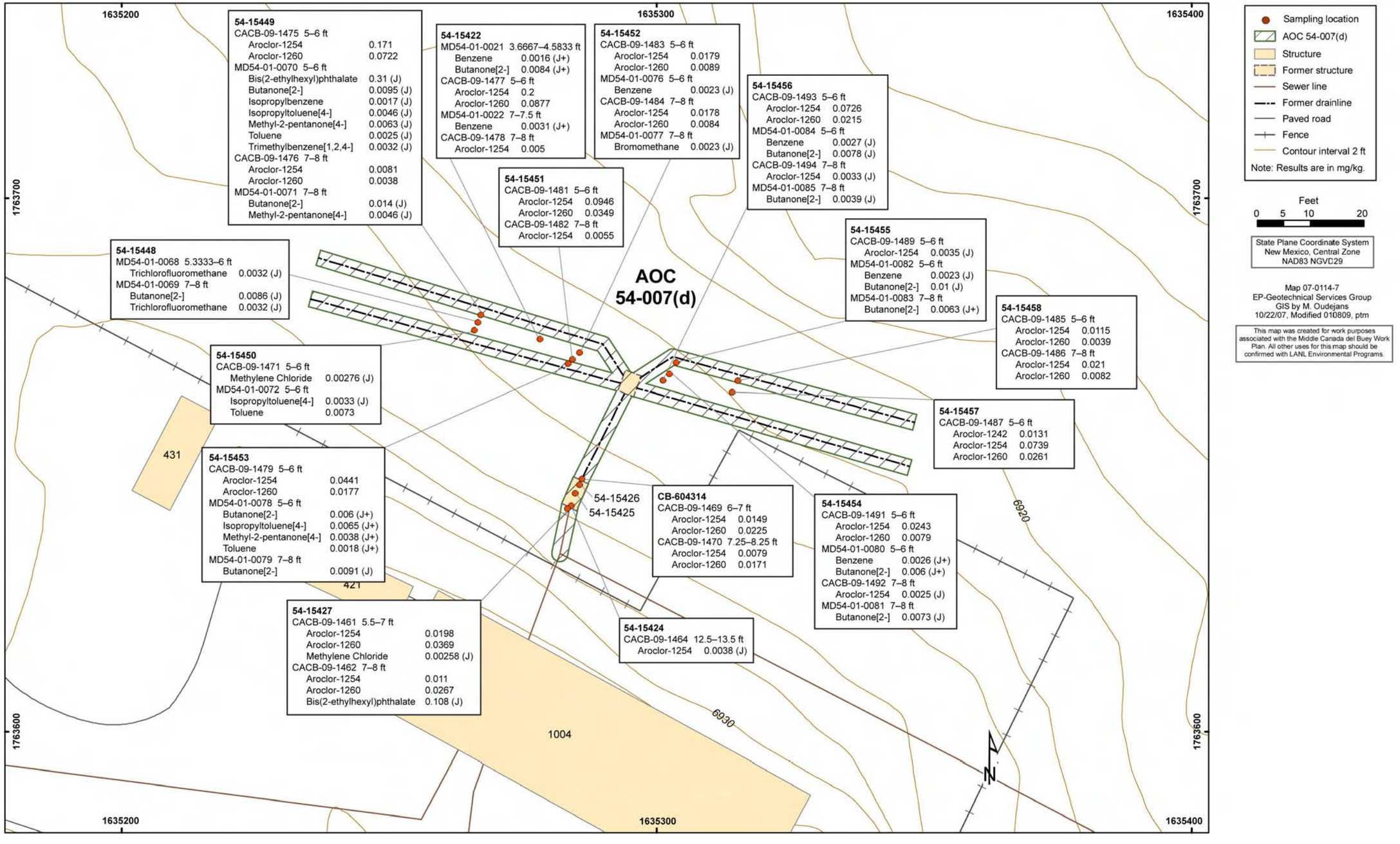


Figure 6.3-3 Organic chemicals detected at AOC 54-007(d)

Table 2.1-1
Status of SWMUs and AOCs in Middle Cañada del Buey Aggregate Area

Site	Description	Status
Sites Investigated		
AOC 18-005(b)	Former explosive storage magazine	Investigation in progress
AOC 18-005(c)	Former explosive storage magazine	Investigation in progress
AOC 51-001	Former septic system	Investigation in progress
AOC 54-007(d)	Former septic system	Investigation in progress
Sites Previously Approved for NFA		
AOC 51-002(a)	Subsurface environmental research caissons	NFA approved by EPA (2005, 088464)
AOC 51-002(b)	Subsurface environmental research caissons	NFA approved by EPA (2005, 088464)
SWMU 54-001(c)	Former tank storage area	Removed from Module VIII HWFP by NMED (1998, 063042)
SWMU 54-007(c)	Former septic system	Removed from Module VIII HWFP by NMED (2003, 078138)
AOC 54-007(e)	Former septic system	NFA approved by NMED (2002, 071424)
SWMU 54-013(a)	Proposed truck washing pit – never constructed	Removed from Module VIII HWFP by NMED (1998, 063042)
SWMU 54-015(h)	Drum storage area	Removed from Module VIII HWFP by NMED (1998, 063042)
AOC 54-016(a)	Secondary containment sump	NFA approved by EPA (2005, 088464)
AOC C-18-002	Former assembly building	NFA approved by EPA (2005, 088464)
AOC C-51-001	Drum storage area	NFA approved by EPA (2005, 088464)
AOC C-51-002	Former explosive storage magazines	NFA approved by EPA (2005, 088464)
Active Waste Management Units		
SWMU 54-001(a)	Hazardous/mixed waste storage area	RCRA-permitted storage unit
AOC 54-001(b)	Hazardous waste storage area	RCRA-permitted storage unit
AOC 54-001(d)	PCB waste storage area	TSCA-approved storage unit
AOC 54-001(e)	Hazardous waste storage area	RCRA-permitted storage unit
AOC 54-002	Hazardous/mixed waste storage area	RCRA-permitted storage unit
Sites Included in Other Investigations/Programs		
SWMU 54-004	MDA H	Investigation complete(NMED 2003, 075939), corrective measure selection ongoing
SWMU 54-005	MDA J	Closed under NMED Solid Waste Regulations (NMED 2003, 098535)
SWMU 54-006	MDA L	Investigation complete (NMED 2007, 098409), corrective measures evaluation ongoing

Table 2.2-1
Summary of Historical Samples Collected and Analyses Requested at AOC 51-001

Sample ID	Location ID	Depth (ft)	Media	Cyanide	Metals	PCBs	Pesticides	SVOCs	VOCs	Gamma Spectroscopy	Gross Alpha/Beta	Tritium	Isotopic Plutonium	Isotopic Uranium	Strontium-90
0551-95-2016	51-09203	50.0–60.0	Qbt 3	1685[a]	1685	1684	1684	1684	1684	1686	1686	—[b]	—	—	—
MD51-01-0001	51-10000	49.0–50.0	Qbt 3	—	—	—	—	8332R	8332R	8334R	—	8334R	8334R	8334R	8334R
MD51-01-0002	51-10000	59.0–60.0	Qbt 3	—	—	—	—	8332R	8332R	8334R	—	8334R	8334R	8334R	8334R
MD51-01-0003	51-10001	49.0–50.0	Qbt 3	—	—	—	—	8332R	8332R	8334R	—	8334R	8334R	8334R	8334R
MD51-01-0004	51-10001	59.0–60.0	Qbt 3	—	—	—	—	8332R	8332R	8334R	—	8334R	8334R	8334R	8334R
MD51-01-0005	51-10002	4.5–5.5	Soil	—	—	—	—	8308R	8308R	8310R	—	8310R	8310R	8310R	8310R
MD51-01-0006	51-10002	5.5–6.5	Fill	—	—	—	—	8308R	8308R	8310R	—	8310R	8310R	8310R	8310R
MD51-01-0007	51-10003	11.0–12.0	Soil	—	—	—	—	8308R	8308R	8310R	—	8310R	8310R	8310R	8310R
MD51-01-0008	51-10003	12.0–13.0	Qbt 3	—	—	—	—	8308R	8308R	8310R	—	8310R	8310R	8310R	8310R
MD51-01-0009	51-10004	11.0–12.0	Soil	—	—	—	—	8308R	8308R	8310R	—	8310R	8310R	8310R	8310R
MD51-01-0010	51-10004	12.0–13.0	Qbt 3	—	—	—	—	8308R	8308R	8310R	—	8310R	8310R	8310R	8310R
MD51-01-0011	51-10005	11.0–12.0	Fill	—	—	—	—	8308R	8308R	8310R	—	8310R	8310R	8310R	8310R
MD51-01-0012	51-10005	12.0–13.0	Qbt 3	—	—	—	—	8308R	8308R	8310R	—	8310R	8310R	8310R	8310R

[a] Request numbers.

[b] — = Analysis not requested.

Table 2.2-2
Organic Chemicals Detected at AOC 51-001 during the 2001 VCA

Sample ID	Location ID	Depth (ft)	Media	Bromomethane	Butanone[2-]	Trichlorofluoromethane
MD51-01-0001	51-10000	49.0–50.0	Qbt 3	—*	0.0056 (J)	—
MD51-01-0002	51-10000	59.0–60.0	Qbt 3	—	0.0086 (J)	—
MD51-01-0003	51-10001	49.0–50.0	Qbt 3	—	—	0.0034 (J)
MD51-01-0004	51-10001	59.0–60.0	Qbt 3	0.0017 (J)	0.014 (J)	0.0054 (J)

Notes: All values in mg/kg. Data qualifiers are defined in Appendix A.
* — = Analyte was not detected.

Table 2.2-3
Summary of Historical Samples Collected and Analyses Requested at AOC 54-007(d)

Sample ID	Location ID	Depth (ft)	Media	SVOCs	VOCs
MD54-01-0021	54-15422	3.67–4.58	Fill	8201R*	8201R
MD54-01-0022	54-15422	7.0–7.5	Qbt 3	8201R	8201R
MD54-01-0025	54-15424	10.5–11.5	Soil	8283R	8283R
MD54-01-0026	54-15424	11.5–12.5	Soil	8283R	8283R
MD54-01-0027	54-15425	10.5–11.5	Soil	8283R	8283R
MD54-01-0028	54-15425	11.5–12.5	Soil	8283R	8283R
MD54-01-0029	54-15426	10.5–11.5	Soil	8283R	8283R
MD54-01-0030	54-15426	11.5–12.5	Soil	8283R	8283R
MD54-01-0031	54-15427	5.25–6.25	Soil	8283R	8283R
MD54-01-0032	54-15427	6.25–7.25	Soil	8283R	8283R
MD54-01-0068	54-15448	5.33–6.0	Fill	8322R	8322R
MD54-01-0069	54-15448	7.0–8.0	Soil	8322R	8322R
MD54-01-0070	54-15449	5.0–6.0	Fill	8322R	8322R
MD54-01-0071	54-15449	7.0–8.0	Fill	8322R	8322R
MD54-01-0072	54-15450	5.0–6.0	Fill	8322R	8322R
MD54-01-0073	54-15450	7.0–8.0	Fill	8322R	8322R
MD54-01-0074	54-15451	5.0–6.0	Fill	8322R	8322R
MD54-01-0075	54-15451	7.0–8.0	Fill	8322R	8322R
MD54-01-0076	54-15452	5.0–6.0	Fill	8322R	8322R
MD54-01-0077	54-15452	7.0–8.0	Fill	8322R	8322R
MD54-01-0078	54-15453	5.0–6.0	Fill	8322R	8322R
MD54-01-0079	54-15453	7.0–8.0	Fill	8322R	8322R
MD54-01-0080	54-15454	5.0–6.0	Fill	8322R	8322R
MD54-01-0081	54-15454	7.0–8.0	Fill	8322R	8322R
MD54-01-0082	54-15455	5.0–6.0	Fill	8322R	8322R
MD54-01-0083	54-15455	7.0–8.0	Fill	8322R	8322R
MD54-01-0084	54-15456	5.0–6.0	Fill	8322R	8322R
MD54-01-0085	54-15456	7.0–8.0	Fill	8322R	8322R
MD54-01-0086	54-15457	5.0–6.0	Fill	8322R	8322R
MD54-01-0087	54-15457	7.0–8.0	Fill	8322R	8322R
MD54-01-0088	54-15458	5.0–6.0	Fill	8322R	8322R
MD54-01-0089	54-15458	7.0–8.0	Fill	8322R	8322R

*Request numbers.

Table 2.2-4
Organic Chemicals Detected at AOC 54-007(d) during the 2001 VCA

Sample ID	Location ID	Depth (ft)	Media	Benzene	Bis(2-ethylhexyl)phthalate	Bromomethane	Butanone[2-]	Isopropylbenzene
MD54-01-0021	54-15422	3.7–4.6	Fill	0.0016 (J+)	—*	0.0023 (J+)	0.0084 (J+)	—
MD54-01-0022	54-15422	7.0–7.5	Qbt 3	0.0031 (J+)	—	0.002 (J+)	—	—
MD54-01-0068	54-15448	5.33–6.0	Fill	—	—	—	—	—
MD54-01-0069	54-15448	7.0–8.0	Soil	—	—	—	0.0086 (J)	—
MD54-01-0070	54-15449	5.0–6.0	Fill	—	0.31 (J)	—	0.0095 (J)	0.0017 (J)
MD54-01-0071	54-15449	7.0–8.0	Fill	—	—	—	0.014 (J)	—
MD54-01-0072	54-15450	5.0–6.0	Fill	—	—	—	—	—
MD54-01-0076	54-15452	5.0–6.0	Fill	0.0023 (J)	—	—	—	—
MD54-01-0077	54-15452	7.0–8.0	Fill	—	—	0.0023 (J)	—	—
MD54-01-0078	54-15453	5.0–6.0	Fill	—	—	—	0.006 (J+)	—
MD54-01-0079	54-15453	7.0–8.0	Fill	—	—	—	0.0091 (J)	—
MD54-01-0080	54-15454	5.0–6.0	Fill	0.0026 (J+)	—	—	0.006 (J+)	—
MD54-01-0081	54-15454	7.0–8.0	Fill	—	—	—	0.0073 (J)	—
MD54-01-0082	54-15455	5.0–6.0	Fill	0.0023 (J)	—	—	0.01 (J)	—
MD54-01-0083	54-15455	7.0–8.0	Fill	—	—	—	0.0063 (J+)	—
MD54-01-0084	54-15456	5.0–6.0	Fill	0.0027 (J)	—	—	0.0078 (J)	—
MD54-01-0085	54-15456	7.0–8.0	Fill	—	—	—	0.0039 (J)	—

Table 2.2-4 (continued)

Sample ID	Location ID	Depth (ft)	Media	Isopropyltoluene[4-]	Methyl-2-pentanone[4-]	Toluene	Trichlorofluoromethane	Trimethylbenzene[1,2,4-]
MD54-01-0021	54-15422	3.7–4.6	Fill	—	—	—	—	—
MD54-01-0022	54-15422	7.0–7.5	Qbt 3	—	—	—	—	—
MD54-01-0068	54-15448	5.33–6.0	Fill	—	—	—	0.0032 (J)	—
MD54-01-0069	54-15448	7.0–8.0	Soil	—	—	—	0.0032 (J)	—
MD54-01-0070	54-15449	5.0–6.0	Fill	0.0046 (J)	0.0063 (J)	0.0025 (J)	—	0.0032 (J)
MD54-01-0071	54-15449	7.0–8.0	Fill	—	0.0046 (J)	—	—	—
MD54-01-0072	54-15450	5.0–6.0	Fill	0.0033 (J)	—	0.0073	—	—
MD54-01-0076	54-15452	5.0–6.0	Fill	—	—	—	—	—
MD54-01-0077	54-15452	7.0–8.0	Fill	—	—	—	—	—
MD54-01-0078	54-15453	5.0–6.0	Fill	0.0065 (J+)	0.0038 (J+)	0.0018 (J+)	—	—
MD54-01-0079	54-15453	7.0–8.0	Fill	—	—	—	—	—
MD54-01-0080	54-15454	5.0–6.0	Fill	—	—	—	—	—
MD54-01-0081	54-15454	7.0–8.0	Fill	—	—	—	—	—
MD54-01-0082	54-15455	5.0–6.0	Fill	—	—	—	—	—
MD54-01-0083	54-15455	7.0–8.0	Fill	—	—	—	—	—
MD54-01-0084	54-15456	5.0–6.0	Fill	—	—	—	—	—
MD54-01-0085	54-15456	7.0–8.0	Fill	—	—	—	—	—

Notes: All values in mg/kg. Data qualifiers are defined in Appendix A.
*— = Analyte was not detected.

Table 4.0-1
Summary of SOPs Used during the 2008 Investigations

Procedure Number	Procedure Title
SOP-01.12	Field Site Closeout Checklist
EP-ERSS-SOP 5018	Integrated Fieldwork Planning and Authorization
EP-ERSS-SOP 5022	Management of Environmental Restoration Project Wastes
EP-ERSS-SOP 5034	Monitor Well and RFI Borehole Abandonment
EP-ERSS-SOP 5055	General Instructions for Field Investigations
EP-ERSS-SOP 5056	Sample Container and Preservation
EP-ERSS-SOP 5057	Handling, Packaging, and Transporting Field Samples
EP-ERSS-SOP 5058	Sample Control and Field Documentation
EP-ERSS-SOP 5059	Field Quality Control Samples
EP-ERSS-SOP 5060	Operational Guidelines for Taking Soil and Water Samples in Explosive Areas
EP-ERSS-SOP 5061	Field Decontamination of Equipment
EP-ERSS-SOP 5077	Field Sampling of Core and Cuttings for Geological Analysis
SOP-12.01	Field Logging, Handling, and Documentation of Borehole Materials
SOP-06.09	Spade and Scoop Method for the Collection of Soil Samples
SOP-06.10	Hand Auger and Thin-Wall Tube Sampler
SOP-06.26	Core Barrel Sampling for Subsurface Earth Materials
SOP-06.33	Headspace Vapor Screening with a Photo Ionization Detector

Table 4.2-1
Summary of Boreholes Drilled during the 2008 Investigations

AOC	Location ID	Work Plan Location ID	Total Depth (ft bgs)
TA-51			
51-001	51-10002	1	14
51-001	CB-604309	2	14
51-001	51-10003	3	14
51-001	51-10004	4	14
51-001	51-10005	5	14
51-001	51-10001	6	61
51-001	51-10000	7	61
TA-54			
54-007(d)	54-15427	1	8
54-007(d)	CB-604314	2	8.5
54-007(d)	54-15424	3	14
54-007(d)	54-15425	4	14
54-007(d)	54-15426	5	14
54-007(d)	54-15457	6	8
54-007(d)	54-15458	7	8
54-007(d)	54-15456	8	8
54-007(d)	54-54454	9	8
54-007(d)	54-15455	10	8
54-007(d)	54-15453	11	8
54-007(d)	54-15451	12	8
54-007(d)	54-15452	13	8
54-007(d)	54-15422	14	8
54-007(d)	54-15450	15	8
54-007(d)	54-15448	16	8
54-007(d)	54-15449	17	8

Table 4.3-1
Summary of Field Screening Results for VOCs and Explosives

Location ID	Sample ID	Depth (ft bgs)	Date Collected	PID Head Space (ppm)	RDX (mg/kg)	TNT (mg/kg)
AOC 18-005(b)						
CB-604295	CACB-09-1423	0.0–1.0	12/9/2008	1.0	<0.5	<0.5
CB-604295	CACB-09-1424	2.0–3.0	12/9/2008	2.2	<0.5	<0.5
CB-604296	CACB-09-1425	0.0–1.0	12/9/2008	2.0	<0.5	<0.5
CB-604296	CACB-09-1426	2.0–3.0	12/9/2008	1.4	<0.5	<0.5
CB-604297	CACB-09-1427	0.0–1.0	12/11/2008	0.0	<0.5	<0.5
CB-604297	CACB-09-1428	2.0–3.0	12/11/2008	0.0	<0.5	<0.5
CB-604298	CACB-09-1429	0.0–1.0	12/11/2008	0.0	<0.5	<0.5
CB-604298	CACB-09-1430	2.0–3.0	12/11/2008	0.0	<0.5	<0.5
AOC 18-005(c)						
CB-604299	CACB-09-1436	0.0–1.0	12/12/2008	1.5	<0.5	<0.5
CB-604299	CACB-09-1437	2.0–3.0	12/12/2008	0.8	<0.5	<0.5
CB-604300	CACB-09-1438	0.0–1.0	12/12/2008	1.5	<0.5	<0.5
CB-604300	CACB-09-1439	2.0–3.0	12/12/2008	1.6	<0.5	<0.5
CB-604301	CACB-09-1440	0.0–1.0	12/12/2008	3.0	<0.5	<0.5
CB-604301	CACB-09-1441	2.0–3.0	12/12/2008	2.1	<0.5	<0.5
CB-604302	CACB-09-1442	0.0–1.0	12/12/2008	1.5	<0.5	<0.5
CB-604302	CACB-09-1443	2.0–3.0	12/12/2008	0.0	<0.5	<0.5
AOC 51-001						
51-10002	CACB-09-1444	7.5–9.0	12/8/2008	2.1	NA*	NA
51-10002	CACB-09-1445	9.5–11.0	12/8/2008	2.5	NA	NA
CB-604309	CACB-09-1456	7.5–9.0	12/8/2008	5.7	NA	NA
CB-604309	CACB-09-1457	9.5–11.0	12/8/2008	2.4	NA	NA
51-10003	CACB-09-1446	10.5–12.0	12/8/2008	2.2	NA	NA
51-10003	CACB-09-1447	12.5–14.0	12/8/2008	3.5	NA	NA
51-10004	CACB-09-1448	10.5–12.0	12/8/2008	5.5	NA	NA
51-10004	CACB-09-1449	12.5–14.0	12/8/2008	6.0	NA	NA
51-10005	CACB-09-1450	10.0–12.0	12/8/2008	2.3	NA	NA
51-10005	CACB-09-1451	12.5–14.5	12/8/2008	5.8	NA	NA
51-10001	CACB-09-1452	49.0–51.5	12/8/2008	2.0	NA	NA
51-10001	CACB-09-1453	59.0–61.0	12/8/2008	2.1	NA	NA
51-10000	CACB-09-1454	49.0–50.5	12/9/2008	0.5	NA	NA
51-10000	CACB-09-1455	59.0–60.5	12/9/2008	0.6	NA	NA

Table 4.3-1 (continued)

Location ID	Sample ID	Depth (ft bgs)	Date Collected	PID Head Space (ppm)	RDX (mg/kg)	TNT (mg/kg)
AOC 54-007(d)						
54-15427	CACB-09-1461	5.5–7.0	12/10/2008	1.8	NA	NA
54-15427	CACB-09-1462	7.0-8.0	12/10/2008	1.8	NA	NA
54-15424	CACB-09-1463	10.5–11.5	12/10/2008	1.5	NA	NA
54-15424	CACB-09-1464	12.5–13.5	12/10/2008	1.6	NA	NA
54-15425	CACB-09-1465	10.5–11.5	12/10/2008	1.5	NA	NA
54-15425	CACB-09-1466	12.5–13.5	12/10/2008	1.5	NA	NA
54-15426	CACB-09-1467	10.5–11.5	12/10/2008	1.5	NA	NA
54-15426	CACB-09-1468	12.5–13.5	12/10/2008	0.0	NA	NA
CB-604314	CACB-09-1469	6.0–7.0	12/10/2008	0.0	NA	NA
CB-604314	CACB-09-1470	7.25–8.25	12/10/2008	0.8	NA	NA
54-15450	CACB-09-1471	5.0–6.0	12/10/2008	0.8	NA	NA
54-15450	CACB-09-1472	7.0–8.0	12/10/2008	0.0	NA	NA
54-15448	CACB-09-1473	5.0–6.0	12/10/2008	0.0	NA	NA
54-15448	CACB-09-1474	7.0–8.0	12/10/2008	0.7	NA	NA
54-15449	CACB-09-1475	5.0–6.0	12/10/2008	0.8	NA	NA
54-15449	CACB-09-1476	7.0–8.0	12/10/2008	1.0	NA	NA
54-15422	CACB-09-1477	5.0–6.0	12/10/2008	1.0	NA	NA
54-15422	CACB-09-1478	7.0–8.0	12/10/2008	1.8	NA	NA
54-15453	CACB-09-1479	5.0–6.0	12/11/2008	0.1	NA	NA
54-15453	CACB-09-1480	7.0–8.0	12/11/2008	1.9	NA	NA
54-15451	CACB-09-1481	5.0–6.0	12/11/2008	2.0	NA	NA
54-15451	CACB-09-1482	7.0–8.0	12/11/2008	0.5	NA	NA
54-15452	CACB-09-1483	5.0–6.0	12/11/2008	0.2	NA	NA
54-15452	CACB-09-1484	7.0–8.0	12/11/2008	0.3	NA	NA
54-15458	CACB-09-1485	5.0–6.0	12/11/2008	0.5	NA	NA
54-15458	CACB-09-1486	7.0–8.0	12/11/2008	20.0	NA	NA
54-15457	CACB-09-1487	5.0–6.0	12/11/2008	0.1	NA	NA
54-15457	CACB-09-1488	7.0–8.0	12/11/2008	0.5	NA	NA
54-15455	CACB-09-1489	5.0–6.0	12/11/2008	0.5	NA	NA
54-15455	CACB-09-1490	7.0–8.0	12/11/2008	0.0	NA	NA
54-15454	CACB-09-1491	5.0–6.0	12/11/2008	0.3	NA	NA
54-15454	CACB-09-1492	7.0–8.0	12/11/2008	0.1	NA	NA
54-15456	CACB-09-1493	5.0–6.0	12/11/2008	0.1	NA	NA
54-15456	CACB-09-1494	7.0–8.0	12/11/2008	1.9	NA	NA

* NA = Not analyzed.

Table 6.1-1
Summary of Samples Collected and Analyses Requested during the 2008 Investigations

Location ID	Sample ID	Depth (ft)	Media	Cyanide	Metals	SVOCs	VOCs	Explosive Compounds	Nitrate
AOC 18-005(b)									
CB-604295	CACB-09-1423	0.0–1.0	Fill	09-489[a]	09-489	—[b]	—	09-488	09-489
CB-604295	CACB-09-1424	2.0–3.0	Fill	09-489	09-489	—	—	09-488	09-489
CB-604296	CACB-09-1425	0.0–1.0	Fill	09-489	09-489	—	—	09-488	09-489
CB-604296	CACB-09-1426	2.0–3.0	Fill	09-489	09-489	—	—	09-488	09-489
CB-604297	CACB-09-1427	0.0–1.0	Fill	09-489	09-489	—	—	09-488	09-489
CB-604297	CACB-09-1428	2.0–3.0	Fill	09-504	09-504	—	—	09-504	09-504
CB-604298	CACB-09-1429	0.0–1.0	Fill	09-504	09-504	—	—	09-504	09-504
CB-604298	CACB-09-1430	2.0–3.0	Fill	09-504	09-504	—	—	09-504	09-504
AOC 18-005(c)									
CB-604299	CACB-09-1436	0.0–1.0	Soil	09-519	09-519	—	—	09-518	09-519
CB-604299	CACB-09-1437	2.0–3.0	Qbt 2	09-519	09-519	—	—	09-518	09-519
CB-604300	CACB-09-1438	0.0–1.0	Soil	09-519	09-519	—	—	09-518	09-519
CB-604300	CACB-09-1439	2.0–3.0	Soil	09-519	09-519	—	—	09-518	09-519
CB-604301	CACB-09-1440	0.0–1.0	Soil	09-519	09-519	—	—	09-518	09-519
CB-604301	CACB-09-1441	2.0–3.0	Qbt 2	09-519	09-519	—	—	09-518	09-519
CB-604302	CACB-09-1442	0.0–1.0	Soil	09-519	09-519	—	—	09-518	09-519
CB-604302	CACB-09-1443	2.0–3.0	Qbt 2	09-519	09-519	—	—	09-518	09-519
AOC 51-001									
51-10000	CACB-09-1454	49.0–50.5	Qbt 1v	09-471	09-471	09-471	09-471	—	09-471
51-10000	CACB-09-1455	59.0–60.5	Qbt 1v	09-471	09-471	09-471	09-471	—	09-471
51-10001	CACB-09-1452	49.0–51.5	Qbt 1v	09-469	09-469	09-468	09-468	—	09-469
51-10001	CACB-09-1453	59.0–61.0	Qbt 1v	09-469	09-469	09-468	09-468	—	09-469
51-10002	CACB-09-1444	7.5–9.0	Qbt 2	09-469	09-469	09-468	09-468	—	09-469
51-10002	CACB-09-1445	9.5–11.0	Qbt 2	09-469	09-469	09-468	09-468	—	09-469
51-10003	CACB-09-1446	10.5–12.0	Qbt 2	09-469	09-469	09-468	09-468	—	09-469
51-10003	CACB-09-1447	12.5–14.0	Qbt 2	09-469	09-469	09-468	09-468	—	09-469
51-10004	CACB-09-1448	10.5–12.0	Qbt 2	09-469	09-469	09-468	09-468	—	09-469
51-10004	CACB-09-1449	12.5–14.0	Qbt 2	09-469	09-469	09-468	09-468	—	09-469
51-10005	CACB-09-1450	10.0–12.0	Fill	09-469	09-469	09-468	09-468	—	09-469
51-10005	CACB-09-1451	12.5–14.5	Qbt 2	09-469	09-469	09-468	09-468	—	09-469
CB-604309	CACB-09-1456	7.5–9.0	Qbt 2	09-469	09-469	09-468	09-468	—	09-469
CB-604309	CACB-09-1457	9.5–11.0	Qbt 2	09-469	09-469	09-468	09-468	—	09-469

Table 6.1-1 (continued)

Location ID	Sample ID	Depth (ft)	Media	Cyanide	Metals	SVOCs	VOCs	Explosive Compounds	Nitrate
AOC 54-007(d)									
54-15422	CACB-09-1477	5.0–6.0	Fill	09-489	09-489	09-488	09-488	—	09-489
54-15422	CACB-09-1478	7.0–8.0	Fill	09-489	09-489	09-488	09-488	—	09-489
54-15424	CACB-09-1463	10.5–11.5	Soil	09-489	09-489	09-488	09-488	—	09-489
54-15424	CACB-09-1464	12.5–13.5	Soil	09-489	09-489	09-488	09-488	—	09-489
54-15425	CACB-09-1465	10.5–11.5	Soil	09-489	09-489	09-488	09-488	—	09-489
54-15425	CACB-09-1466	12.5–13.5	Soil	09-489	09-489	09-488	09-488	—	09-489
54-15426	CACB-09-1467	10.5–11.5	Soil	09-489	09-489	09-488	09-488	—	09-489
54-15426	CACB-09-1468	12.5–13.5	Soil	09-489	09-489	09-488	09-488	—	09-489
54-15427	CACB-09-1461	5.5–7.0	Soil	09-489	09-489	09-488	09-488	—	09-489
54-15427	CACB-09-1462	7.0-8.0	Fill	09-489	09-489	09-488	09-488	—	09-489
54-15448	CACB-09-1473	5.0–6.0	Fill	09-489	09-489	09-488	09-488	—	09-489
54-15448	CACB-09-1474	7.0–8.0	Fill	09-489	09-489	09-488	09-488	—	09-489
54-15449	CACB-09-1475	5.0–6.0	Fill	09-489	09-489	09-488	09-488	—	09-489
54-15449	CACB-09-1476	7.0–8.0	Fill	09-489	09-489	09-488	09-488	—	09-489
54-15450	CACB-09-1471	5.0–6.0	Soil	09-489	09-489	09-488	09-488	—	09-489
54-15450	CACB-09-1472	7.0–8.0	Fill	09-489	09-489	09-488	09-488	—	09-489
54-15451	CACB-09-1481	5.0–6.0	Soil	09-497	09-497	09-496	09-496	—	09-497
54-15451	CACB-09-1482	7.0–8.0	Fill	09-497	09-497	09-496	09-496	—	09-497
54-15452	CACB-09-1483	5.0–6.0	Fill	09-497	09-497	09-496	09-496	—	09-497
54-15452	CACB-09-1484	7.0–8.0	Fill	09-497	09-497	09-496	09-496	—	09-497
54-15453	CACB-09-1479	5.0–6.0	Fill	09-497	09-497	09-496	09-496	—	09-497
54-15453	CACB-09-1480	7.0–8.0	Fill	09-497	09-497	09-496	09-496	—	09-497
54-15454	CACB-09-1491	5.0–6.0	Fill	09-497	09-497	09-496	09-496	—	09-497
54-15454	CACB-09-1492	7.0–8.0	Fill	09-497	09-497	09-496	09-496	—	09-497
54-15455	CACB-09-1489	5.0–6.0	Fill	09-497	09-497	09-496	09-496	—	09-497
54-15455	CACB-09-1490	7.0–8.0	Fill	09-497	09-497	09-496	09-496	—	09-497
54-15456	CACB-09-1493	5.0–6.0	Fill	09-497	09-497	09-496	09-496	—	09-497
54-15456	CACB-09-1494	7.0–8.0	Fill	09-497	09-497	09-496	09-496	—	09-497
54-15457	CACB-09-1487	5.0–6.0	Fill	09-497	09-497	09-496	09-496	—	09-497
54-15457	CACB-09-1488	7.0–8.0	Fill	09-497	09-497	09-496	09-496	—	09-497
54-15458	CACB-09-1485	5.0–6.0	Fill	09-497	09-497	09-496	09-496	—	09-497
54-15458	CACB-09-1486	7.0–8.0	Fill	09-497	09-497	09-496	09-496	—	09-497
CB-604314	CACB-09-1469	6.0–7.0	Fill	09-489	09-489	09-488	09-488	—	09-489
CB-604314	CACB-09-1470	7.25–8.25	Fill	09-489	09-489	09-488	09-488	—	09-489

Table 6.1-1 (continued)

Location ID	Sample ID	Depth (ft)	Media	Perchlorate	Tritium	PCBs	Pesticides	Isotopic Plutonium	Isotopic Uranium
AOC 18-005(b)									
CB-604295	CACB-09-1423	0.0–1.0	Fill	09-489	—	—	—	—	—
CB-604295	CACB-09-1424	2.0–3.0	Fill	09-489	—	—	—	—	—
CB-604296	CACB-09-1425	0.0–1.0	Fill	09-489	—	—	—	—	—
CB-604296	CACB-09-1426	2.0–3.0	Fill	09-489	—	—	—	—	—
CB-604297	CACB-09-1427	0.0–1.0	Fill	09-489	—	—	—	—	—
CB-604297	CACB-09-1428	2.0–3.0	Fill	09-504	—	—	—	—	—
CB-604298	CACB-09-1429	0.0–1.0	Fill	09-504	—	—	—	—	—
CB-604298	CACB-09-1430	2.0–3.0	Fill	09-504	—	—	—	—	—
AOC 18-005(c)									
CB-604299	CACB-09-1436	0.0–1.0	Soil	09-519	—	—	—	—	—
CB-604299	CACB-09-1437	2.0–3.0	Qbt 2	09-519	—	—	—	—	—
CB-604300	CACB-09-1438	0.0–1.0	Soil	09-519	—	—	—	—	—
CB-604300	CACB-09-1439	2.0–3.0	Soil	09-519	—	—	—	—	—
CB-604301	CACB-09-1440	0.0–1.0	Soil	09-519	—	—	—	—	—
CB-604301	CACB-09-1441	2.0–3.0	Qbt 2	09-519	—	—	—	—	—
CB-604302	CACB-09-1442	0.0–1.0	Soil	09-519	—	—	—	—	—
CB-604302	CACB-09-1443	2.0–3.0	Qbt 2	09-519	—	—	—	—	—
AOC 51-001									
51-10000	CACB-09-1454	49.0–50.5	Qbt 1v	—	09-471	—	—	09-471	09-471
51-10000	CACB-09-1455	59.0–60.5	Qbt 1v	—	09-471	—	—	09-471	09-471
51-10001	CACB-09-1452	49.0–51.5	Qbt 1v	—	09-470	—	—	09-470	09-470
51-10001	CACB-09-1453	59.0–61.0	Qbt 1v	—	09-470	—	—	09-470	09-470
51-10002	CACB-09-1444	7.5–9.0	Qbt 2	—	09-470	—	—	09-470	09-470
51-10002	CACB-09-1445	9.5–11.0	Qbt 2	—	09-470	—	—	09-470	09-470
51-10003	CACB-09-1446	10.5–12.0	Qbt 2	—	09-470	—	—	09-470	09-470
51-10003	CACB-09-1447	12.5–14.0	Qbt 2	—	09-470	—	—	09-470	09-470
51-10004	CACB-09-1448	10.5–12.0	Qbt 2	—	09-470	—	—	09-470	09-470
51-10004	CACB-09-1449	12.5–14.0	Qbt 2	—	09-470	—	—	09-470	09-470
51-10005	CACB-09-1450	10.0–12.0	Fill	—	09-470	—	—	09-470	09-470
51-10005	CACB-09-1451	12.5–14.5	Qbt 2	—	09-470	—	—	09-470	09-470
CB-604309	CACB-09-1456	7.5–9.0	Qbt 2	—	09-470	—	—	09-470	09-470
CB-604309	CACB-09-1457	9.5–11.0	Qbt 2	—	09-470	—	—	09-470	09-470
AOC 54-007(d)									
54-15422	CACB-09-1477	5.0–6.0	Fill	—	—	09-488	09-488	—	09-490
54-15422	CACB-09-1478	7.0–8.0	Fill	—	—	09-488	09-488	—	09-490

Table 6.1-1 (continued)

Location ID	Sample ID	Depth (ft)	Media	Perchlorate	Tritium	PCBs	Pesticides	Isotopic Plutonium	Isotopic Uranium
54-15424	CACB-09-1463	10.5–11.5	Soil	—	—	09-488	09-488	—	09-490
54-15424	CACB-09-1464	12.5–13.5	Soil	—	—	09-488	09-488	—	09-490
54-15425	CACB-09-1465	10.5–11.5	Soil	—	—	09-488	09-488	—	09-490
54-15425	CACB-09-1466	12.5–13.5	Soil	—	—	09-488	09-488	—	09-490
54-15426	CACB-09-1467	10.5–11.5	Soil	—	—	09-488	09-488	—	09-490
54-15426	CACB-09-1468	12.5–13.5	Soil	—	—	09-488	09-488	—	09-490
54-15427	CACB-09-1461	5.5–7.0	Soil	—	—	09-488	09-488	—	09-490
54-15427	CACB-09-1462	7.0-8.0	Fill	—	—	09-488	09-488	—	09-490
54-15448	CACB-09-1473	5.0–6.0	Fill	—	—	09-488	09-488	—	09-490
54-15448	CACB-09-1474	7.0–8.0	Fill	—	—	09-488	09-488	—	09-490
54-15449	CACB-09-1475	5.0–6.0	Fill	—	—	09-488	09-488	—	09-490
54-15449	CACB-09-1476	7.0–8.0	Fill	—	—	09-488	09-488	—	09-490
54-15450	CACB-09-1471	5.0–6.0	Soil	—	—	09-488	09-488	—	09-490
54-15450	CACB-09-1472	7.0–8.0	Soil	—	—	09-488	09-488	—	09-490
54-15451	CACB-09-1481	5.0–6.0	Soil	—	—	09-496	09-496	—	09-498
54-15451	CACB-09-1482	7.0–8.0	Soil	—	—	09-496	09-496	—	09-498
54-15452	CACB-09-1483	5.0–6.0	Fill	—	—	09-496	09-496	—	09-498
54-15452	CACB-09-1484	7.0–8.0	Fill	—	—	09-496	09-496	—	09-498
54-15453	CACB-09-1479	5.0–6.0	Fill	—	—	09-496	09-496	—	09-498
54-15453	CACB-09-1480	7.0–8.0	Fill	—	—	09-496	09-496	—	09-498
54-15454	CACB-09-1491	5.0–6.0	Fill	—	—	09-496	09-496	—	09-498
54-15454	CACB-09-1492	7.0–8.0	Fill	—	—	09-496	09-496	—	09-498
54-15455	CACB-09-1489	5.0–6.0	Fill	—	—	09-496	09-496	—	09-498
54-15455	CACB-09-1490	7.0–8.0	Fill	—	—	09-496	09-496	—	09-498
54-15456	CACB-09-1493	5.0–6.0	Fill	—	—	09-496	09-496	—	09-498
54-15456	CACB-09-1494	7.0–8.0	Fill	—	—	09-496	09-496	—	09-498
54-15457	CACB-09-1487	5.0–6.0	Fill	—	—	09-496	09-496	—	09-498
54-15457	CACB-09-1488	7.0–8.0	Fill	—	—	09-496	09-496	—	09-498
54-15458	CACB-09-1485	5.0–6.0	Fill	—	—	09-496	09-496	—	09-498
54-15458	CACB-09-1486	7.0–8.0	Fill	—	—	09-496	09-496	—	09-498
CB-604314	CACB-09-1469	6.0–7.0	Fill	—	—	09-488	09-488	—	09-490
CB-604314	CACB-09-1470	7.25–8.25	Fill	—	—	09-488	09-488	—	09-490

[a] Request numbers.

[b] — = Analysis not requested.

Table 6.1-2
Inorganic Chemicals above BVs at AOC 18-005(b)

Location ID	Sample ID	Depth (ft)	Media	Antimony	Barium	Cadmium	Calcium	Nitrate	Perchlorate
Soil BV[a]				**0.83**	**295**	**0.4**	**6120**	**na**[b]	**na**
Residential SSL[c]				**31.3**	**15600**	**39.0**	**na**	**100000**	**55**[d]
Industrial SSL[c]				**454**	**100000**	**564**	**na**	**100000**	**720**[d]
Construction Worker SSL[c]				**124**	**60200**	**154**	**na**	**100000**	**na**
CB-604295	CACB-09-1423	0.0–1.0	Fill	1.21	—[e]	0.52 (U)	—	8.25	0.000596 (J)
CB-604295	CACB-09-1424	2.0–3.0	Fill	—	—	0.578 (U)	—	8.43	—
CB-604296	CACB-09-1425	0.0–1.0	Fill	1.04 (J)	—	0.546 (U)	—	9.37	—
CB-604296	CACB-09-1426	2.0–3.0	Fill	0.909 (J)	—	0.576 (U)	6710	14	0.000756 (J)
CB-604297	CACB-09-1427	0.0–1.0	Fill	1.04 (J)	—	0.544 (U)	—	13.2	—
CB-604297	CACB-09-1428	2.0–3.0	Fill	—	—	0.552 (U)	6920	22.2	—
CB-604298	CACB-09-1429	0.0–1.0	Fill	1.3	—	0.537 (U)	—	32.7	—
CB-604298	CACB-09-1430	2.0–3.0	Fill	1.14 (U)	420	0.569 (U)	—	15.5	—

Notes: Units are mg/kg. Data qualifiers are defined in Appendix A.

[a] BVs from LANL (1998, 059730).

[b] na = Not available.

[c] SSLs from NMED (2006, 092513), unless otherwise noted.

[d] SSL from EPA regional screening table (http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/pdf/composite_sl_table_run_12SEP2008.pdf).

[e] — = Result was not detected or was below the BV.

Table 6.1-3
Inorganic Chemicals above BVs at AOC 18-005(c)

Location ID	Sample ID	Depth (ft)	Media	Antimony	Arsenic	Barium	Cadmium	Calcium	Chromium	Lead	Nitrate	Perchlorate
Soil BV[a]				**0.83**	**8.17**	**295**	**0.4**	**6120**	**19.3**	**22.3**	**na**[b]	**na**
Qbt 2 BV[a]				**0.5**	**2.79**	**46**	**1.63**	**2200**	**7.14**	**11.2**	**na**	**na**
Residential SSL[c]				**31.3**	**3.9**	**15600**	**39.0**	**na**	**2800**[d]	**400**	**100000**	**55**[d]
Industrial SSL[c]				**454**	**17.7**	**100000**	**564**	**na**	**14000**[d]	**800**	**100000**	**720**[d]
Construction Worker SSL[c]				**124**	**85.2**	**60200**	**154**	**na**	**26.1**[e]	**800**	**100000**	**na**
CB-604299	CACB-09-1436	0.0–1.0	Soil	1.58	—[f]	—	0.524 (U)	—	—	—	—	—
CB-604299	CACB-09-1437	2.0–3.0	Qbt 2	—	5.27	91.3	—	7060	16.3	12	—	0.00215
CB-604300	CACB-09-1438	0.0–1.0	Soil	1.51	—	—	0.51 (U)	—	—	—	1.02 (J-)	0.000775 (J)
CB-604300	CACB-09-1439	2.0–3.0	Soil	1.57	—	—	0.525 (U)	—	—	—	3.19 (J-)	0.00312
CB-604301	CACB-09-1440	0.0–1.0	Soil	—	—	—	0.535 (U)	—	—	—	—	—
CB-604301	CACB-09-1441	2.0–3.0	Qbt 2	—	3.74	47	—	—	7.37	—	—	0.000606 (J)
CB-604302	CACB-09-1442	0.0–1.0	Soil	0.882 (J)	—	—	0.548 (U)	—	—	—	—	0.00057 (J)
CB-604302	CACB-09-1443	2.0–3.0	Qbt 2	—	3.67	53.7	—	—	9.56	—	—	0.00107 (J)

Notes: Units are mg/kg. Data qualifiers are defined in Appendix A.

[a] BVs from LANL (1998, 059730).

[b] na = Not available.

[c] SSLs from NMED (2006, 092513), unless otherwise noted.

[d] SSL from EPA regional screening table (http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/pdf/composite_sl_table_run_12SEP2008.pdf).

[e] SSL for hexavalent chromium is from NMED (2006, 092513).

[f] — = Result was not detected or was below the BV.

Table 6.2-1
Inorganic Chemicals above BVs at AOC 51-001

Sample ID	Location ID	Depth (ft)	Media	Antimony	Arsenic	Barium	Cadmium	Calcium	Chromium
Soil BV[a]				**0.83**	**8.17**	**295**	**0.4**	**6120**	**19.3**
Qbt 2/Qbt 3 BV[a]				**0.5**	**2.79**	**46**	**1.63**	**2200**	**7.14**
Qbt 1v BV[a]				**0.5**	**1.81**	**26.5**	**0.4**	**3700**	**2.24**
Residential SSL[b]				**31.3**	**3.9**	**15600**	**39.0**	**na**[c]	**2800**[d]
Construction SSL[b]				**124**	**85.2**	**60200**	**154**	**na**	**26.1**[e]
0551-95-2016	51-09203	50.0–60.0	Qbt 3	11 (UJ)	—[f]	—	—	—	—
CACB-09-1454	51-10000	49.0–50.5	Qbt 1v	1.02 (U)	—	—	—	—	4.83
CACB-09-1455	51-10000	59.0–60.5	Qbt 1v	1.04 (U)	1.87	—	—	—	—
CACB-09-1452	51-10001	49.0–51.5	Qbt 1v	—	2.78	—	0.499 (U)	—	5.04
CACB-09-1453	51-10001	59.0–61.0	Qbt 1v	—	2.43	—	0.498 (U)	—	2.87
CACB-09-1444	51-10002	7.5–9.0	Qbt 2	0.563 (J)	3.61	—	—	—	—
CACB-09-1445	51-10002	9.5–11.0	Qbt 2	—	2.82	—	—	—	—
CACB-09-1446	51-10003	10.5–12.0	Qbt 2	0.914 (J)	4.92	63	—	3920 (J+)	—
CACB-09-1447	51-10003	12.5–14.0	Qbt 2	—	3.21	—	—	—	—
CACB-09-1448	51-10004	10.5–12.0	Qbt 2	0.885 (J)	4.35	—	—	—	—
CACB-09-1449	51-10004	12.5–14.0	Qbt 2	0.524 (J)	3.48	—	—	—	—
CACB-09-1450	51-10005	10.0–12.0	Fill	1.12	—	—	0.494 (U)	7050 (J+)	—
CACB-09-1451	51-10005	12.5–14.5	Qbt 2	—	3.04	—	—	—	—

Table 6.2-1 (continued)

Sample ID	Location ID	Depth (ft)	Media	Lead	Mercury	Nitrate	Selenium	Silver
Soil BV[a]				**22.3**	**0.1**	**na**	**1.52**	**1**
Qbt 2/Qbt 3 BV[a]				**11.2**	**0.1**	**na**	**0.3**	**1**
Qbt 1v BV[a]				**18.4**	**0.1**	**na**	**0.3**	**1**
Residential SSL[b]				**400**	**23**[d]	**100000**	**391**	**391**
Construction SSL[b]				**800**	**927**[g]	**100000**	**1550**	**1550**
0551-95-2016	51-09203	50.0–60.0	Qbt 3	13	0.27 (U)	NA[h]	1.1 (U)	2.1 (U)
CACB-09-1454	51-10000	49.0–50.5	Qbt 1v	—	—	1.76	1.07 (U)	—
CACB-09-1455	51-10000	59.0–60.5	Qbt 1v	—	—	1.98	1.04 (U)	—
CACB-09-1452	51-10001	49.0–51.5	Qbt 1v	—	—	10.5 (J-)	1 (U)	—
CACB-09-1453	51-10001	59.0–61.0	Qbt 1v	—	—	1.86 (J-)	1.04 (U)	—
CACB-09-1444	51-10002	7.5–9.0	Qbt 2	12	—	—	0.991 (U)	—
CACB-09-1445	51-10002	9.5–11.0	Qbt 2	—	—	—	1.04 (U)	—
CACB-09-1446	51-10003	10.5–12.0	Qbt 2	—	—	7.55 (J-)	1 (U)	—
CACB-09-1447	51-10003	12.5–14.0	Qbt 2	—	—	3.72 (J-)	1.04 (U)	—
CACB-09-1448	51-10004	10.5–12.0	Qbt 2	—	—	6.32 (J-)	0.996 (U)	—
CACB-09-1449	51-10004	12.5–14.0	Qbt 2	—	—	2.2 (J-)	1.02 (U)	—
CACB-09-1450	51-10005	10.0–12.0	Fill	—	—	7.78 (J-)	—	—
CACB-09-1451	51-10005	12.5–14.5	Qbt 2	—	—	2.18 (J-)	1.01 (U)	—

Notes: Units are mg/kg. Data qualifiers are defined in Appendix A.

[a] BVs from LANL (1998, 059730).

[b] SSLs from NMED (2006, 092513), unless otherwise noted.

[c] na = Not available.

[d] SSL from EPA regional screening table (http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/pdf/composite_sl_table_run_12SEP2008.pdf).

[e] SSL for hexavalent chromium is from NMED (2006, 092513).

[f] — = Result was not detected or was below the BV.

[g] SSL is for elemental mercury from NMED (2006, 092513).

[h] NA = Not analyzed.

Table 6.2-2
Organic Chemicals Detected at AOC 51-001

Sample ID	Location ID	Depth (ft)	Media	Bromomethane	Butanone[2-]	Trichlorofluoromethane
Residential SSL[a]				**8.51**	**31800**	**588**
Construction Worker SSL[a]				**28.2**	**48700**	**983**
MD51-01-0001	51-10000	49.0–50.0	Qbt 3	—[b]	0.0056 (J)	—
MD51-01-0002	51-10000	59.0–60.0	Qbt 3	—	0.0086 (J)	—
MD51-01-0003	51-10001	49.0–50.0	Qbt 3	—	—	0.0034 (J)
MD51-01-0004	51-10001	59.0–60.0	Qbt 3	0.0017 (J)	0.014 (J)	0.0054 (J)

Notes: Units are mg/kg. Data qualifiers are defined in Appendix A.

[a] SSLs from NMED (2006, 092513).

[b] — = Result was not detected.

Table 6.2-3
Radionuclides Detected or Detected above BVs/FVs at AOC 51-001

Sample ID	Location ID	Depth (ft)	Media	Cesium-137	Uranium-235/236	Tritium
Soil BV/FV[a]				**1.65**	**0.20**	**na[b]**
Qbt 2 BV/FV[a]				**na**	**0.09**	**na**
Residential SAL[c]				**5.6**	**17**	**750**
Construction Worker SAL[c]				**18**	**43**	**320000**
MD51-01-0006	51-10002	5.5–6.5	Fill	0.0761	—	—[d]
CACB-09-1449	51-10004	12.5–14.0	Qbt 2	NA[e]	—	0.192906
CACB-09-1450	51-10005	10.0–12.0	Fill	NA	—	0.012422
CACB-09-1457	CB-604309	9.5–11.0	Qbt 2	NA	0.098	—

Note: Units are pCi/g.

[a] BVs/FVs from LANL (1998, 059730).

[b] na = Not available.

[c] SALs from LANL (2005, 088493).

[d] — = Result was not detected or was below the BV/FV.

[e] NA = Not analyzed.

Table 6.3-1
Inorganic Chemicals above BVs at AOC 54-007(d)

Sample ID	Location ID	Depth (ft)	Media	Antimony	Arsenic	Cadmium	Nitrate	Zinc
Soil BV[a]				**0.83**	**8.17**	**0.4**	**na**[b]	**48.8**
Residential SSL[c]				**31.3**	**3.9**	**39**	**100000**	**23500**
Construction Worker SSL[c]				**124**	**85.2**	**154**	**100000**	**92900**
CACB-09-1477	54-15422	5.0–6.0	Fill	—[d]	—	0.522 (U)	4.03 (J-)	—
CACB-09-1478	54-15422	7.0–8.0	Fill	—	—	0.524 (U)	—	—
CACB-09-1463	54-15424	10.5–11.5	Soil	2.08	10.1	0.579 (U)	—	—
CACB-09-1464	54-15424	12.5–13.5	Soil	0.855 (J)	—	0.558 (U)	—	—
CACB-09-1465	54-15425	10.5–11.5	Soil	3.75	12.5	0.555 (U)	—	—
CACB-09-1466	54-15425	12.5–13.5	Soil	4.1	13.4	0.561 (U)	0.681 (J-)	—
CACB-09-1467	54-15426	10.5–11.5	Soil	4.46	14	0.573 (U)	0.632 (J-)	—
CACB-09-1468	54-15426	12.5–13.5	Soil	4	12.5	0.557 (U)	1.16	—
CACB-09-1461	54-15427	5.5–7.0	Soil	1.23	—	0.517 (U)	3.15 (J-)	—
CACB-09-1462	54-15427	7.0–8.0	Fill	2.51	10.1	0.554 (U)	2.85 (J-)	—
CACB-09-1473	54-15448	5.0–6.0	Fill	—	—	0.507 (U)	—	—
CACB-09-1474	54-15448	7.0–8.0	Fill	2.84	10.6	0.524 (U)	—	—
CACB-09-1475	54-15449	5.0–6.0	Fill	3.75	12.1	0.513 (U)	—	—
CACB-09-1476	54-15449	7.0–8.0	Fill	1.69	8.29	0.518 (U)	—	—
CACB-09-1471	54-15450	5.0–6.0	Soil	3.23	11.2	—	—	—
CACB-09-1472	54-15450	7.0–8.0	Fill	3.07	11.6	—	—	—
CACB-09-1481	54-15451	5.0–6.0	Soil	3.33	12.3	0.546 (U)	1.31 (J-)	—
CACB-09-1482	54-15451	7.0–8.0	Fill	1.62	8.6	0.527 (U)	2.48 (J-)	—
CACB-09-1483	54-15452	5.0–6.0	Fill	2.36	10.4	0.527 (U)	0.608 (J-)	—
CACB-09-1484	54-15452	7.0–8.0	Fill	2.53	10.2	0.531 (U)	8.42 (J-)	—
CACB-09-1479	54-15453	5.0–6.0	Fill	3.09	11.6	0.53 (U)	5.44 (J-)	—
CACB-09-1480	54-15453	7.0–8.0	Fill	1.94	8.66	0.507 (U)	1.89 (J-)	—
CACB-09-1491	54-15454	5.0–6.0	Fill	1.4	—	0.54 (U)	1.27 (J-)	—
CACB-09-1492	54-15454	7.0–8.0	Fill	—	—	0.528 (U)	—	—
CACB-09-1489	54-15455	5.0–6.0	Fill	2.52	10	0.526 (U)	—	—
CACB-09-1490	54-15455	7.0–8.0	Fill	—	—	0.539 (U)	—	—
CACB-09-1493	54-15456	5.0–6.0	Fill	2.48	10.9	0.528 (U)	—	—
CACB-09-1494	54-15456	7.0–8.0	Fill	0.868 (J)	—	0.535 (U)	1.8 (J-)	—
CACB-09-1487	54-15457	5.0–6.0	Fill	2.72	10.8	0.54 (U)	4 (J-)	190
CACB-09-1488	54-15457	7.0–8.0	Fill	—	—	0.538 (U)	2.01 (J-)	—
CACB-09-1485	54-15458	5.0–6.0	Fill	1.05	—	0.523 (U)	0.876 (J-)	—

Table 6.3-1 (continued)

Sample ID	Location ID	Depth (ft)	Media	Antimony	Arsenic	Cadmium	Nitrate	Zinc
Soil BV[a]				**0.83**	**8.17**	**0.4**	**na**[b]	**48.8**
Residential SSL[c]				**31.3**	**3.9**	**39**	**100000**	**23500**
Construction Worker SSL[c]				**124**	**85.2**	**154**	**100000**	**92900**
CACB-09-1486	54-15458	7.0–8.0	Fill	—	—	0.521 (U)	5.25 (J-)	—
CACB-09-1469	CB-604314	6.0–7.0	Fill	3.23	10.9	0.535 (U)	3.6 (J-)	—
CACB-09-1470	CB-604314	7.25–8.25	Fill	3.1	11	—	3.6 (J-)	195

Notes: Units are mg/kg. Data qualifiers are defined in Appendix A.

[a] BVs from LANL (1998, 059730).

[b] na = Not available.

[c] SSLs from NMED (2006, 092513).

[d] — = Result was not detected or was below the BV.

Table 6.3-2
Organic Chemicals Detected at AOC 54-007(d)

Sample ID	Location ID	Depth (ft bgs)	Media	Aroclor-1242	Aroclor-1254	Aroclor-1260	Benzene	Bis(2-ethylhexyl)phthalate	Bromomethane	Butanone[2-]	Isopropylbenzene	Isopropyltoluene[4-]	Methyl-2-pentanone[4-]	Methylene Chloride	Toluene	Trichlorofluoromethane	Trimethylbenzene[1,2,4-]
Residential SSL[a]				**1.12**	**1.12**	**1.12**	**10.3**	**347**	**8.51**	**31800**	**271**	**271**[b]	**5510**	**182**	**252**	**588**	**58.0**
Construction Worker SSL[a]				**4.28**	**4.28**	**4.28**	**174**	**4660**	**28.2**	**48700**	**389**	**389**[b]	**7010**	**263**	**252**	**983**	**190**
MD54-01-0021	54-15422	3.7–4.6	Fill	NA[c]	NA	NA	0.0016 (J+)	—[d]	—	0.0084 (J+)	—	—	—	—	—	—	NA
CACB-09-1477	54-15422	5.0–6.0	Fill	—	0.2	0.0877	—	—	—	—	—	—	—	—	—	—	—
MD54-01-0022	54-15422	7.0–7.5	Qbt 3	NA	NA	NA	0.0031 (J+)	—	—	—	—	—	—	—	—	—	NA
CACB-09-1478	54-15422	7.0–8.0	Fill	—	0.005	—	—	—	—	—	—	—	—	—	—	—	—
CACB-09-1464	54-15424	12.5–13.5	Soil	—	0.0038 (J)	—	—	—	—	—	—	—	—	—	—	—	—
CACB-09-1461	54-15427	5.5–7.0	Soil	—	0.0198	0.0369	—	—	—	—	—	—	—	0.00258 (J)	—	—	—
CACB-09-1462	54-15427	7.0–8.0	Fill	—	0.011	0.0267	—	0.108 (J)	—	—	—	—	—	—	—	—	—
MD54-01-0068	54-15448	5.3–6.0	Fill	NA	NA	NA	—	—	—	—	—	—	—	—	—	0.0032 (J)	—
MD54-01-0069	54-15448	7.0–8.0	Soil	NA	NA	NA	—	—	—	0.0086 (J)	—	—	—	—	—	0.0032 (J)	—
CACB-09-1475	54-15449	5.0–6.0	Fill	—	0.171	0.0722	—	—	—	—	—	—	—	—	—	—	—
MD54-01-0070	54-15449	5.0–6.0	Fill	NA	NA	NA	—	0.31 (J)	—	0.0095 (J)	0.0017 (J)	0.0046 (J)	0.0063 (J)	—	0.0025 (J)	—	0.0032 (J)
CACB-09-1476	54-15449	7.0–8.0	Fill	—	0.0081	0.0038	—	—	—	—	—	—	—	—	—	—	—
MD54-01-0071	54-15449	7.0–8.0	Fill	NA	NA	NA	—	—	—	0.014 (J)	—	—	0.0046 (J)	—	—	—	—
CACB-09-1471	54-15450	5.0–6.0	Soil	—	—	—	—	—	—	—	—	—	—	0.00276 (J)	—	—	—
MD54-01-0072	54-15450	5.0–6.0	Fill	NA	NA	NA	—	—	—	—	—	0.0033 (J)	—	—	0.0073	—	—
CACB-09-1481	54-15451	5.0–6.0	Soil	—	0.0946	0.0349	—	—	—	—	—	—	—	—	—	—	—
CACB-09-1482	54-15451	7.0–8.0	Fill	—	0.0055	—	—	—	—	—	—	—	—	—	—	—	—
CACB-09-1483	54-15452	5.0–6.0	Fill	—	0.0179	0.0089	—	—	—	—	—	—	—	—	—	—	—
MD54-01-0076	54-15452	5.0–6.0	Fill	NA	NA	NA	0.0023 (J)	—	—	—	—	—	—	—	—	—	—
CACB-09-1484	54-15452	7.0–8.0	Fill	—	0.0178	0.0084	—	—	—	—	—	—	—	—	—	—	—
MD54-01-0077	54-15452	7.0–8.0	Fill	NA	NA	NA	—	—	0.0023 (J)	—	—	—	—	—	—	—	—
CACB-09-1479	54-15453	5.0–6.0	Fill	—	0.0441	0.0177	—	—	—	—	—	—	—	—	—	—	—
MD54-01-0078	54-15453	5.0–6.0	Fill	NA	NA	NA	—	—	—	0.006 (J+)	—	0.0065 (J+)	0.0038 (J+)	—	0.0018 (J+)	—	—
MD54-01-0079	54-15453	7.0–8.0	Fill	NA	NA	NA	—	—	—	0.0091 (J)	—	—	—	—	—	—	—
CACB-09-1491	54-15454	5.0–6.0	Fill	—	0.0243	0.0079	—	—	—	—	—	—	—	—	—	—	—
MD54-01-0080	54-15454	5.0–6.0	Fill	NA	NA	NA	0.0026 (J+)	—	—	0.006 (J+)	—	—	—	—	—	—	—
CACB-09-1492	54-15454	7.0–8.0	Fill	—	0.0025 (J)	—	—	—	—	—	—	—	—	—	—	—	—
MD54-01-0081	54-15454	7.0–8.0	Fill	NA	NA	NA	—	—	—	0.0073 (J)	—	—	—	—	—	—	—
CACB-09-1489	54-15455	5.0–6.0	Fill	—	0.0035 (J)	—	—	—	—	—	—	—	—	—	—	—	—

Table 6.3-2 (continued)

Sample ID	Location ID	Depth (ft bgs)	Media	Aroclor-1242	Aroclor-1254	Aroclor-1260	Benzene	Bis(2-ethylhexyl)phthalate	Bromomethane	Butanone[2-]	Isopropylbenzene	Isopropyltoluene[4-]	Methyl-2-pentanone[4-]	Methylene Chloride	Toluene	Trichlorofluoromethane	Trimethylbenzene[1,2,4-]
Residential SSL[a]				**1.12**	**1.12**	**1.12**	**10.3**	**347**	**8.51**	**31800**	**271**	**271[b]**	**5510**	**18.2**	**252**	**588**	**58.0**
Construction Worker SSL[a]				**4.28**	**4.28**	**4.28**	**174**	**4660**	**28.2**	**48700**	**389**	**389[b]**	**7010**	**263**	**252**	**983**	**190**
MD54-01-0082	54-15455	5.0–6.0	Fill	NA	NA	NA	0.0023 (J)	—	—	0.01 (J)	—	—	—	—	—	—	—
MD54-01-0083	54-15455	7.0–8.0	Fill	NA	NA	NA	—	—	—	0.0063 (J+)	—	—	—	—	—	—	—
CACB-09-1493	54-15456	5.0–6.0	Fill	—	0.0726	0.0215	—	—	—	—	—	—	—	—	—	—	—
MD54-01-0084	54-15456	5.0–6.0	Fill	NA	NA	NA	0.0027 (J)	—	—	0.0078 (J)	—	—	—	—	—	—	—
CACB-09-1494	54-15456	7.0–8.0	Fill	—	0.0033 (J)	—	—	—	—	—	—	—	—	—	—	—	—
MD54-01-0085	54-15456	7.0–8.0	Fill	NA	NA	NA	—	—	—	0.0039 (J)	—	—	—	—	—	—	—
CACB-09-1487	54-15457	5.0–6.0	Fill	0.0131	0.0739	0.0261	—	—	—	—	—	—	—	—	—	—	—
CACB-09-1485	54-15458	5.0–6.0	Fill	—	0.0115	0.0039	—	—	—	—	—	—	—	—	—	—	—
CACB-09-1486	54-15458	7.0–8.0	Fill	—	0.021	0.0082	—	—	—	—	—	—	—	—	—	—	—
CACB-09-1469	CB-604314	6.0–7.0	Fill	—	0.0149	0.0225	—	—	—	—	—	—	—	—	—	—	—
CACB-09-1470	CB-604314	7.2–8.2	Fill	—	0.0079	0.0171	—	—	—	—	—	—	—	—	—	—	—

Note: Units are mg/kg. Data qualifiers are defined in Appendix A.

[a] Soil screening levels from NMED 2006, 092513.

[b] Soil screening level not available. Isopropylbenzene used as surrogate based on structural similarity.

[c] NA = Not analyzed.

[d] — = Result was not detected.

Appendix A

Acronyms and Abbreviations,
Metric Conversion Table, and Data Qualifier Definitions

A-1.0 ACRONYMS AND ABBREVIATIONS

%R	percent recovery
%RSD	percent relative standard deviation
AK	acceptable knowledge
AOC	area of concern
ASTM	American Society for Testing and Materials
ATSDR	Agency for Toxic Substances and Disease Registry
bgs	below ground surface
BV	background value
C_{sat}	saturation limit
CCV	continuing calibration verification
COC	chain of custody
COPC	chemical of potential concern
COPEC	chemical of potential ecological concern
cpm	count per minute
CVAA	cold vapor atomic absorption
CWDR	chemical waste disposal request
DAF	dilution attenuation factor
DDE	dichlorophenyltrichloroethylene
DDT	dichlorodiphenyltrichloroethane
DER	duplicate error ratio
DGPS	differential global-positioning system
DL	detection limit
DOE	Department of Energy (U.S.)
dpm	disintegration per minute
EDL	estimated detection limit
EETF	Experimental Engineering Test Facility
Eh	oxidation/reduction potential
EP	Environmental Programs Directorate
EPA	Environmental Protection Agency (U.S.)
EPC	exposure point concentrations
EQL	estimated quantitation limit
ER	environmental restoration
ER	Environmental Restoration Project

ESL	ecological screening level
FV	fallout value
GC/MS	gas chromatography-mass spectrometry
GFAA	graphite furnace atomic absorption
HE	high explosive(s) (also HEXP)
HI	hazard index
HIR	historical investigation report
HQ	hazard quotient
HSA	hollow-stem auger
ICS	interference check sample
ICV	initial calibration verification
I.D.	inside diameter
IDW	investigation-derived waste
K_d	soil-water partition coefficient
K_{oc}	organic carbon-water partition coefficient
K_{sat}	saturated hydraulic conductivity
LAL	lower acceptance level
LANL	Los Alamos National Laboratory
LCS	laboratory control sample
LOAEL	lowest-observed-adverse-effect level
LLW	low-level radioactive waste
MDA	material disposal area
MDC	minimum detectable concentration
MDL	method detection limit
MS	matrix spike
NFA	no further action
NMED	New Mexico Environment Department
NMSA	New Mexico Statutes Annotated
NOAEL	no-observed-adverse-effect level
O.D.	outside diameter
OU	operable unit
PB	preparation blank
PCB	polychlorinated biphenyl
PID	photoionization detector

PPE	personal protective equipment
ppm	part per million
PRG	preliminary remediation goal
PVC	polyvinyl chloride
QA	quality assurance
QC	quality control
RANT	Radioassay and Nondestructive Testing
RCRA	Resource Conservation and Recovery Act
RCT	radiation control technician
RDX	research department explosive (also hexahydro-1,3,5-trinitro-1,3,5-triazine)
RfD	reference dose
RFI	RCRA facility investigation
RL	reporting limit
RPD	relative percent difference
RPF	Records Processing Facility
RSL	regional screening level
SAL	screening action level
SCL	sample collection log
SF	slope factor
SSL	soil screening level
SMO	Sample Management Office
SOP	standard operating procedure
SOW	statement of work
SSO	site safety officer
SVOC	semivolatile organic compound
SWMU	solid waste management unit
SWCS	Sanitary Wastewater Consolidation System
T&E	threatened and endangered (species)
TA	technical area
TAL	target analyte list (EPA)
TBD	to be determined
TCLP	toxicity characteristic leaching procedure
TNT	2.4.6-trinitrotoluene
TSCA	Toxic Substances Control Act

TVR toxicity reference value

UAL upper acceptance limit

UCL upper confidence limit

VCA voluntary corrective action

VOC volatile organic compound

WCSF waste characterization strategy form

WPF waste profile form

A-2.0 METRIC CONVERSION TABLE

Multiply SI (Metric) Unit	by	To Obtain U.S. Customary Unit
kilometers (km)	0.622	miles (mi)
kilometers (km)	3281	feet (ft)
meters (m)	3.281	feet (ft)
meters (m)	39.37	inches (in.)
centimeters (cm)	0.03281	feet (ft)
centimeters (cm)	0.394	inches (in.)
millimeters (mm)	0.0394	inches (in.)
micrometers or microns (µm)	0.0000394	inches (in.)
square kilometers (km^2)	0.3861	square miles (mi^2)
hectares (ha)	2.5	acres
square meters (m^2)	10.764	square feet (ft^2)
cubic meters (m^3)	35.31	cubic feet (ft^3)
kilograms (kg)	2.2046	pounds (lb)
grams (g)	0.0353	ounces (oz)
grams per cubic centimeter (g/cm^3)	62.422	pounds per cubic foot (lb/ft^3)
milligrams per kilogram (mg/kg)	1	parts per million (ppm)
micrograms per gram (µg/g)	1	parts per million (ppm)
liters (L)	0.26	gallons (gal.)
milligrams per liter (mg/L)	1	parts per million (ppm)
degrees Celsius (°C)	9/5 + 32	degrees Fahrenheit (°F)

A-3.0 DATA QUALIFIER DEFINITIONS

Data Qualifier	Definition
U	The analyte was analyzed for but not detected.
J	The analyte was positively identified, and the associated numerical value is estimated to be more uncertain than would normally be expected for that analysis.
J+	The analyte was positively identified, and the result is likely to be biased high.
J-	The analyte was positively identified, and the result is likely to be biased low.
UJ	The analyte was not positively identified in the sample, and the associated value is an estimate of the sample-specific detection or quantitation limit.
R	The data are rejected as a result of major problems with quality assurance/quality control (QA/QC) parameters.

Appendix B

Data Review

B-1.0 INTRODUCTION

Data discussed in this appendix are the results from samples collected during the investigations of the four areas of concern (AOCs) in the Middle Cañada del Buey Aggregate Area at Los Alamos National Laboratory (the Laboratory). The investigation work plan (LANL 2007, 102622) specified the locations and target depth intervals from which samples were collected for submission to off-site contract laboratories for analyses. These samples were shipped through the Sample Management Office (SMO) to off-site contract laboratories for analyses and were accompanied by full chain-of-custody (COC) and quality documentation. Data collected in 2008 were combined with data from previous Resource Conservation and Recovery Act (RCRA) facility investigations (RFIs) (LANL 1992, 007669) and voluntary corrective actions (VCAs) (LANL 2000, 070658; LANL 2001, 071473), which met current data quality requirements. The data set is used to identify chemicals of potential concern (COPCs) and define the nature and extent of contamination at each AOC. The final data set and the identified COPCs are also evaluated in the human health and ecological risk screening assessments presented in Appendix H. Complete data sets, analytical data packages, COC forms, and sample collection logs for all sites investigated are provided on DVD (Appendix F).

B-2.0 OVERVIEW OF COPC IDENTIFICATION

A primary purpose of the data review is to identify COPCs for each site in the Middle Cañada del Buey Aggregate Area addressed in this investigation report. This section describes the COPC identification process applied to the final data set for the AOCs in the Middle Cañada del Buey Aggregate Area.

Background data are generally available for soil, sediment, and tuff (LANL 1998, 059730). Sample media encountered in this investigation include soil (designated by the media code Soil); fill (media code Fill); and Bandelier Tuff (media codes Qbt 3, Qbt 2, and Qbt 1v). The results from fill samples are evaluated by comparison to soil background data (LANL 1998, 059730). Analytes are identified as COPCs for an entire site if they are COPCs in any of the media sampled at the site.

An inorganic chemical is initially identified as a COPC if at least one result or the analytical detection limit (DL) exceeds the background values (BVs) (LANL 1998, 059730). If additional comparisons with the background data set demonstrate that inorganic chemical concentrations are within the range of background concentrations, the chemicals are eliminated as COPCs. If there are no associated BVs, the chemicals are retained as COPCs if detected in site samples. Organic chemicals have no BVs and are identified as COPCs based on detection status. Radionuclides are identified as COPCs based on background comparisons or detection status.

Radionuclides are identified as COPCs based on comparisons to BVs for naturally occurring radionuclides or fallout values (FVs) for fallout radionuclides (americium-241, cesium-137, plutonium-238, plutonium-239/240, strontium-90, and tritium). The soil FVs typically apply only to surface samples (0–0.5 ft below ground surface [bgs]). If the activity of a fallout radionuclide exceeds the FV in a sample from the top 6 in., it is initially identified as a COPC. If additional comparisons with the background data set demonstrate that sample activities are within the range of background activities, the radionuclide is eliminated as a COPC. Fallout radionuclides detected in samples collected below 6 in. in undisturbed soil or detected in tuff are designated as COPCs. Naturally occurring radionuclides (uranium-234, uranium-235, and uranium-238) detected at activities above their respective BVs in site samples are identified as COPCs. For all radionuclides, if there is no associated BV/FV for the radionuclide and it is detected in site samples, it is retained as a COPC.

B-3.0 COPCs FOR AOC 18-005(b)

No sampling was previously conducted at AOC 18-005(b). Eight fill samples were collected from four locations in 2008. These samples were analyzed for target analyte list (TAL) metals, cyanide, explosive compounds, semivolatile organic chemicals (SVOCs), nitrate, and perchlorate. Table B-3.0-1 lists the samples collected and the analyses requested.

B-3.1 Results of Inorganic Chemicals in Samples Collected from AOC 18-005(b)

Eight samples were analyzed for TAL metals, cyanide, nitrate, and perchlorate. Table B-3.1-1 presents the inorganic chemicals above BVs at AOC 18-005(b). The locations and concentrations of inorganic chemicals detected above BVs at AOC 18-005(b) are shown in Figure 6.1-2.

Calcium is detected above the soil BV, and cadmium had DLs above soil BV, but they are not retained as COPCs because their concentrations and DLs are within the range of concentrations in the soil background data sets (LANL 1998, 059730).

Antimony and barium are detected in at least one sample above the soil BVs and the maximum soil background concentrations. These inorganic chemicals are retained as COPCs.

Nitrate and perchlorate are detected in at least one sample but have no BVs. These inorganic chemicals are retained as COPCs.

B-3.2 Results of Organic Chemicals in Samples Collected from AOC 18-005(b)

Eight fill samples were analyzed for explosive compounds and SVOCs. No organic chemicals were detected at AOC 18-005(b).

B-3.3 Results of Radionuclides in Samples Collected from AOC 18-005(b)

Radionuclides were not analyzed for in the samples from AOC 18-005(b).

B-3.4 Summary of COPCs for AOC 18-005(b)

Four inorganic chemicals are identified as COPCs and are summarized in Table B-3.4-1.

B-4.0 COPCs FOR AOC 18-005(c)

No sampling was previously conducted at AOC 18-005(c). Five soil samples and three tuff samples were collected from four locations in 2008. These samples were analyzed for TAL metals, cyanide, explosive compounds, SVOCs, nitrate, and perchlorate. Table B-4.0-1 lists the samples collected and the analyses requested.

B-4.1 Results of Inorganic Chemicals in Samples Collected from AOC 18-005(c)

Eight samples were analyzed for TAL metals, cyanide, nitrate, and perchlorate. Table B-4.1-1 presents the inorganic chemicals above BVs at AOC 18-005(b). The locations and concentrations of inorganic chemicals detected above BVs at AOC 18-005(c) are shown in Figure 6.1-3.

B-4.1.1 Inorganic Chemicals in Soil

Antimony is detected above the soil BV and the maximum soil background concentration. Antimony is retained as a COPC.

Nitrate and perchlorate are detected in at least one soil sample but have no BVs. These inorganic chemicals are retained as COPCs.

Cadmium was not detected but several DLs are above the soil BV. The DLs are within the range of concentrations in the soil background data set (LANL 1998, 059730). Cadmium is not retained as a COPC.

B-4.1.2 Inorganic Chemicals in Tuff

Lead was detected above the tuff BV in one sample but was not retained as a COPC because the concentration is within the range of concentrations in the tuff background data set (LANL 1998, 059730).

Arsenic, barium, and chromium are detected concentration above the tuff BVs and the maximum tuff background concentrations. These inorganic chemicals are retained as COPCs.

Perchlorate was detected in at least one tuff sample but has no BV. Perchlorate is retained as a COPC.

Calcium was detected above the tuff BV and the maximum tuff background concentration in one sample. Calcium is not retained as a COPC because it was detected infrequently and is an essential nutrient (EPA 1989, 008021).

B-4.2 Results of Organic Chemicals in Samples Collected from AOC 18-005(c)

Five soil samples and three tuff samples were analyzed for explosive compounds and SVOCs. No organic chemicals were detected at AOC 18-005(c).

B-4.3 Results of Radionuclides in Samples Collected from AOC 18-005(c)

Radionuclides were not analyzed for in the samples from AOC 18-005(c).

B-4.4 Summary of COPCs for AOC 18-005(c)

Three inorganic chemicals are identified as COPCs in fill and four inorganic chemicals are identified as COPCs in tuff. COPCs for AOC 18-005(c) are summarized in Table B-3.4-1.

B-5.0 COPCs FOR AOC 51-001

One tuff sample was collected in 1995 as part of the RFI and analyzed for TAL metals, cyanide, polychlorinated biphenyls (PCBs), pesticides, SVOCs, volatile organic compounds (VOCs), gamma spectroscopy, and gross alpha-beta radioactivity. Five soil/fill and seven tuff samples were collected from six locations in 2001 as part of the VCA and analyzed for SVOCs, VOCs, gamma spectroscopy, tritium, isotopic plutonium, isotopic uranium, and strontium-90. One fill sample and 13 tuff samples were collected from seven locations in 2008. These samples were analyzed for TAL metals, cyanide, SVOCs, VOCs, nitrate, tritium, isotopic plutonium, and isotopic uranium. Table B-5.0-1 lists the samples collected and the analyses requested.

B-5.1 Results of Inorganic Chemicals in Samples Collected from AOC 51-001

Fifteen samples were analyzed for TAL metals and cyanide and 14 samples were analyzed for nitrate. Table B-5.1-1 presents the inorganic chemicals above BVs at AOC 51-001. The locations and concentrations of the inorganic chemicals detected above BVs at AOC 51-001 are shown in Figure 6.2-2.

B-5.1.1 Inorganic Chemicals in Soil and Fill

Calcium is detected above the soil BV and cadmium has a DL above soil BV in one sample. Calcium and cadmium are not retained as COPCs because the concentration and DL are within the range of concentrations in the soil background data sets (LANL 1998, 059730).

Antimony was detected above the soil BV and the maximum soil background concentration in one sample. Antimony is retained as a COPC.

Nitrate was detected in one sample, but has no BV. Nitrate is retained as a COPC.

B-5.1.2 Inorganic Chemicals in Tuff

Lead is detected above the tuff BV in two samples, but is not retained as a COPC because the detected concentrations are within the range of concentrations in the tuff background data set (LANL 1998, 059730).

Calcium was detected above the tuff BV and maximum tuff background concentration in one sample. The detected concentration is less than two times the maximum background concentration. Calcium is not retained as a COPC because it was detected infrequently at a concentration only slightly higher than background, and is an essential nutrient (EPA 1989, 008021).

Antimony, arsenic, barium, and chromium are detected above the tuff BVs and the maximum tuff background concentrations. These inorganic chemicals are retained as COPCs.

Nitrate is detected in at least one sample, but has no BV. Nitrate is retained as a COPC.

Cadmium, mercury, selenium, and silver are not detected but have at least one DL above the tuff BVs and the maximum tuff background concentrations. These inorganic chemicals are retained as COPCs.

B-5.2 Results of Organic Chemicals in Samples Collected from AOC 51-001

Twenty-seven samples were analyzed for SVOCs and VOCs and one sample was analyzed for PCBs and pesticides. The organic chemicals detected are bromomethane, butanone[-2], and trichlorofluoromethane (Table B-5.2-1). All detected organic chemicals are retained as COPCs.

B-5.3 Results of Radionuclides in Samples Collected from AOC 51-001

Twenty-six samples were analyzed for tritium, isotopic plutonium, and isotopic uranium, 13 samples were analyzed by gamma spectroscopy, and 12 samples were analyzed for strontium-90. Table B-5.3-1 presents radionuclides detected or detected above BVs/FVs. The locations and concentrations of radionuclides detected or detected above BVs/FVs at AOC 51-001 are shown in Figure 6.2-3.

B-5.3-1 Radionuclides in Soil and Fill

Cesium-137 and tritium are detected in one fill sample below 0–0.5 ft. These radionuclides are retained as COPCs.

B-5.3-2 Radionuclides in Tuff

Tritium is detected in one tuff sample and is retained as a COPC.

Uranium-235/236 was detected in one tuff sample slightly above BV and is retained as a COPC.

B-5.4 Summary of COPCs for AOC 51-001

Two inorganic chemicals are identified as COPCs in fill and nine inorganic chemicals are identified as COPCs in tuff. Two radionuclides are identified as COPCs in fill and two radionuclides are identified as COPCs in tuff. Three organic chemicals are identified as COPCs in tuff. COPCs for AOC 51-001 are summarized in Table B-3.4-1.

B-6.0 AOC 54-007(d)

Thirty-one soil/fill samples and one tuff sample were collected in 2001 as part of the VCA and analyzed for SVOCs and VOCs. Thirty-four soil/fill samples from 17 locations were collected in 2008 and analyzed for TAL metals, cyanide, SVOCs, VOCs, nitrate, PCBs, pesticides, and isotopic uranium. Table B-6.0-1 lists the samples collected and the analyses requested.

B-6.1 Results of Inorganic Chemicals in Samples Collected from AOC 54-007(d)

Thirty-four samples were analyzed for TAL metals, cyanide, and nitrate. Table B-6.1-1 presents the inorganic chemicals above BVs at AOC 54-007(d). The locations and concentrations of the inorganic chemicals above BVs at AOC 54-007(d) are shown in Figure 6.3-2.

Cadmium is not detected but has DLs above its soil BV. Cadmium is not retained as a COPC because the DLs are within the range of concentrations in the soil background data set (LANL 1998, 059730).

Antimony, arsenic, and zinc are detected concentration above soil BVs and the maximum soil background concentrations. These inorganic chemicals are retained as COPCs.

Nitrate is detected in at least one sample, but has no soil BV. Nitrate is retained as a COPC.

B-6.2 Results of Organic Chemicals in Samples Collected from AOC 54-007(d)

Sixty-six samples were analyzed for SVOCs and VOCs, and 34 samples were analyzed for PCBs and pesticides. The organic chemicals detected include Aroclor-1242, Aroclor-1254, Aroclor-1260, benzene, bis(2-ethylhexyl)phthalate, bromomethane, butanone[-2], isopropyltoluene, isopropyltoluene[-4], methyl-2-pentanone[-4], methylene chloride, toluene, trichlorofluoromethane, and trimethylbenzene[1,2,4-] (Table B-6.2-1). All detected organic chemicals are retained as COPCs.

B-6.3 Results of Radionuclides in Samples Collected from AOC 54-007(d)

Thirty-four soil/fill samples were collected in 2008 and analyzed for isotopic uranium. No uranium isotopes were detected above BVs and there are no radionuclide COPCs.

B-6.4 Summary of COPCs for AOC 54-007(d)

Four inorganic chemicals are identified as COPCs in fill and soil. Fourteen organic chemicals are identified as COPCs in soil and fill. COPCs for AOC 54-007(d) are summarized in Table B-3.4-1.

B-7.0 NATURE AND EXTENT OF CONTAMINATION AT AOC 18-005(b)

Eight samples were collected from four locations at AOC 18-005(b) and four inorganic COPCs were identified.

Antimony was detected at levels slightly above the maximum soil background concentration (1 mg/kg) and concentrations decreased with depth at all four sampling locations. The concentrations are likely naturally occurring and not indicative of a release. The extent of antimony is defined.

Barium was detected slightly above the maximum soil background concentration (410 mg/kg) in one sample at 2-3 ft bgs. All other samples had barium detected below the soil BV. The one barium concentration is likely naturally occurring and not indicative of a release. The extent of barium is defined.

Nitrate was detected in all eight samples. Nitrate concentrations decrease with depth at one location, do not change with depth at one location, and increase slightly at two locations. The concentrations are likely naturally occurring and not indicative of a release. The extent of nitrate is defined.

Perchlorate was detected in a surface sample at a concentration less than the estimated DL at one location and was not detected in the deeper sample. Perchlorate was also detected in one deeper sample at one location at a concentration less than the estimated DL. The detected concentrations are not indicative of a release. The extent of perchlorate is defined.

B-8.0 NATURE AND EXTENT OF CONTAMINATION AT AOC 18-005(c)

Eight samples were collected from four locations at AOC 18-005(c) and six inorganic COPCs were identified.

Antimony was detected at levels slightly above the maximum soil background concentration (1 mg/kg) at three locations. Concentrations decreased with depth at two locations and remained unchanged with depth at one location. The concentrations are likely naturally occurring and not indicative of a release. The extent of antimony is defined.

Arsenic was detected above the tuff BV at three locations. Two concentrations were less than the maximum tuff background concentration (5 mg/kg) and one concentration was slightly above the maximum at 5.27 mg/kg. The concentrations are likely naturally occurring and not indicative of a release. The extent of arsenic is defined.

Barium was detected above the tuff BV at three locations. One concentration was less than the maximum tuff background concentration (51.6 mg/kg), one concentration was slightly above the maximum at

53.7 mg/kg, and one concentration was less than twice the maximum at 91.3 mg/kg. The concentrations are likely naturally occurring levels and not indicative of a release. The extent of barium is defined.

Chromium was detected above the tuff BV at three locations. Two concentrations were less than the maximum tuff background concentration (13 mg/kg), and one concentration was slightly above the maximum at 16.3 mg/kg. The concentrations are likely naturally occurring and not indicative of a release. The extent of chromium is defined.

Nitrate was detected at two samples from one location. The concentrations are likely naturally occurring and not indicative of a release. The extent of nitrate is defined.

Perchlorate was detected at all four locations at concentrations slightly above or below the estimated DLs. The detected concentrations are not indicative of a release. The extent of perchlorate is defined.

B-9.0 NATURE AND EXTENT OF CONTAMINATION AT AOC 51-001

Twenty-seven samples were collected from eight locations and five inorganic COPCs, three organic COPCs, and three radionuclide COPCs were detected at AOC 51-001. Samples were collected from beneath the septic tank and drainlines and adjacent to the seepage pit and were designed to characterize the site at depth.

Antimony was detected above the soil BV in one sample and the tuff BV in four samples at four locations. Concentrations decreased with depth at each location. The concentrations are likely naturally occurring and not indicative of a release. The extent of antimony is defined.

Arsenic was detected above the maximum background concentration for Qbt 1v (2 mg/kg) in two samples at one location. The concentrations at this location decrease very slightly with depth and are slightly above the maximum. The other arsenic concentrations in tuff are either less than the maximum background concentration for Qbt 1v or less than the maximum background concentration for Qbt 2 (5 mg/kg). The concentrations are likely naturally occurring and not indicative of a release. The extent of arsenic is defined.

Barium was detected in one tuff sample (63 mg/kg), slightly above the maximum background concentration for Qbt 2 (51.6 mg/kg) but was not detected in the deeper samples at this location (location 51-10003). The concentrations are likely naturally occurring levels and not indicative of a release. The extent of barium is defined.

Chromium was detected above the Qbt 1v BV (2.24 mg/kg) in three tuff samples at two locations (locations 51-10000 and 51-10001). Chromium was not detected in the deeper sample at location 51-10000 and concentrations decreased with depth at location 51-10001. The concentrations are likely naturally occurring and not indicative of a release. The extent of chromium is defined.

Nitrate was detected in nine tuff samples and one fill sample at five locations. Concentrations decreased with depth at all locations. The concentrations are likely naturally occurring and not indicative of a release. The extent of nitrate is defined.

Cesium-137 was detected in one sample at location 51-10002 but was not detected in deeper samples at this location. The extent of cesium-137 is defined.

Tritium was detected at low concentrations in two samples—one each at locations 51-10004 and 51-10005. Tritium was not detected in the deeper samples at location 51-10005. The detected tritium was

in the deepest sample at location 51-10004 but was not detected at shallower depths. The extent of tritium is defined.

Uranium-235/236 was detected slightly above the Qbt 2 BV (0.09 pCi/g) at 0.098 pCi/g in the deepest sample at location CB-604309. Uranium-235/236 was not detected above BV in any other samples or locations. The concentrations are likely naturally occurring and not indicative of a release. The extent of uranium-235/236 is defined.

Three VOCs (bromomethane, 2-butanone, and trichlorofluoromethane) were detected at concentrations below estimated quantitation limits (EQLs) at two locations. The VOCs were detected at concentrations below the EQLs in the deepest samples collected in 2001 at location 51-10000 and/or location 51-10001. None of these VOCs were detected in the samples collected in 2008 from the same sampling locations but slightly deeper depths (50 ft and 60 ft in 2001 samples compared with 50.5 ft and 60.5 ft at location 51-10000 and 51.5 ft and 61 ft at location 51-10001 in 2008). The extent of bromomethane, 2-butanone, and trichlorofluoromethane is defined.

B-10.0 NATURE AND EXTENT OF CONTAMINATION AT AOC 54-007(d)

Sixty-six samples were collected from 17 locations and 4 inorganic COPCs and 14 organic COPCs were identified at AOC 54-007(d). Samples were collected from beneath the septic tank, drainlines, and the drain field and were designed to characterize the site at depth.

Antimony was detected above the maximum background concentration in 25 soil/fill samples at 16 sampling locations. Antimony concentrations were consistent across the site, and concentrations decreased with depth at 9 of the 16 sampling locations. Concentrations did not change substantially with depth at three locations and increased slightly with depth at four locations. Concentrations above background ranged from 1.05 to 4.46 mg/kg. The concentrations of antimony are likely naturally occurring and not indicative of a release. The extent of antimony is defined.

Arsenic was detected above the maximum background concentration in 22 fill samples at 14 locations. Arsenic concentrations decreased with depth at 9 of the 14 sampling locations, did not change substantially with depth at 4 locations, and increased slightly with depth at 2 locations. Concentrations above background ranged from 10 mg/kg to 13.4 mg/kg. The concentrations of arsenic are likely naturally occurring and not indicative of a release. The extent of arsenic is defined.

Nitrate was detected in 20 fill samples at 12 locations. Concentrations ranged from 0.608 to 8.42 mg/kg and are likely naturally occurring. The extent of nitrate is defined.

Zinc was detected above the maximum background concentration in two fill samples at locations 54-15457 and CB-604314. Zinc was not detected in the deeper sample at location 54-15457 and was not detected in the shallower sample at location CB-604314. The extent of zinc is defined.

Benzene, bis(2-ethylhexyl)phthalate, bromomethane, butanone[2-], isopropylbenzene, isopropyltoluene[4-], methyl-2-pentanone[4-], methylene chloride, trichlorofluoromethane, and trimethylbenzene[1,2,4-] were detected at concentrations below EQLs. Concentrations for all of the organic chemicals generally decreased with depth. Benzene at one location increased slightly with depth; bis(2-ethylhexyl)phthalate and bromomethane at one location were detected below the EQLs in only the deepest sample; butanone[2-] at three locations increased slightly with depth; and trichlorofluoromethane did not change with depth at one location. Concentrations for these five organic COPCs were below the EQLs. The extent of benzene, bis(2-ethylhexyl)phthalate, bromomethane, butanone[2-],

isopropylbenzene, isopropyltoluene[4-], methyl-2-pentanone[4-], methylene chloride, trichlorofluoromethane, and trimethylbenzene[1,2,4-] is defined.

Aroclor-1242 was detected in only one sample at location 54-15457 but was not detected in the deeper sample at this location. Aroclor-1254 was detected in 22 samples from 13 locations. Concentrations decreased with depth at 10 locations, increased slightly with depth at 2 locations and did not change at 1 location. Concentrations showing an increase or no change with depth were 0.02 mg/kg or less. Aroclor-1260 was detected in samples at 11 locations. Concentrations decreased with depth at 9 locations, increased slightly at 1 location, and did not change at 1 location. Concentrations showing an increase or no change with depth were less than 0.009 mg/kg. The extent of Aroclor-1242, Aroclor-1254, and Aroclor-1260 is defined.

Toluene was detected at three locations, with two concentrations being below the EQL. Concentrations decreased with depth at each location. The extent of toluene is defined.

B-11.0 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 number. This information is also included in text citations. ER ID numbers 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 New Mexico Environment Department Hazardous Waste Bureau; the U.S. Department of Energy–Los Alamos Site Office; the U.S. Environmental Protection Agency, Region 6; 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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LANL (Los Alamos National Laboratory), May 2005. "Derivation and Use of Radionuclide Screening Action Levels, Revision 1," Los Alamos National Laboratory document LA-UR-05-1849, Los Alamos, New Mexico. (LANL 2005, 088493)

LANL (Los Alamos National Laboratory), December 2007. "Investigation Work Plan for Middle Cañada del Buey Aggregate Area, Revision 1," Los Alamos National Laboratory document LA-UR-07-8316, Los Alamos, New Mexico. (LANL 2007, 102622)

NMED (New Mexico Environment Department), June 2006. "Technical Background Document for Development of Soil Screening Levels, Revision 4.0, Volume 1, Tier 1: Soil Screening Guidance Technical Background Document," New Mexico Environment Department, Hazardous Waste Bureau and Ground Water Quality Bureau Voluntary Remediation Program, Santa Fe, New Mexico. (NMED 2006, 092513)

Table B-3.0-1
Summary of Samples Collected and Analyses Requested at AOC 18-005(b)

Location ID	Sample ID	Depth (ft)	Media	Cyanide	Metals	Explosive Compounds	SVOCs	Nitrate	Perchlorate
CB-604295	CACB-09-1423	0.0–1.0	Fill	09-489*	09-489	09-488	09-488	09-489	09-489
CB-604295	CACB-09-1424	2.0–3.0	Fill	09-489	09-489	09-488	09-488	09-489	09-489
CB-604296	CACB-09-1425	0.0–1.0	Fill	09-489	09-489	09-488	09-488	09-489	09-489
CB-604296	CACB-09-1426	2.0–3.0	Fill	09-489	09-489	09-488	09-488	09-489	09-489
CB-604297	CACB-09-1427	0.0–1.0	Fill	09-504	09-504	09-504	09-504	09-504	09-504
CB-604297	CACB-09-1428	2.0–3.0	Fill	09-504	09-504	09-504	09-504	09-504	09-504
CB-604298	CACB-09-1429	0.0–1.0	Fill	09-504	09-504	09-504	09-504	09-504	09-504
CB-604298	CACB-09-1430	2.0–3.0	Fill	09-504	09-504	09-504	09-504	09-504	09-504

*Request numbers.

Table B-3.1-1
Inorganic Chemicals above BVs at AOC 18-005(b)

Location ID	Sample ID	Depth (ft)	Media	Antimony	Barium	Cadmium	Calcium	Nitrate	Perchlorate
Soil BV[a]				**0.83**	**295**	**0.4**	**6120**	**na**[b]	**na**
Residential Soil Screening Level (SSL)[c]				**31.3**	**15600**	**39.0**	**na**	**100000**	**55**[d]
Industrial SSL[c]				**454**	**100000**	**564**	**na**	**100000**	**720**[d]
Construction Worker SSL[c]				**124**	**60200**	**154**	**na**	**100000**	**na**
CB-604295	CACB-09-1423	0.0–1.0	Fill	1.21	—[e]	0.52 (U)	—	8.25	0.000596 (J)
CB-604295	CACB-09-1424	2.0–3.0	Fill	—	—	0.578 (U)	—	8.43	—
CB-604296	CACB-09-1425	0.0–1.0	Fill	1.04 (J)	—	0.546 (U)	—	9.37	—
CB-604296	CACB-09-1426	2.0–3.0	Fill	0.909 (J)	—	0.576 (U)	6710	14	0.000756 (J)
CB-604297	CACB-09-1427	0.0–1.0	Fill	1.04 (J)	—	0.544 (U)	—	13.2	—
CB-604297	CACB-09-1428	2.0–3.0	Fill	—	—	0.552 (U)	6920	22.2	—
CB-604298	CACB-09-1429	0.0–1.0	Fill	1.3	—	0.537 (U)	—	32.7	—
CB-604298	CACB-09-1430	2.0–3.0	Fill	1.14 (U)	420	0.569 (U)	—	15.5	—

Notes: Units are mg/kg. Data qualifiers are defined in Appendix A.

[a] BVs from LANL (1998, 059730).

[b] na = Not available.

[c] SSLs from NMED (2006, 092513), unless otherwise noted.

[d] SSL from EPA regional screening table (http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/pdf/composite_sl_table_run_12SEP2008.pdf).

[e] — = Result was not detected or was below the BV.

Table B-3.4-1
COPCs in Fill, Soil, and Tuff at Middle Cañada Del Buey Aggregate Area

COPC	Media	Reason Retained
AOC 18-005(b)		
Inorganic Chemicals		
Antimony	Fill	Detected above background
Barium	Fill	Detected above background
Nitrate	Fill	Detected but no background available
Perchlorate	Fill	Detected but no background available
AOC 18-005(c)		
Inorganic Chemicals		
Antimony	Soil	Detected above background
Arsenic	Tuff	Detected above background
Barium	Tuff	Detected above background
Chromium	Tuff	Detected above background
Nitrate	Soil	Detected but no background available
Perchlorate	Soil, Tuff	Detected but no background available
AOC 51-001		
Inorganic Chemicals		
Antimony	Fill, Tuff	Detected above background
Arsenic	Tuff	Detected above background
Barium	Tuff	Detected above background
Cadmium	Tuff	Detection limit exceeds background
Chromium	Tuff	Detected above background
Mercury	Tuff	Detection limit exceeds background
Nitrate	Fill, Tuff	Detected above background
Selenium	Tuff	Detection limit exceeds background
Silver	Tuff	Detection limit exceeds background
Radionuclides		
Tritium	Fill, Tuff	Detected below 0.5 ft bgs
Cesium-137	Fill	Detected below 0.5 ft bgs
Uranium-235/236	Tuff	Detected above background
Organic Chemicals		
Bromomethane	Tuff	Detected
Butanone[2-]	Tuff	Detected
Trichlorofluoromethane	Tuff	Detected

Table B-3.4-1 (continued)

COPC	Media	Reason Retained
AOC 54-007(d)		
Inorganic Chemicals		
Antimony	Soil, Fill	Detected above background
Arsenic	Soil, Fill	Detected above background
Nitrate	Soil, Fill	Detected and no background
Zinc	Fill	Detected above background
Organic Chemicals		
Aroclor-1242	Fill	Detected
Aroclor-1254	Soil, Fill	Detected
Aroclor-1260	Soil, Fill	Detected
Benzene	Fill, Tuff	Detected
Bis(2-ethylhexyl)phthalate	Fill	Detected
Bromomethane	Fill	Detected
Butanone[2-]	Soil, Fill	Detected
Isopropylbenzene	Fill	Detected
Isopropyltoluene[4-]	Fill	Detected
Methyl-2-pentanone[4-]	Fill	Detected
Methylene Chloride	Soil	Detected
Toluene	Fill	Detected
Trichlorofluoromethane	Soil, Fill	Detected
Trimethylbenzene[1,2,4-]	Fill	Detected

Table B-4.0-1
Summary of Samples Collected and Analyses Requested at AOC 18-005(c)

Location ID	Sample ID	Depth (ft)	Media	Cyanide	Metals	Explosive Compounds	SVOC	Nitrate	Perchlorate
CB-604299	CACB-09-1436	0.0–1.0	Soil	09-519*	09-519	09-518	09-518	09-519	09-519
CB-604299	CACB-09-1437	2.0–3.0	Qbt 2	09-519	09-519	09-518	09-518	09-519	09-519
CB-604300	CACB-09-1438	0.0–1.0	Soil	09-519	09-519	09-518	09-518	09-519	09-519
CB-604300	CACB-09-1439	2.0–3.0	Soil	09-519	09-519	09-518	09-518	09-519	09-519
CB-604301	CACB-09-1440	0.0–1.0	Soil	09-519	09-519	09-518	09-518	09-519	09-519
CB-604301	CACB-09-1441	2.0–3.0	Qbt 2	09-519	09-519	09-518	09-518	09-519	09-519
CB-604302	CACB-09-1442	0.0–1.0	Soil	09-519	09-519	09-518	09-518	09-519	09-519
CB-604302	CACB-09-1443	2.0–3.0	Qbt 2	09-519	09-519	09-518	09-518	09-519	09-519

*Request numbers.

Table B-4.1-1
Inorganic Chemicals above BVs at AOC 18-005(c)

Location ID	Sample ID	Depth (ft)	Media	Antimony	Arsenic	Barium	Cadmium	Calcium	Chromium	Lead	Nitrate	Perchlorate
Soil BV[a]				**0.83**	**8.17**	**295**	**0.4**	**6120**	**19.3**	**22.3**	**na**[b]	**na**
Qbt 2 BV[a]				**0.5**	**2.79**	**46**	**1.63**	**2200**	**7.14**	**11.2**	**na**	**na**
Residential Soil Screening Level (SSL)[c]				**31.3**	**3.9**	**15600**	**39.0**	**na**	**2800**[d]	**400**	**100000**	**55**[d]
Industrial SSL[c]				**454**	**17.7**	**100000**	**564**	**na**	**14000**[d]	**800**	**100000**	**720**[d]
Construction Worker SSL[c]				**124**	**85.2**	**60200**	**154**	**na**	**26.1**[e]	**800**	**100000**	**na**
CB-604299	CACB-09-1436	0.0–1.0	Soil	1.58	—[f]	—	0.524 (U)	—	—	—	—	—
CB-604299	CACB-09-1437	2.0–3.0	Qbt 2	—	5.27	91.3	—	7060	16.3	12	—	0.00215
CB-604300	CACB-09-1438	0.0–1.0	Soil	1.51	—	—	0.51 (U)	—	—	—	1.02 (J-)	0.000775 (J)
CB-604300	CACB-09-1439	2.0–3.0	Soil	1.57	—	—	0.525 (U)	—	—	—	3.19 (J-)	0.00312
CB-604301	CACB-09-1440	0.0–1.0	Soil	—	—	—	0.535 (U)	—	—	—	—	—
CB-604301	CACB-09-1441	2.0–3.0	Qbt 2	—	3.74	47	—	—	7.37	—	—	0.000606 (J)
CB-604302	CACB-09-1442	0.0–1.0	Soil	0.882 (J)	—	—	0.548 (U)	—	—	—	—	0.00057 (J)
CB-604302	CACB-09-1443	2.0–3.0	Qbt 2	—	3.67	53.7	—	—	9.56	—	—	0.00107 (J)

Notes: Units are mg/kg. Data qualifiers are defined in Appendix A.

[a] BVs from LANL (1998, 059730).

[b] na = Not available.

[c] SSLs from NMED (2006, 092513), unless otherwise noted.

[d] SSL from EPA regional screening table (http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/pdf/composite_sl_table_run_12SEP2008.pdf).

[e] SSL for hexavalent chromium is from NMED (2006, 092513).

[f] — = Result was not detected or was below the BV.

Table B-5.0-1
Summary of Samples Collected and Analyses Requested at AOC 51-001

Sample ID	Location ID	Depth (ft)	Media	Cyanide	Metals	PCBs	Pesticides	SVOCs	VOCs	Nitrate
0551-95-2016	51-09203	50.0–60.0	Qbt 3	1685[a]	1685	1684	1684	1684	1684	—[b]
MD51-01-0001	51-10000	49.0–50.0	Qbt 3	—	—	—	—	8332R	8332R	—
CACB-09-1454	51-10000	49.0–50.5	Qbt 1v	09-471	09-471	—	—	09-471	09-471	09-471
MD51-01-0002	51-10000	59.0–60.0	Qbt 3	—	—	—	—	8332R	8332R	—
CACB-09-1455	51-10000	59.0–60.5	Qbt 1v	09-471	09-471	—	—	09-471	09-471	09-471
MD51-01-0003	51-10001	49.0–50.0	Qbt 3	—	—	—	—	8332R	8332R	—
CACB-09-1452	51-10001	49.0–51.5	Qbt 1v	09-469	09-469	—	—	09-468	09-468	09-469
MD51-01-0004	51-10001	59.0–60.0	Qbt 3	—	—	—	—	8332R	8332R	—
CACB-09-1453	51-10001	59.0–61.0	Qbt 1v	09-469	09-469	—	—	09-468	09-468	09-469
MD51-01-0005	51-10002	4.5–5.5	Soil	—	—	—	—	8308R	8308R	—
MD51-01-0006	51-10002	5.5–6.5	Fill	—	—	—	—	8308R	8308R	—
CACB-09-1444	51-10002	7.5–9.0	Qbt 2	09-469	09-469	—	—	09-468	09-468	09-469
CACB-09-1445	51-10002	9.5–11.0	Qbt 2	09-469	09-469	—	—	09-468	09-468	09-469
CACB-09-1446	51-10003	10.5–12.0	Qbt 2	09-469	09-469	—	—	09-468	09-468	09-469
MD51-01-0007	51-10003	11.0–12.0	Soil	—	—	—	—	8308R	8308R	—
MD51-01-0008	51-10003	12.0–13.0	Qbt 3	—	—	—	—	8308R	8308R	—
CACB-09-1447	51-10003	12.5–14.0	Qbt 2	09-469	09-469	—	—	09-468	09-468	09-469
CACB-09-1448	51-10004	10.5–12.0	Qbt 2	09-469	09-469	—	—	09-468	09-468	09-469
MD51-01-0009	51-10004	11.0–12.0	Soil	—	—	—	—	8308R	8308R	—
MD51-01-0010	51-10004	12.0–13.0	Qbt 3	—	—	—	—	8308R	8308R	—
CACB-09-1449	51-10004	12.5–14.0	Qbt 2	09-469	09-469	—	—	09-468	09-468	09-469
CACB-09-1450	51-10005	10.0–12.0	Fill	09-469	09-469	—	—	09-468	09-468	09-469
MD51-01-0011	51-10005	11.0–12.0	Fill	—	—	—	—	8308R	8308R	—
MD51-01-0012	51-10005	12.0–13.0	Qbt 3	—	—	—	—	8308R	8308R	—
CACB-09-1451	51-10005	12.5–14.5	Qbt 2	09-469	09-469	—	—	09-468	09-468	09-469
CACB-09-1456	CB-604309	7.5–9.0	Qbt 2	09-469	09-469	—	—	09-468	09-468	09-469
CACB-09-1457	CB-604309	9.5–11.0	Qbt 2	09-469	09-469	—	—	09-468	09-468	09-469

Table B-5.0-1 (continued)

Sample ID	Location ID	Depth (ft)	Media	Gamma Spectroscopy	Gross Alpha/Beta	Tritium	Isotopic Plutonium	Isotopic Uranium	Strontium-90
0551-95-2016	51-09203	50.0–60.0	Qbt 3	1686	1686	—	—	—	—
MD51-01-0001	51-10000	49.0–50.0	Qbt 3	8334R	—	8334R	8334R	8334R	8334R
CACB-09-1454	51-10000	49.0–50.5	Qbt 1v	—	—	09-471	09-471	09-471	—
MD51-01-0002	51-10000	59.0–60.0	Qbt 3	8334R	—	8334R	8334R	8334R	8334R
CACB-09-1455	51-10000	59.0–60.5	Qbt 1v	—	—	09-471	09-471	09-471	—
MD51-01-0003	51-10001	49.0–50.0	Qbt 3	8334R	—	8334R	8334R	8334R	8334R
CACB-09-1452	51-10001	49.0–51.5	Qbt 1v	—	—	09-470	09-470	09-470	—
MD51-01-0004	51-10001	59.0–60.0	Qbt 3	8334R	—	8334R	8334R	8334R	8334R
CACB-09-1453	51-10001	59.0–61.0	Qbt 1v	—	—	09-470	09-470	09-470	—
MD51-01-0005	51-10002	4.5–5.5	Soil	8310R	—	8310R	8310R	8310R	8310R
MD51-01-0006	51-10002	5.5–6.5	Fill	8310R	—	8310R	8310R	8310R	8310R
CACB-09-1444	51-10002	7.5–9.0	Qbt 2	—	—	09-470	09-470	09-470	—
CACB-09-1445	51-10002	9.5–11.0	Qbt 2	—	—	09-470	09-470	09-470	—
CACB-09-1446	51-10003	10.5–12.0	Qbt 2	—	—	09-470	09-470	09-470	—
MD51-01-0007	51-10003	11.0–12.0	Soil	8310R	—	8310R	8310R	8310R	8310R
MD51-01-0008	51-10003	12.0–13.0	Qbt 3	8310R	—	8310R	8310R	8310R	8310R
CACB-09-1447	51-10003	12.5–14.0	Qbt 2	—	—	09-470	09-470	09-470	—
CACB-09-1448	51-10004	10.5–12.0	Qbt 2	—	—	09-470	09-470	09-470	—
MD51-01-0009	51-10004	11.0–12.0	Soil	8310R	—	8310R	8310R	8310R	8310R
MD51-01-0010	51-10004	12.0–13.0	Qbt 3	8310R	—	8310R	8310R	8310R	8310R
CACB-09-1449	51-10004	12.5–14.0	Qbt 2	—	—	09-470	09-470	09-470	—
CACB-09-1450	51-10005	10.0–12.0	Fill	—	—	09-470	09-470	09-470	—
MD51-01-0011	51-10005	11.0–12.0	Fill	8310R	—	8310R	8310R	8310R	8310R
MD51-01-0012	51-10005	12.0–13.0	Qbt 3	8310R	—	8310R	8310R	8310R	8310R
CACB-09-1451	51-10005	12.5–14.5	Qbt 2	—	—	09-470	09-470	09-470	—

Table B-5.0-1 (continued)

Sample ID	Location ID	Depth (ft)	Media	Gamma Spectroscopy	Gross Alpha/Beta	Tritium	Isotopic Plutonium	Isotopic Uranium	Strontium-90
CACB-09-1456	CB-604309	7.5–9.0	Qbt 2	—	—	09-470	09-470	09-470	—
CACB-09-1457	CB-604309	9.5–11.0	Qbt 2	—	—	09-470	09-470	09-470	—

[a] Request numbers.

[b] — = Analysis not requested.

Table B-5.1-1
Inorganic Chemicals above BVs at AOC 51-001

Sample ID	Location ID	Depth (ft)	Media	Antimony	Arsenic	Barium	Cadmium	Calcium	Chromium
Soil BV[a]				**0.83**	**8.17**	**295**	**0.4**	**6120**	**19.3**
Qbt 2/Qbt 3 BV[a]				**0.5**	**2.79**	**46**	**1.63**	**2200**	**7.14**
Qbt 1v BV[a]				**0.5**	**1.81**	**26.5**	**0.4**	**3700**	**2.24**
Residential Soil Screening Level (SSL)[b]				**31.3**	**3.9**	**15600**	**39.0**	**na**[c]	**2800**[d]
Construction SSL[b]				**124**	**85.2**	**60200**	**154**	**na**	**26.1**[e]
0551-95-2016	51-09203	50.0–60.0	Qbt 3	11 (UJ)	—[f]	—	—	—	—
CACB-09-1454	51-10000	49.0–50.5	Qbt 1v	1.02 (U)	—	—	—	—	4.83
CACB-09-1455	51-10000	59.0–60.5	Qbt 1v	1.04 (U)	1.87	—	—	—	—
CACB-09-1452	51-10001	49.0–51.5	Qbt 1v	—	2.78	—	0.499 (U)	—	5.04
CACB-09-1453	51-10001	59.0–61.0	Qbt 1v	—	2.43	—	0.498 (U)	—	2.87
CACB-09-1444	51-10002	7.5–9.0	Qbt 2	0.563 (J)	3.61	—	—	—	—
CACB-09-1445	51-10002	9.5–11.0	Qbt 2	—	2.82	—	—	—	—
CACB-09-1446	51-10003	10.5–12.0	Qbt 2	0.914 (J)	4.92	63	—	3920 (J+)	—
CACB-09-1447	51-10003	12.5–14.0	Qbt 2	—	3.21	—	—	—	—
CACB-09-1448	51-10004	10.5–12.0	Qbt 2	0.885 (J)	4.35	—	—	—	—
CACB-09-1449	51-10004	12.5–14.0	Qbt 2	0.524 (J)	3.48	—	—	—	—
CACB-09-1450	51-10005	10.0–12.0	Fill	1.12	—	—	0.494 (U)	7050 (J+)	—
CACB-09-1451	51-10005	12.5–14.5	Qbt 2	—	3.04	—	—	—	—

Table B-5.1-1 (continued)

Sample ID	Location ID	Depth (ft)	Media	Lead	Mercury	Nitrate	Selenium	Silver
Soil BV[a]				**22.3**	**0.1**	**na**	**1.52**	**1**
Qbt 2/Qbt 3 BV[a]				**11.2**	**0.1**	**na**	**0.3**	**1**
Qbt 1v BV[a]				**18.4**	**0.1**	**na**	**0.3**	**1**
Residential SSL[b]				**400**	**23[d]**	**100000**	**391**	**391**
Construction SSL[b]				**800**	**927[g]**	**100000**	**1550**	**1550**
0551-95-2016	51-09203	50.0–60.0	Qbt 3	13	0.27 (U)	NA[h]	1.1 (U)	2.1 (U)
CACB-09-1454	51-10000	49.0–50.5	Qbt 1v	—	—	1.76	1.07 (U)	—
CACB-09-1455	51-10000	59.0–60.5	Qbt 1v	—	—	1.98	1.04 (U)	—
CACB-09-1452	51-10001	49.0–51.5	Qbt 1v	—	—	10.5 (J-)	1 (U)	—
CACB-09-1453	51-10001	59.0–61.0	Qbt 1v	—	—	1.86 (J-)	1.04 (U)	—
CACB-09-1444	51-10002	7.5–9.0	Qbt 2	12	—	—	0.991 (U)	—
CACB-09-1445	51-10002	9.5–11.0	Qbt 2	—	—	—	1.04 (U)	—
CACB-09-1446	51-10003	10.5–12.0	Qbt 2	—	—	7.55 (J-)	1 (U)	—
CACB-09-1447	51-10003	12.5–14.0	Qbt 2	—	—	3.72 (J-)	1.04 (U)	—
CACB-09-1448	51-10004	10.5–12.0	Qbt 2	—	—	6.32 (J-)	0.996 (U)	—
CACB-09-1449	51-10004	12.5–14.0	Qbt 2	—	—	2.2 (J-)	1.02 (U)	—
CACB-09-1450	51-10005	10.0–12.0	Fill	—	—	7.78 (J-)	—	—
CACB-09-1451	51-10005	12.5–14.5	Qbt 2	—	—	2.18 (J-)	1.01 (U)	—

Notes: Units are mg/kg. Data qualifiers are defined in Appendix A.

[a] BVs from LANL (1998, 059730).

[b] SSLs from NMED (2006, 092513), unless otherwise noted.

[c] na = Not available.

[d] SSL from EPA regional screening table (http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/pdf/composite_sl_table_run_12SEP2008.pdf).

[e] SSL for hexavalent chromium is from NMED (2006, 092513).

[f] — = Result was not detected or was below the BV.

[g] SSL is for elemental mercury from NMED (2006, 092513).

[h] NA = Not analyzed.

Table B-5.2-1
Organic Chemicals Detected at AOC 51-001

Sample ID	Location ID	Depth (ft)	Media	Bromomethane	Butanone[2-]	Trichlorofluoromethane
Residential Soil Screening Level (SSL)[a]				**8.51**	**31800**	**588**
Construction Worker SSL[a]				**28.2**	**48700**	**983**
MD51-01-0001	51-10000	49.0–50.0	Qbt 3	—[b]	0.0056 (J)	—
MD51-01-0002	51-10000	59.0–60.0	Qbt 3	—	0.0086 (J)	—
MD51-01-0003	51-10001	49.0–50.0	Qbt 3	—	—	0.0034 (J)
MD51-01-0004	51-10001	59.0–60.0	Qbt 3	0.0017 (J)	0.014 (J)	0.0054 (J)

Notes: Units are mg/kg. Data qualifiers are defined in Appendix A.

[a] SSLs from NMED (2006, 092513).

[b] — = Result was not detected.

Table B-5.3-1
Radionuclides Detected or Detected above BVs/FVs at AOC 51-001

Sample ID	Location ID	Depth (ft)	Media	Cesium-137	Uranium-235/236	Tritium
Soil BV/FV[a]				**1.65**	**0.20**	**na[b]**
Qbt 2 BV/FV[a]				**na**	**0.09**	**na**
Residential Screening Action Level (SAL)[c]				**5.6**	**17**	**750**
Construction Worker SAL[c]				**18**	**43**	**320000**
MD51-01-0006	51-10002	5.5–6.5	Fill	0.0761	—	—[d]
CACB-09-1449	51-10004	12.5–14.0	Qbt 2	NA[e]	—	0.192906
CACB-09-1450	51-10005	10.0–12.0	Fill	NA	—	0.012422
CACB-09-1457	CB-604309	9.5–11.0	Qbt 2	NA	0.098	—

Note: Units are pCi/g.

[a] BVs/FVs from LANL (1998, 059730).

[b] na = Not available.

[c] SALSs from LANL (2005, 088493).

[d] — = Result was not detected or was below the BV/FV.

[e] NA = Not analyzed.

Table B-6.0-1
Summary of Samples Collected and Analyses Requested at AOC 54-007(d)

Sample ID	Location ID	Depth (ft)	Media	Cyanide	Metals	Nitrate	SVOCs	VOCs	PCBs	Pesticides	Isotopic Uranium
MD54-01-0021	54-15422	3.67–4.58	Fill	—[a]	—	—	8201R[b]	8201R	—	—	—
CACB-09-1477	54-15422	5.0–6.0	Fill	09-489	09-489	09-489	09-488	09-488	09-488	09-488	09-490
MD54-01-0022	54-15422	7.0–7.5	Qbt 3	—	—	—	8201R	8201R	—	—	—
CACB-09-1478	54-15422	7.0–8.0	Fill	09-489	09-489	09-489	09-488	09-488	09-488	09-488	09-490
CACB-09-1463	54-15424	10.5–11.5	Soil	09-489	09-489	09-489	09-488	09-488	09-488	09-488	09-490
MD54-01-0025	54-15424	10.5–11.5	Soil	—	—	—	8283R	8283R	—	—	—
MD54-01-0026	54-15424	11.5–12.5	Soil	—	—	—	8283R	8283R	—	—	—
CACB-09-1464	54-15424	12.5–13.5	Soil	09-489	09-489	09-489	09-488	09-488	09-488	09-488	09-490
CACB-09-1465	54-15425	10.5–11.5	Soil	09-489	09-489	09-489	09-488	09-488	09-488	09-488	09-490
MD54-01-0027	54-15425	10.5–11.5	Soil	—	—	—	8283R	8283R	—	—	—
MD54-01-0028	54-15425	11.5–12.5	Soil	—	—	—	8283R	8283R	—	—	—
CACB-09-1466	54-15425	12.5–13.5	Soil	09-489	09-489	09-489	09-488	09-488	09-488	09-488	09-490
CACB-09-1467	54-15426	10.5–11.5	Soil	09-489	09-489	09-489	09-488	09-488	09-488	09-488	09-490
MD54-01-0029	54-15426	10.5–11.5	Soil	—	—	—	8283R	8283R	—	—	—
MD54-01-0030	54-15426	11.5–12.5	Soil	—	—	—	8283R	8283R	—	—	—
CACB-09-1468	54-15426	12.5–13.5	Soil	09-489	09-489	09-489	09-488	09-488	09-488	09-488	09-490
MD54-01-0031	54-15427	5.25–6.25	Soil	—	—	—	8283R	8283R	—	—	—
CACB-09-1461	54-15427	5.5–7.0	Soil	09-489	09-489	09-489	09-488	09-488	09-488	09-488	09-490
MD54-01-0032	54-15427	6.25–7.25	Soil	—	—	—	8283R	8283R	—	—	—
CACB-09-1462	54-15427	7.0-8.0	Fill	09-489	09-489	09-489	09-488	09-488	09-488	09-488	09-490
CACB-09-1473	54-15448	5.0–6.0	Fill	09-489	09-489	09-489	09-488	09-488	09-488	09-488	09-490
MD54-01-0068	54-15448	5.33–6.0	Fill	—	—	—	8322R	8322R	—	—	—

Table B-6.0-1 (continued)

Sample ID	Location ID	Depth (ft)	Media	Cyanide	Metals	Nitrate	SVOCs	VOCs	PCBs	Pesticides	Isotopic Uranium
CACB-09-1474	54-15448	7.0–8.0	Fill	09-489	09-489	09-489	09-488	09-488	09-488	09-488	09-490
MD54-01-0069	54-15448	7.0–8.0	Soil	—	—	—	8322R	8322R	—	—	—
CACB-09-1475	54-15449	5.0–6.0	Fill	09-489	09-489	09-489	09-488	09-488	09-488	09-488	09-490
MD54-01-0070	54-15449	5.0–6.0	Fill	—	—	—	8322R	8322R	—	—	—
CACB-09-1476	54-15449	7.0–8.0	Fill	09-489	09-489	09-489	09-488	09-488	09-488	09-488	09-490
MD54-01-0071	54-15449	7.0–8.0	Fill	—	—	—	8322R	8322R	—	—	—
CACB-09-1471	54-15450	5.0–6.0	Soil	09-489	09-489	09-489	09-488	09-488	09-488	09-488	09-490
MD54-01-0072	54-15450	5.0–6.0	Fill	—	—	—	8322R	8322R	—	—	—
CACB-09-1472	54-15450	7.0–8.0	Fill	09-489	09-489	09-489	09-488	09-488	09-488	09-488	09-490
MD54-01-0073	54-15450	7.0–8.0	Fill	—	—	—	8322R	8322R	—	—	—
CACB-09-1481	54-15451	5.0–6.0	Soil	09-497	09-497	09-497	09-496	09-496	09-496	09-496	09-498
MD54-01-0074	54-15451	5.0–6.0	Fill	—	—	—	8322R	8322R	—	—	—
CACB-09-1482	54-15451	7.0–8.0	Fill	09-497	09-497	09-497	09-496	09-496	09-496	09-496	09-498
MD54-01-0075	54-15451	7.0–8.0	Fill	—	—	—	8322R	8322R	—	—	—
CACB-09-1483	54-15452	5.0–6.0	Fill	09-497	09-497	09-497	09-496	09-496	09-496	09-496	09-498
MD54-01-0076	54-15452	5.0–6.0	Fill	—	—	—	8322R	8322R	—	—	—
CACB-09-1484	54-15452	7.0–8.0	Fill	09-497	09-497	09-497	09-496	09-496	09-496	09-496	09-498
MD54-01-0077	54-15452	7.0–8.0	Fill	—	—	—	8322R	8322R	—	—	—
CACB-09-1479	54-15453	5.0–6.0	Fill	09-497	09-497	09-497	09-496	09-496	09-496	09-496	09-498
MD54-01-0078	54-15453	5.0–6.0	Fill	—	—	—	8322R	8322R	—	—	—
CACB-09-1480	54-15453	7.0–8.0	Fill	09-497	09-497	09-497	09-496	09-496	09-496	09-496	09-498
MD54-01-0079	54-15453	7.0–8.0	Fill	—	—	—	8322R	8322R	—	—	—
CACB-09-1491	54-15454	5.0–6.0	Fill	09-497	09-497	09-497	09-496	09-496	09-496	09-496	09-498

Table B-6.0-1 (continued)

Sample ID	Location ID	Depth (ft)	Media	Cyanide	Metals	Nitrate	SVOCs	VOCs	PCBs	Pesticides	Isotopic Uranium
MD54-01-0080	54-15454	5.0–6.0	Fill	—	—	—	8322R	8322R	—	—	—
CACB-09-1492	54-15454	7.0–8.0	Fill	09-497	09-497	09-497	09-496	09-496	09-496	09-496	09-498
MD54-01-0081	54-15454	7.0–8.0	Fill	—	—	—	8322R	8322R	—	—	—
CACB-09-1489	54-15455	5.0–6.0	Fill	09-497	09-497	09-497	09-496	09-496	09-496	09-496	09-498
MD54-01-0082	54-15455	5.0–6.0	Fill	—	—	—	8322R	8322R	—	—	—
CACB-09-1490	54-15455	7.0–8.0	Fill	09-497	09-497	09-497	09-496	09-496	09-496	09-496	09-498
MD54-01-0083	54-15455	7.0–8.0	Fill	—	—	—	8322R	8322R	—	—	—
CACB-09-1493	54-15456	5.0–6.0	Fill	09-497	09-497	09-497	09-496	09-496	09-496	09-496	09-498
MD54-01-0084	54-15456	5.0–6.0	Fill	—	—	—	8322R	8322R	—	—	—
CACB-09-1494	54-15456	7.0–8.0	Fill	09-497	09-497	09-497	09-496	09-496	09-496	09-496	09-498
MD54-01-0085	54-15456	7.0–8.0	Fill	—	—	—	8322R	8322R	—	—	—
CACB-09-1487	54-15457	5.0–6.0	Fill	09-497	09-497	09-497	09-496	09-496	09-496	09-496	09-498
MD54-01-0086	54-15457	5.0–6.0	Fill	—	—	—	8322R	8322R	—	—	—
CACB-09-1488	54-15457	7.0–8.0	Fill	09-497	09-497	09-497	09-496	09-496	09-496	09-496	09-498
MD54-01-0087	54-15457	7.0–8.0	Fill	—	—	—	8322R	8322R	—	—	—
CACB-09-1485	54-15458	5.0–6.0	Fill	09-497	09-497	09-497	09-496	09-496	09-496	09-496	09-498
MD54-01-0088	54-15458	5.0–6.0	Fill	—	—	—	8322R	8322R	—	—	—
CACB-09-1486	54-15458	7.0–8.0	Fill	09-497	09-497	09-497	09-496	09-496	09-496	09-496	09-498
MD54-01-0089	54-15458	7.0–8.0	Fill	—	—	—	8322R	8322R	—	—	—
CACB-09-1469	CB-604314	6.0–7.0	Fill	09-489	09-489	09-489	09-488	09-488	09-488	09-488	09-490
CACB-09-1470	CB-604314	7.25–8.25	Fill	09-489	09-489	09-489	09-488	09-488	09-488	09-488	09-490

[a] — = Analysis not requested.

[b] Request numbers.

Table B-6.1-1
Inorganic Chemicals above BVs at AOC 54-007(d)

Sample ID	Location ID	Depth (ft)	Media	Antimony	Arsenic	Cadmium	Nitrate	Zinc
Soil BV[a]				**0.83**	**8.17**	**0.4**	**na**[b]	**48.8**
Residential Soil Screening Level (SSL)[c]				**31.3**	**3.9**	**39**	**100000**	**23500**
Construction Worker SSL[c]				**124**	**85.2**	**154**	**100000**	**92900**
CACB-09-1477	54-15422	5.0–6.0	Fill	—[d]	—	0.522 (U)	4.03 (J-)	—
CACB-09-1478	54-15422	7.0–8.0	Fill	—	—	0.524 (U)	—	—
CACB-09-1463	54-15424	10.5–11.5	Soil	2.08	10.1	0.579 (U)	—	—
CACB-09-1464	54-15424	12.5–13.5	Soil	0.855 (J)	—	0.558 (U)	—	—
CACB-09-1465	54-15425	10.5–11.5	Soil	3.75	12.5	0.555 (U)	—	—
CACB-09-1466	54-15425	12.5–13.5	Soil	4.1	13.4	0.561 (U)	0.681 (J-)	—
CACB-09-1467	54-15426	10.5–11.5	Soil	4.46	14	0.573 (U)	0.632 (J-)	—
CACB-09-1468	54-15426	12.5–13.5	Soil	4	12.5	0.557 (U)	1.16	—
CACB-09-1461	54-15427	5.5–7.0	Soil	1.23	—	0.517 (U)	3.15 (J-)	—
CACB-09-1462	54-15427	7.0–8.0	Fill	2.51	10.1	0.554 (U)	2.85 (J-)	—
CACB-09-1473	54-15448	5.0–6.0	Fill	—	—	0.507 (U)	—	—
CACB-09-1474	54-15448	7.0–8.0	Fill	2.84	10.6	0.524 (U)	—	—
CACB-09-1475	54-15449	5.0–6.0	Fill	3.75	12.1	0.513 (U)	—	—
CACB-09-1476	54-15449	7.0–8.0	Fill	1.69	8.29	0.518 (U)	—	—
CACB-09-1471	54-15450	5.0–6.0	Soil	3.23	11.2	—	—	—
CACB-09-1472	54-15450	7.0–8.0	Fill	3.07	11.6	—	—	—
CACB-09-1481	54-15451	5.0–6.0	Soil	3.33	12.3	0.546 (U)	1.31 (J-)	—
CACB-09-1482	54-15451	7.0–8.0	Fill	1.62	8.6	0.527 (U)	2.48 (J-)	—
CACB-09-1483	54-15452	5.0–6.0	Fill	2.36	10.4	0.527 (U)	0.608 (J-)	—
CACB-09-1484	54-15452	7.0–8.0	Fill	2.53	10.2	0.531 (U)	8.42 (J-)	—
CACB-09-1479	54-15453	5.0–6.0	Fill	3.09	11.6	0.53 (U)	5.44 (J-)	—
CACB-09-1480	54-15453	7.0–8.0	Fill	1.94	8.66	0.507 (U)	1.89 (J-)	—
CACB-09-1491	54-15454	5.0–6.0	Fill	1.4	—	0.54 (U)	1.27 (J-)	—
CACB-09-1492	54-15454	7.0–8.0	Fill	—	—	0.528 (U)	—	—
CACB-09-1489	54-15455	5.0–6.0	Fill	2.52	10	0.526 (U)	—	—
CACB-09-1490	54-15455	7.0–8.0	Fill	—	—	0.539 (U)	—	—
CACB-09-1493	54-15456	5.0–6.0	Fill	2.48	10.9	0.528 (U)	—	—
CACB-09-1494	54-15456	7.0–8.0	Fill	0.868 (J)	—	0.535 (U)	1.8 (J-)	—
CACB-09-1487	54-15457	5.0–6.0	Fill	2.72	10.8	0.54 (U)	4 (J-)	190
CACB-09-1488	54-15457	7.0–8.0	Fill	—	—	0.538 (U)	2.01 (J-)	—
CACB-09-1485	54-15458	5.0–6.0	Fill	1.05	—	0.523 (U)	0.876 (J-)	—

Table B-6.1-1 (continued)

Sample ID	Location ID	Depth (ft)	Media	Antimony	Arsenic	Cadmium	Nitrate	Zinc
Soil BV[a]				**0.83**	**8.17**	**0.4**	**na**[b]	**48.8**
Residential Soil Screening Level (SSL)[c]				**31.3**	**3.9**	**39**	**100000**	**23500**
Construction Worker SSL[c]				**124**	**85.2**	**154**	**100000**	**92900**
CACB-09-1486	54-15458	7.0–8.0	Fill	—	—	0.521 (U)	5.25 (J-)	—
CACB-09-1469	CB-604314	6.0–7.0	Fill	3.23	10.9	0.535 (U)	3.6 (J-)	—
CACB-09-1470	CB-604314	7.25–8.25	Fill	3.1	11	—	3.6 (J-)	195

Notes: Units are mg/kg. Data qualifiers are defined in Appendix A.

[a] BVs from LANL (1998, 059730).

[b] na = Not available.

[c] SSLs from NMED (2006, 092513).

[d] — = Result was not detected or was below the BV.

Table B-6.2-1
Organic Chemicals Detected at AOC 54-007(d)

Sample ID	Location ID	Depth (ft bgs)	Media	Aroclor-1242	Aroclor-1254	Aroclor-1260	Benzene	Bis(2-ethylhexyl)phthalate	Bromomethane	Butanone[2-]	Isopropylbenzene	Isopropyltoluene[4-]	Methyl-2-pentanone[4-]	Methylene Chloride	Toluene	Trichlorofluoromethane	Trimethylbenzene[1,2,4-]
Residential Soil Screening Level[a]				**1.12**	**1.12**	**1.12**	**10.3**	**347**	**8.51**	**31800**	**271**	**271[b]**	**5510**	**182**	**252**	**588**	**58.0**
Construction Worker Soil Screening Level[a]				**4.28**	**4.28**	**4.28**	**174**	**4660**	**28.2**	**48700**	**389**	**389[b]**	**7010**	**263**	**252**	**983**	**190**
MD54-01-0021	54-15422	3.7–4.6	Fill	NA[c]	NA	NA	0.0016 (J+)	—[d]	—	0.0084 (J+)	—	—	—	—	—	—	NA
CACB-09-1477	54-15422	5.0–6.0	Fill	—	0.2	0.0877	—	—	—	—	—	—	—	—	—	—	—
MD54-01-0022	54-15422	7.0–7.5	Qbt 3	NA	NA	NA	0.0031 (J+)	—	—	—	—	—	—	—	—	—	NA
CACB-09-1478	54-15422	7.0–8.0	Fill	—	0.005	—	—	—	—	—	—	—	—	—	—	—	—
CACB-09-1464	54-15424	12.5–13.5	Soil	—	0.0038 (J)	—	—	—	—	—	—	—	—	—	—	—	—
CACB-09-1461	54-15427	5.5–7.0	Soil	—	0.0198	0.0369	—	—	—	—	—	—	—	0.00258 (J)	—	—	—
CACB-09-1462	54-15427	7.0–8.0	Fill	—	0.011	0.0267	—	0.108 (J)	—	—	—	—	—	—	—	—	—
MD54-01-0068	54-15448	5.3–6.0	Fill	NA	NA	NA	—	—	—	—	—	—	—	—	—	0.0032 (J)	—
MD54-01-0069	54-15448	7.0–8.0	Soil	NA	NA	NA	—	—	—	0.0086 (J)	—	—	—	—	—	0.0032 (J)	—
CACB-09-1475	54-15449	5.0–6.0	Fill	—	0.171	0.0722	—	—	—	—	—	—	—	—	—	—	—
MD54-01-0070	54-15449	5.0–6.0	Fill	NA	NA	NA	—	0.31 (J)	—	0.0095 (J)	0.0017 (J)	0.0046 (J)	0.0063 (J)	—	0.0025 (J)	—	0.0032 (J)
CACB-09-1476	54-15449	7.0–8.0	Fill	—	0.0081	0.0038	—	—	—	—	—	—	—	—	—	—	—
MD54-01-0071	54-15449	7.0–8.0	Fill	NA	NA	NA	—	—	—	0.014 (J)	—	—	0.0046 (J)	—	—	—	—
CACB-09-1471	54-15450	5.0–6.0	Soil	—	—	—	—	—	—	—	—	—	—	0.00276 (J)	—	—	—
MD54-01-0072	54-15450	5.0–6.0	Fill	NA	NA	NA	—	—	—	—	—	0.0033 (J)	—	—	0.0073	—	—
CACB-09-1481	54-15451	5.0–6.0	Soil	—	0.0946	0.0349	—	—	—	—	—	—	—	—	—	—	—
CACB-09-1482	54-15451	7.0–8.0	Fill	—	0.0055	—	—	—	—	—	—	—	—	—	—	—	—
CACB-09-1483	54-15452	5.0–6.0	Fill	—	0.0179	0.0089	—	—	—	—	—	—	—	—	—	—	—
MD54-01-0076	54-15452	5.0–6.0	Fill	NA	NA	NA	0.0023 (J)	—	—	—	—	—	—	—	—	—	—
CACB-09-1484	54-15452	7.0–8.0	Fill	—	0.0178	0.0084	—	—	—	—	—	—	—	—	—	—	—
MD54-01-0077	54-15452	7.0–8.0	Fill	NA	NA	NA	—	—	0.0023 (J)	—	—	—	—	—	—	—	—
CACB-09-1479	54-15453	5.0–6.0	Fill	—	0.0441	0.0177	—	—	—	—	—	—	—	—	—	—	—
MD54-01-0078	54-15453	5.0–6.0	Fill	NA	NA	NA	—	—	—	0.006 (J+)	—	0.0065 (J+)	0.0038 (J+)	—	0.0018 (J+)	—	—
MD54-01-0079	54-15453	7.0–8.0	Fill	NA	NA	NA	—	—	—	0.0091 (J)	—	—	—	—	—	—	—
CACB-09-1491	54-15454	5.0–6.0	Fill	—	0.0243	0.0079	—	—	—	—	—	—	—	—	—	—	—
MD54-01-0080	54-15454	5.0–6.0	Fill	NA	NA	NA	0.0026 (J+)	—	—	0.006 (J+)	—	—	—	—	—	—	—
CACB-09-1492	54-15454	7.0–8.0	Fill	—	0.0025 (J)	—	—	—	—	—	—	—	—	—	—	—	—
MD54-01-0081	54-15454	7.0–8.0	Fill	NA	NA	NA	—	—	—	0.0073 (J)	—	—	—	—	—	—	—
CACB-09-1489	54-15455	5.0–6.0	Fill	—	0.0035 (J)	—	—	—	—	—	—	—	—	—	—	—	—

Table B-6.2-1 (continued)

Sample ID	Location ID	Depth (ft bgs)	Media	Aroclor-1242	Aroclor-1254	Aroclor-1260	Benzene	Bis(2-ethylhexyl)phthalate	Bromomethane	Butanone[2-]	Isopropylbenzene	Isopropyltoluene[4-]	Methyl-2-pentanone[4-]	Methylene Chloride	Toluene	Trichlorofluoromethane	Trimethylbenzene[1,2,4-]
Residential Soil Screening Level[a]				**1.12**	**1.12**	**1.12**	**10.3**	**347**	**8.51**	**31800**	**271**	**271[b]**	**5510**	**18.2**	**252**	**588**	**58.0**
Construction Worker Soil Screening Level[a]				**4.28**	**4.28**	**4.28**	**174**	**4660**	**28.2**	**48700**	**389**	**389[b]**	**7010**	**263**	**252**	**983**	**190**
MD54-01-0082	54-15455	5.0–6.0	Fill	NA	NA	NA	0.0023 (J)	—	—	0.01 (J)	—	—	—	—	—	—	—
MD54-01-0083	54-15455	7.0–8.0	Fill	NA	NA	NA	—	—	—	0.0063 (J+)	—	—	—	—	—	—	—
CACB-09-1493	54-15456	5.0–6.0	Fill	—	0.0726	0.0215	—	—	—	—	—	—	—	—	—	—	—
MD54-01-0084	54-15456	5.0–6.0	Fill	NA	NA	NA	0.0027 (J)	—	—	0.0078 (J)	—	—	—	—	—	—	—
CACB-09-1494	54-15456	7.0–8.0	Fill	—	0.0033 (J)	—	—	—	—	—	—	—	—	—	—	—	—
MD54-01-0085	54-15456	7.0–8.0	Fill	NA	NA	NA	—	—	—	0.0039 (J)	—	—	—	—	—	—	—
CACB-09-1487	54-15457	5.0–6.0	Fill	0.0131	0.0739	0.0261	—	—	—	—	—	—	—	—	—	—	—
CACB-09-1485	54-15458	5.0–6.0	Fill	—	0.0115	0.0039	—	—	—	—	—	—	—	—	—	—	—
CACB-09-1486	54-15458	7.0–8.0	Fill	—	0.021	0.0082	—	—	—	—	—	—	—	—	—	—	—
CACB-09-1469	CB-604314	6.0–7.0	Fill	—	0.0149	0.0225	—	—	—	—	—	—	—	—	—	—	—
CACB-09-1470	CB-604314	7.2–8.2	Fill	—	0.0079	0.0171	—	—	—	—	—	—	—	—	—	—	—

Note: Units are mg/kg. Data qualifiers are defined in Appendix A.

[a] Soil screening levels from NMED 2006, 092513.

[b] Soil screening level not available. Isopropylbenzene used as surrogate based on structural similarity.

[c] NA = Not analyzed.

[d] — = Result was not detected.

Appendix C

Field Methods

C-1.0 INTRODUCTION

This appendix summarizes field methods used during investigations at the Middle Cañada del Buey Aggregate Area, including Areas of Concern (AOCs) 18-005(b), 18-005(c), 51-001, and 54-007(d). Investigation activities were conducted in December 2008 in accordance with the most current versions of applicable Los Alamos National Laboratory (LANL or the Laboratory) Environmental Programs (EP) Directorate standard operating procedures (SOPs). The SOPs used during field activities are listed in Table C-1.0-1 and are available at the following URL: http://www.lanl.gov/environment/all/qa/adep.shtml.

The field activities conducted at the Middle Cañada del Buey Aggregate Area are described in the revised investigation work plan (LANL 2007, 102622) and include the following:

- Conducting geodetic surveys to locate AOCs, associated historical sampling locations, and new sampling locations
- Drilling 24 boreholes at AOCs 51-001 and 54-007(d) to collect subsurface soil and tuff samples (borehole logs for the two 60-ft borings are presented in Appendix D)
- Collecting surface and subsurface soil and tuff samples from AOCs 18-005(b) and 18-005(c) using the spade-and-scoop and hand-auger methods
- Performing radiological screening of borehole cores and surface and subsurface soil and tuff samples for gross alpha and beta/gamma radioactivity, volatile organic compounds (VOCs), and high explosives (HE)
- Documenting field activities on a daily basis

Table C-1.0-2 provides a general summary of the field methods used. The following sections describe specific field methods used in the characterization activities at the sites investigated in the Middle Cañada del Buey Aggregate Area.

C-2.0 EXPLORATORY DRILLING CHARACTERIZATION

Twenty-four vertical boreholes were advanced using a CME 85 drill rig equipped with 8-in. hollow-stem augers. Continuous core samples were collected using split-spoon sampling. Soil and tuff samples were collected from the boreholes at the locations and depth intervals specified in the revised investigation work plan (LANL 2007, 102622). Core samples were collected in accordance with SOP-06.26, “Core Barrel Sampling for Subsurface Earth Materials.”

C-2.1 Borehole Logging

Borehole lithologic logs were completed for the 60-ft borings located at AOC 51-001 during the field investigation. The 60-ft borings were continuously cored and logged in 5-ft intervals in accordance with SOP-12.01, “Field Logging, Handling, and Documentation of Borehole Materials.” Information recorded in field logs includes footage and recovery in feet, lithology, sample-collection depth, field-screening results for radioactivity and organic vapors, completion time of core logging, and other relevant observations.

The lithologic description for each core interval included the following:

- color (using a Munsell Soil Color Chart)
- ash matrix size

- degree of welding of matrix
- presence and size of phenocrysts
- presence of pumice clasts (in tuff) with color, size, alteration, and color, size, and nature of phenocrysts
- staining and/or presence of clay-filled fracture zones
- angle, thickness, and density of fractures, if present
- qualitative description of moisture presence
- any other information pertinent to the geology of the core recovered

The logs for boreholes completed during the field activities are presented in Appendix D.

C-2.2 Borehole Abandonment

The boreholes drilled during the field investigation were permanently abandoned in accordance with EP-ERSS-SOP-5034, "Monitor Well and RFI Borehole Abandonment." The boreholes were abandoned by tremie grouting. The tremie grout consisted of a bentonite/cement and water mixture. The boreholes were grouted from the bottom to approximately 2 ft below ground surface; the remaining 2 ft was topped with a cement cap. Care was taken to ensure the grout did not bridge or form gaps or voids in the grout column, and the bottom of the tremie tube was kept submerged in the grout column while the tube was slowly withdrawn as the grout was placed in the borehole. After 24 to 48 h, the backfill level was checked for settling, and additional grout was added as necessary. The remainder of each boring was filled with Portland type I/II cement to surface grade.

C-3.0 FIELD-SCREENING METHODS

This section summarizes the field-screening methods used during the 2008 investigation activities conducted at the Middle Cañada del Buey Aggregate Area. Field-screening results collected during drilling, sampling and remediation activities are provided in Table 4.3-1 of the investigation report.

C-3.1 Field Screening for VOCs

Screening of surface and subsurface samples for VOCs was performed using a MiniRae 2000, Model PGM-7600 photoionization detector (PID) with an 11.7-eV bulb immediately after sample retrieval. In addition, headspace vapor screening for VOCs was performed on recovered surface and subsurface media in accordance with SOP-06.33, "Headspace Vapor Screening with a Photoionization Detector." Samples were placed in a glass container and covered with aluminum foil. The container was sealed, gently shaken, and allowed to equilibrate for 5 min. The sample was then screened by inserting the PID detector probe into the container and measuring and recording any detected vapors.

The field-screening results for VOCs were recorded in a field-screening log. Organic vapors were detected at several surface sample locations where the media were slightly moist and/or contained root material or other organic matter. Detected organic vapor headspace concentrations ranged from 0.0 to 20.0 parts per million (ppm) in soil, fill, and tuff samples. The background value of the PID ranged from 0.1 to 2.0 ppm. The VOC field-screening results for all samples collected during this investigation are presented in Table 4.3-1 of the investigation report.

C-3.2 Field Screening for Radioactivity

Hand-auger samples, core samples, and cuttings were screened for gross alpha and beta radiation before submittal to the Laboratory's Sample Management Office (SMO). Screening was performed using an Eberline E600 with either a 380AB or SHP360 probe (or equivalent) and an ESP-1 rate meter with a 210 probe (or equivalent) in accordance with field subcontractor SOPs. A radiation control technician (RCT) collected and recorded background measurements for gross-alpha and gross-beta radiation daily.

Local background levels in air were calculated daily using the following procedure. Minimum detectable activity describes the instrument's lower detection limit. A background reading was taken in the field to determine the minimum detectable activity, which was calculated as follows:

$$\text{minimum detectable activity} = \frac{2.71 + 4.65\sqrt{0.2\,R_b}}{0.2}$$

where R_b is the background rate in counts per minute (cpm). The minimum detectable activity was converted from cpm to disintegrations per minute (dpm) as follows:

dpm = corrected cpm / efficiency

where efficiency was assumed to be 20% for the SHP-380AB attachment based on the manufacturer's specifications. All field-screening results for radioactivity were recorded in dpm.

Samples were transported to the SMO in sealed coolers before they were shipped to the analytical laboratory. Personnel at the SMO reviewed and approved the sample-collection log (SCL) and chain-of-custody (COC) forms and accepted custody of the samples, after which the samples were shipped to the laboratory for analysis.

C-3.3 Field Screening for Explosives

Samples collected at AOCs 18-005(b) and 18-005(c) were field screened for high explosives by analyzing for RDX (hexahydro-1,3,5-trinitro-1,3,5-triazine) and TNT (2,4,6-trinitrotoluene) using D TECH test kits. The detection limit of both the RDX and TNT test kits is 0.5 mg/kg. The TNT test kits used U.S. Environmental Protection Agency (EPA) Method 4050, "TNT Explosives in Soil by Immunoassay," and the RDX kits used EPA Method 4051, "Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX) in Soil by Immunoassay." The RDX and TNT field-screening results are presented in Table 4.3-1 of the investigation report.

C-4.0 FIELD-INSTRUMENT CALIBRATION

Field-instrument calibration was completed daily or as necessary based on changing environmental conditions. Several environmental factors affected the instrument's integrity, including air temperature, atmospheric pressure, wind speed, and humidity. The PID was calibrated by the site safety officer (SSO), and the Eberline E-600 was calibrated by the RCT. All calibrations were performed according to the manufacturers' specifications and requirements and recorded on a field-calibration log or in the field notebook.

C-4.1 PID Calibration

The PID was calibrated daily in the field, 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 the calibration log:

- instrument identification number
- date and time
- concentration and type of calibration gas used (isobutylene at 100 ppm)
- name of the SSO performing the calibration.

All daily calibration procedures for the MiniRAE 2000 PID met the manufacturer's specifications for standard reference gas calibration.

C-4.2 Eberline E-600 Instrument Calibration

The Eberline E-600 was calibrated in the field daily by the RCT before local background levels for radioactivity were measured and recorded by the RCT in independent field documentation. The instrument was calibrated using plutonium-239 and chloride-36 sources for alpha and beta/gamma emissions, respectively. The following five checks were performed as part of the calibration procedures: date of calibration, signs of physical damage, battery function, response to a source of radioactivity, and background level. All calibrations performed for the Eberline E-600 met the manufacturer's specifications and the HSR-1 Eberline E-600 Radiation Detection Instrument Manual HSR1-INS-009 (February 9, 2004).

C-5.0 SURFACE AND SUBSURFACE SAMPLING

This section summarizes the methods used for collecting samples for laboratory analysis, including soil, fill, and rock samples. The samples were collected at the locations and depth intervals specified in the revised investigation work plan (LANL 2007, 102622).

C-5.1 Surface and Shallow Subsurface Soil and Fill Sampling Methods

Surface and shallow subsurface samples were collected from soil and fill using a spade and scoop. All sampling was performed in accordance with SOP-0.6.09, "Spade and Scoop Method for Collection of Soil Samples."

C-5.2 Rock Sampling Methods

Rock samples were collected from boreholes in accordance with SOP-06.26, "Core Barrel Sampling for Subsurface Earth Materials," for fixed-laboratory analysis. Borehole samples were contained in a stainless-steel, split-spoon, core-barrel sampler that retrieved core in 5-ft intervals.

Borehole core and hand auger collected samples retrieved from the subsurface were field screened and visually inspected before aliquots were collected for analysis. The interval to be sampled was field

screened and then removed from the core or hand-auger barrel, placed in a decontaminated stainless-steel bowl, and homogenized. The material was crushed with a decontaminated rock hammer and stainless-steel spoon to allow material to fit into sample containers. The samples were placed in sterile sample containers, sealed, and labeled with the location ID, date, time, depth interval, and type of material.

C-5.3 Quality Assurance/Quality Control Samples

Quality assurance (QA)/quality control (QC) samples for soil and rock were collected in accordance with EP-ERSS-SOP-5059, "Field Quality Control Samples." Field duplicate samples were collected at a frequency of at least 1 duplicate sample for every 10 samples collected. Field trip blanks were also collected at a frequency of one field trip blank for each day that VOC samples were collected and submitted to the SMO. Data for QA/QC samples for soil and rock are included in Appendix F (provided on DVD).

C-5.4 Sample Documentation and Handling

Field personnel completed an SCL and associated COC form for each sample set. The sample containers were sealed with signed COC seals and placed into coolers to maintain a temperature of approximately 4°C. The samples were preserved, as necessary, packed, handled, and shipped in accordance with EP-ERSS-SOP-5056, "Sample Container and Preservation," and EP-ERSS-SOP-5057, "Handling, Packaging, and Shipping of Samples."

C-5.5 Decontamination of Sampling Equipment

The split-spoon, core-barrel, stainless-steel bowls and scoops, and all other sampling equipment that came into, or may have come into, contact with sample materials were decontaminated after each sample was retrieved. Decontamination included wiping the equipment with a household-strength cleaning spray and paper towels. Dry decontamination of the drilling equipment was done with wire brushes before the drill rig was mobilized to another borehole to avoid cross-contamination between samples and borehole locations. Decontamination activities were performed in accordance with EP-ERSS-SOP-5061, "Field Decontamination of Equipment."

C-6.0 GEODETIC SURVEYING

Geodetic surveying for the Middle Cañada del Buey Aggregate Area investigation was performed to locate historical and new sampling locations. Locations were surveyed using a Trimble 5700 differential global positioning system (DGPS). All coordinates are expressed as State Plane Coordinate System 83, New Mexico Central, U.S. ft.

C-7.0 WASTE STORAGE AND DISPOSAL

All investigation-derived waste (IDW) generated during the Middle Cañada del Buey Aggregate Area was managed in accordance with applicable regulations and EP-ERSS-SOP-5022 "Management of Environmental Restoration Project Waste." This SOP incorporates the requirements of all applicable EPA and New Mexico Environment Department (NMED) regulations.

The waste streams associated with the investigation at the Middle Cañada del Buey Aggregate Area included drill cuttings and core materials, contact IDW, and spent acetone from RDX and TNT D TECH

field screening test kits. Appendix G presents the waste streams and approximate waste volumes generated during the investigation. Drill cuttings and discarded core from boreholes were collected and containerized in waste bags and stored in a less-than-90-day waste storage area at both AOC 51-001 and AOC 54-007(d). All waste generated during this investigation was classified as hazardous pending characterization analysis.

C-8.0 DEVIATIONS FROM APPROVED WORK PLAN

The only deviation from the scope of activities, as defined in the investigation work plan and NMED directions to modify (LANL 2007, 102622; NMED 2008, 099819), was the moving of one sampling point. Location 2 at AOC 51-001 (location CB-604309) was moved approximately 3 ft to the west because a large container blocked drill-rig access.

C-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 number. This information is also included in text citations. ER ID numbers are assigned by the EP 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; the U.S. Department of Energy–Los Alamos Site Office; EPA, Region 6; 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), December 2007. "Investigation Work Plan for Middle Cañada del Buey Aggregate Area, Revision 1," Los Alamos National Laboratory document LA-UR-07-8316, Los Alamos, New Mexico. (LANL 2007, 102622)

NMED (New Mexico Environment Department), January 16, 2008. "Correction for Direction to Modify Letter for Investigation Work Plan for Middle Cañada del Buey Aggregate Area, Revision 1," New Mexico Environment Department letter to D. Gregory (DOE-LASO) and D. McInroy (LANL) from N. Dhawan (NMED-HWB), Santa Fe, New Mexico. (NMED 2008, 099819)

Table C-1.0-1
Summary of SOPs Used during the 2008 Investigations

Procedure Number	Procedure Title
SOP-01.12	Field Site Closeout Checklist
EP-ERSS-SOP 5018	Integrated Fieldwork Planning and Authorization
EP-ERSS-SOP 5022	Management of Environmental Restoration Project Wastes
EP-ERSS-SOP 5034	Monitor Well and RFI Borehole Abandonment
EP-ERSS-SOP 5055	General Instructions for Field Investigations
EP-ERSS-SOP 5056	Sample Container and Preservation
EP-ERSS-SOP 5057	Handling, Packaging, and Transporting Field Samples
EP-ERSS-SOP 5058	Sample Control and Field Documentation
EP-ERSS-SOP 5059	Field Quality Control Samples
EP-ERSS-SOP 5060	Operational Guidelines for Taking Soil and Water Samples in Explosive Areas
EP-ERSS-SOP 5061	Field Decontamination of Equipment
EP-ERSS-SOP 5077	Field Sampling of Core and Cuttings for Geological Analysis
SOP-12.01	Field Logging, Handling, and Documentation of Borehole Materials
SOP-06.09	Spade and Scoop Method for the Collection of Soil Samples
SOP-06.10	Hand Auger and Thin-Wall Tube Sampler
SOP-06.26	Core Barrel Sampling for Subsurface Earth Materials
SOP-06.33	Headspace Vapor Screening with a Photo Ionization Detector

Table C-1.0-2
Summary of Investigation Methods

Method	Summary
Locating Utilities	Excavation/Soil Disturbance Permits were obtained from the Industrial Hygiene and Safety–Operational Support Division. Underground utilities were located, and the excavation permits were secured before the readiness and planning review and before any field activities were undertaken at the Middle Cañada del Buey Aggregate Area.
Spade-and-Scoop Collection of Soil Samples	This method was used to collect surface (i.e., 0–6 in.) soil or fill samples. A hole was dug to the desired depth, as prescribed in the work plan, and a discrete grab sample was collected. The sample was homogenized in a decontaminated stainless-steel bowl before it was transferred to the appropriate sample containers.
Hand Auger Collection of Soil Samples	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 is reached, the auger is decontaminated before advancing the hole through the sampling depth. The sampling material is transferred from the auger bucket to a stainless-steel sampling bowl before filling the various required sample containers.
Split-Spoon Core-Barrel Sampling	The split-spoon core barrel is a cylindrical barrel split lengthwise so that the two halves can be separated to expose the core sample. The stainless-steel core barrel (3-in.-I.D. and 5 ft long) is pushed directly into the subsurface media with a hollow-stem auger drilling rig. A continuous length of core is extracted with the core barrel. Once it was extracted, the section of core was screened for radioactivity and organic vapors, photographed, and described in a lithologic log. If it was located within a targeted sampling interval, a portion of the core was collected for fixed laboratory analysis.
Field Logging, Handling, and Documentation of Borehole Materials	Upon reaching the surface, core barrels were immediately opened for field screening, logging, and sampling. Logging of borehole materials included run number, core recovery in feet, depth interval (in 5-ft increments), field-screening results, lithological and structural description, and photographs. Once the core material was logged, selected samples were taken from discrete intervals of the core. All borehole material not sampled was then disposed of as waste.
Headspace Vapor Screening	Samples from each 5-ft core interval were field screened for VOCs by placing a portion of the sample in a glass jar. The jar was sealed with foil and gently shaken and allowed to equilibrate for approximately 5 min. The sample was then screened by inserting a PID probe equipped with an 11.7-eV lamp into the container. The results were recorded in units of ppm.
Handling, Packaging, and Shipping of Samples	Samples were sealed and labeled before being packed in ice. Sample and transport containers were examined to ensure they were free of external contamination. Samples were packaged to minimize the possibility of breakage during transport. After environmental samples were collected, packaged, and preserved, they were transported to the SMO. A split of each sample was sent to an SMO-approved radiation-screening laboratory under COC. Once radiation-screening results were received, the SMO sent the corresponding analytical samples to fixed laboratories for full analysis.
Containers and Preservation of Samples	Specific requirements/processes for sample containers, preservation techniques, and holding times were based on EPA guidance for environmental sampling, preservation, and QA. Specific requirements for each sample were printed in the SCLs provided by the SMO (size and type of container, preservatives, etc.). All samples were preserved by placing them in insulated containers with ice to maintain a temperature of 4°C.

Table C-1.0-2 (continued)

Method	Summary
Sample Control and Field Documentation	The collection, screening, and transport of samples were documented on standard forms generated by the SMO. These forms included SCLs, COC forms, and sample container labels. Collection logs were completed at the time the samples were collected and were signed by the sampler and a reviewer who verified the logs were complete and accurate. Corresponding labels were initialed and applied to each sample container, and custody seals were placed around container lids or openings. The COC forms were completed and assigned to verify that the samples were not left unattended.
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 are expressed as State Plane Coordinate System, North American Datum 83, New Mexico Central Zone, U.S. survey feet. All elevation data are reported relative to the National Geodetic Vertical Datum of 1983.
Management, Characterization, and Storage of IDW	The IDW was managed, characterized, and stored in accordance with an approved waste characterization strategy form that documents site history, field activities, and the characterization approach for each waste stream managed. Waste characterization complied with on-site or off-site waste acceptance criteria, as appropriate. All stored IDW was marked with appropriate signs and labels. Each waste generated container was individually labeled with waste classification, item ID, and radioactivity (if applicable) immediately following containerization. All waste was segregated by classification and compatibility to prevent cross-contamination.
Field Quality Control Samples	Field QC samples were collected as follows. Field duplicate samples were collected at a frequency of 10%. Field duplicates were collected at the same time as a regular sample and submitted for the same analyses. Trip blanks were collected whenever samples were collected for VOC analysis. Trip blanks were collected at a frequency of one sample per day when VOC samples were collected. Trip-blank containers consisting of certified clean sand are opened and kept with the other sample containers during the sampling process.
Field Decontamination of Equipment	Dry decontamination was the preferred method at the Middle Cañada del Buey Aggregate Area to minimize generating liquid waste. Dry decontamination included using a wire brush or other tool to remove soil or other material adhering to the sampling equipment, followed by applying a commercial cleaning agent (i.e., Fantastik) and paper wipes.

Appendix D

2008 Geodetic Survey Coordinates and Borehole Logs

This appendix contains the geodetic survey coordinates of the sample locations from the 2008 Middle Cañada del Buey investigation and the logs of the two deep (60-ft) boreholes installed during the investigation. The sample location coordinates are presented in Table D-1. All coordinates are expressed as State Plan Coordinate System 83, New Mexico Central, U.S. ft. Logs of the two 60-ft boreholes installed at Area of Concern (AOC) 51-001 are presented in Attachment D-1.

Table D-1
Geodetic Survey Coordinates of 2008 Sample Locations

Location ID	Easting (ft)	Northing (ft)
AOC 18-005(b)		
CB-604295	1635666.336	1763349.614
CB-604296	1635674.743	1763342.274
CB-604297	1635668.679	1763335.706
CB-604298	1635660.259	1763342.670
AOC 18-005(c)		
CB-604299	1635531.198	1763448.220
CB-604300	1635539.010	1763441.710
CB-604301	1635527.292	1763427.821
CB-604302	1635519.045	1763435.200
AOC 51-001		
51-10000	1633733.286	1764750.276
51-10001	1633743.382	1764747.620
51-10002	1633721.067	1764687.879
51-10003	1633722.284	1764690.453
51-10004	1633722.772	1764693.462
51-10005	1633723.480	1764696.938
CB-604309	1633724.948	1764700.573
AOC 54-007(d)		
54-15422	1635278.242	1763673.652
54-15424	1635284.053	1763642.461
54-15425	1635284.814	1763644.787
54-15426	1635285.629	1763646.419
54-15427	1635283.341	1763641.941
54-15448	1635266.61	1763676.806
54-15449	1635267.177	1763678.168
54-15450	1635265.973	1763675.330
54-15451	1635284.309	1763669.865
54-15452	1635285.641	1763671.102
54-15453	1635283.504	1763669.050
54-15454	1635302.43	1763667.152
54-15455	1635303.696	1763669.264
54-15456	1635301.204	1763665.905
54-15457	1635314.131	1763663.691
54-15458	1635315.185	1763665.886
CB-604314	1635286.104	1763647.525

Attachment D-1

Borehole Logs

BOREHOLE LOG

Bayo Canyon Aggregate Investigation

BH ID:51-10001	TA: TA-51 (Location #6)	Drill Depth: 0-61 ft bgs	Total Pages: 2
Driller: Dave Starnes		Start Date: 12/08/2008	End Date: 12/08/2008
Drilling Equipment/Method: CME 85 Hollow-Stem Auger			
Sampling Equipment/Method: 3" ID 5' Length Split-Barrel Sampler			Logged By: P. Baucom

DEPTH (ft bgs)	FIELD SCREENING RESULTS: PID (ppm)	SAMPLE ID	LITHOLOGICAL DESCRIPTION	LITHOLOGY	NOTES
0 1 2 3 4 5	PID = background		0-.5' Soil, sandy silt with root material, slightly moist 0.5-6' sand with silt and gravels, some crushed tuff, very slightly moist	Fill Material	Material described by examining drill cuttings and core samples
6 7 8 9 10	PID = background				**Approximate Qbt 2/Fill Contact = 6 ft bgs**
11 12 13 14 15	PID = background				
16 17 18 19 20	PID = background				
21 22 23 24 25	PID = background				
26 27 28 29 30	PID = background		6-45' Tuff-moderately welded, light gray (7.5YR 7/1), dry, 10-15% quartz, 5-10% sandine, 5-15% pumice. Pumice have a sugary texture and are large (up to 4 cm in diameter)	Qbt 2	
31 32 33 34 35	PID = background				
36 37 38 39 40	PID = background				
41 42 43 44 45	PID = background				

BOREHOLE LOG

Bayo Canyon Aggregate Investigation

BH ID:51-10001	TA: TA-51 (Location #6)	Drill Depth: 0-61 ft bgs	Total Pages: 2
Driller: Dave Starnes		Start Date: 12/08/2008	End Date: 12/08/2008
Drilling Equipment/Method: CME 85 Hollow-Stem Auger			
Sampling Equipment/Method: 3" ID 5' Length Split-Barrel Sampler			Logged By: P. Baucom

DEPTH (ft bgs)	FIELD SCREENING RESULTS: PID (ppm)	SAMPLE ID	LITHOLOGICAL DESCRIPTION	LITHOLOGY	NOTES
46 47 48 49 50	PID = background	49-51.5 ft bgs CACB-09-1452	45-61' Tuff, poorly welded, pinkish gray (5YR7/2 to white (5YR 8/1), 10% quartz, 5% sanidine, 5% pumice, 3% lithics. Pumice are dark purple and brittle	Qbt 1v	**Approximate Qbt 2/Qbt 1v Contact = 45 ft bgs**
51 52 53 54 55	PID = background	CACB-09-1458 (FD)			
56 57 58 59 60	PID = background	59-61 ft bgs CACB-09-1453			**TD = 61 ft bgs**

BOREHOLE LOG

Bayo Canyon Aggregate Investigation

BH ID:51-10000	TA: TA-51 (Location #7)	Drill Depth: 0-61 ft bgs	Total Pages: 2
Driller: Dave Starnes		Start Date: 12/09/2008	End Date: 12/09/2008
Drilling Equipment/Method: CME 85 Hollow-Stem Auger			
Sampling Equipment/Method: 3" ID 5' Length Split-Barrel Sampler			Logged By: P. Baucom

DEPTH (ft bgs)	FIELD SCREENING RESULTS: PID (ppm)	SAMPLE ID	LITHOLOGICAL DESCRIPTION	LITHOLOGY	NOTES
0 1 2 3 4 5	PID = background		0-.5' Soil, sandy silt with root material, slightly moist 0.5-6.5' sand with silt and gravels, some crushed tuff, very slightly moist	Fill Material	Material described by examining drill cuttings and core samples
6 7 8 9 10	PID = background				**Approximate Qbt 2/Fill Contact = 6 ft bgs**
11 12 13 14 15	PID = background				
16 17 18 19 20	PID = background				
21 22 23 24 25	PID = background				
26 27 28 29 30	PID = background		6.5-45' Tuff-moderately welded, light gray (7.5YR 7/1), dry, 10-15% quartz, 5-10% sandine, 5-15% pumice. Pumice have a sugary texture and are large (up to 4 cm in diameter)		
31 32 33 34 35	PID = background			Qbt 2	
36 37 38 39 40	PID = background				
41 42 43 44 45	PID = background				

BOREHOLE LOG

Bayo Canyon Aggregate Investigation

BH ID:51-10000	TA: TA-51 (Location #7)	Drill Depth: 0-61 ft bgs	Total Pages: 2
Driller: Dave Starnes		Start Date: 12/09/2008	End Date: 12/09/2008
Drilling Equipment/Method: CME 85 Hollow-Stem Auger			
Sampling Equipment/Method: 3" ID 5' Length Split-Barrel Sampler			Logged By: P. Baucom

DEPTH (ft bgs)	FIELD SCREENING RESULTS: PID (ppm)	SAMPLE ID	LITHOLOGICAL DESCRIPTION	LITHOLOGY	NOTES
46 47 48 49 50	PID = background	49-50.5 ft bgs CACB-09-1454	46-61' Tuff, poorly welded, pinkish gray (5YR7/2 to white (5YR 8/1), 10% quartz, 5% sanidine, 5% pumice, 3% lithics. Pumice are dark purple and brittle	Qbt 1v	**Approximate Qbt 2/Qbt 1v Contact = 46 ft bgs**
51 52 53 54 55	PID = background				
56 57 58 59 60	PID = background	59-60.5 ft bgs CACB-09-1455			**TD = 61 ft bgs**

Appendix E

Analytical Program

E-1.0 INTRODUCTION

This appendix discusses the analytical methods and data-quality review for samples collected during investigations of Middle Cañada del Buey Aggregate Area sites [Areas of Concern (AOCs) 51-001, 18-005(b), 18-005(c), and 54-007(d)].

Quality assurance (QA), quality control (QC), and data validation procedures were implemented in accordance with the "Quality Assurance Project Plan Requirements for Sampling and Analysis" (LANL 1996, 054609), and the Los Alamos National Laboratory's statements of work (SOWs) for analytical laboratories (LANL 1995, 049738; LANL 2000, 071233). The results of the QA/QC procedures were used to estimate the accuracy, bias, and precision of the analytical measurements. Samples for QC include method blanks, matrix spikes (MSs), laboratory control samples (LCSs), internal standards, initial calibration verifications (ICVs) and continuing calibration verifications (CCVs), surrogates, and tracers.

The type and frequency of laboratory QC analyses are described in the SOWs for analytical laboratories (LANL 1995, 049738; LANL 2000, 071233). Other QC factors, such as sample preservation and holding times, were also assessed in accordance with the requirements outlined in standard operating procedure (SOP) EP-ERSS-SOP-5056, Sample Containers and Preservation.

The following SOPs, available at http://www.lanl.gov/environment/all/qa/adep.shtml, were used for data validation:

- SOP-5161, Routine Validation of Volatile Organic Data
- SOP-5162, Routine Validation of Semivolatile Organic Compound (SVOC) Analytical Data
- SOP-5163, Routine Validation of Organochlorine Pesticides and PCB Analytical Data
- SOP-5164, Routine Validation of High Explosives Analytical Data
- SOP-5165, Routine Validation of Metals Analytical Data
- SOP-5166, Routine Validation of Gamma Spectroscopy Data, Chemical Separation Alpha Spectrometry, Gas Proportional Counting, and Liquid Scintillation Analytical Data
- Model Data Validation Procedure, Revision 4.1

Routine data validation was performed for each data package (also referred to as request numbers), and analytical data were reviewed and evaluated based on U.S. Environmental Protection Agency (EPA) National Functional Guidelines, where applicable (EPA 1994, 048639; EPA 1999, 066649). As a result of the data validation and assessment efforts, qualifiers are assigned to the analytical records as appropriate. The data-qualifier definitions are provided in Appendix A.

E-2.0 ANALYTICAL DATA ORGANIZATION AND VINTAGE

E-2.1 Laboratory Data and Sample Documentation

Only analytical data for which complete data packages and sample documentation are available are appropriate for decision-making purposes and are included in reporting data sets. In addition, all analytical historical data are reviewed and revalidated to current QA standards.

E-2.1.1 Historical Samples

Solid media historical samples were collected at AOCs 51-001 and 54-007(d) in 1995 and 2001; no historical data are available for AOCs 18-005(b) and 18-005(c). All samples associated with these investigations were submitted for analysis to an approved off-site analytical laboratory. Some of the 1995 data from AOC 54-007(d) were determined to be screening-level data and are not included in the data set. One sample collected in 1995 at AOC 51-001 contains decision-level data and is included in the data set (Appendix F).

E-2.1.2 2008 Investigation Samples

Soil or tuff samples were collected during the 2008 investigations and submitted for analysis by an approved off-site analytical laboratory. All of the 2008 data are decision-level and included in the data set for each site (Appendix F).

E-3.0 INORGANIC CHEMICAL ANALYTICAL METHODS

The soil and tuff samples collected during the investigations were analyzed by one or more of the following inorganic chemical methods: anions, target analyte list (TAL) metals, cyanide, perchlorate, and pH. Samples were analyzed for TAL metals using EPA SW-846 Methods 6010A, 6010B, 6020, 7060A, 7421, 7740, 7841, and 7471A. Other analytical methods included EPA SW-846 Method 9012A for cyanide, EPA SW-846 Method 6850 for perchlorate, and EPA Method 300.0 for anions. The analytical methods used are listed in Table E-3.0-1.

Tables B-3.0-1, B-4.0-1, B-5.0-1, and B-6.0-1 in Appendix B summarize the samples collected and the inorganic chemical analyses requested for each site. All inorganic chemical results are included in Appendix F.

E-3.1 Inorganic Chemical QA/QC Samples

To assess the accuracy and precision of inorganic chemical analyses, LCSs, preparation blanks (PBs), MS samples, laboratory duplicate samples, interference check samples (ICSs), and serial dilution samples were analyzed as part of the investigations. Each of these QA/QC sample types is defined in the analytical services SOWs (LANL 1995, 049738; LANL 2000, 071233) and is described briefly in the sections below.

The LCS serves as a monitor of the overall performance of each step during the analysis, including sample digestion. Following Laboratory SOP guidance, analytical results were qualified according to EPA National Functional Guidelines (EPA 1994, 048639) if the individual LCS recovery indicated an unacceptable bias in the measurement of individual analytes. For inorganic chemicals in soil/tuff, LCS percent recoveries (%R) should fall into the control limits of 75%–125% (LANL 1995, 049738; LANL 2000, 071233).

Preparation blanks are used to measure bias and potential cross-contamination. All inorganic chemical results for the PB should be below the method detection limit (MDL).

The accuracy of inorganic chemical analyses is also assessed using MS samples. These samples are designed to provide information about the effect of the sample matrix on the sample preparation procedures and analytical technique. The MS acceptance criteria are 75%–125%, inclusive for all spiked analytes (LANL 1995, 049738; LANL 2000, 071233).

Laboratory duplicate samples assess the precision of inorganic chemical analyses. All relative percent differences (RPDs) between the sample and laboratory duplicate should be ±35% for soil (LANL 1995, 049738; LANL 2000, 071233).

The ICSs assess the accuracy of the analytical laboratory's interelement and background correction factors used for inductively coupled plasma emission spectroscopy. The ICS %R should be within the acceptance range of 80%–120%. The QC acceptance limits are ±20%.

Serial dilution samples measure potential physical or chemical interferences and correspond to a sample dilution ratio of 1:5. The chemical concentration in the undiluted sample must be at least 50 times the MDL (100 times for inductively coupled plasma mass spectroscopy) for valid comparison. For sufficiently high concentrations, the RPD should be within 10%.

Details regarding the quality of the inorganic chemical analytical data are summarized in the following subsections.

E-3.1.1 AOC 51-001

Samples were collected at AOC 51-001 and submitted for the analysis of TAL metals, cyanide, and nitrate.

One cyanide result was rejected because the holding time was exceeded by more than 2 times.

Inorganic chemical data were qualified as estimated (J) because

- both the sample and duplicate sample results were greater than or equal to 5 times the reporting limit (RL) and the duplicate RPD exceeded 35%;
- the inorganic chemical was detected in the method blank but the concentration was greater than 5 times the sample result; or
- the detected concentration is between the MDL and the estimated detection limit (EDL).

Inorganic chemical data qualified as estimated biased high (J+) because

- the MS %R exceeded the upper acceptance level (UAL).

Inorganic chemical data qualified as estimated biased low (J-) because

- the MS %R was greater than 10% but less than the lower acceptance level (LAL) of 75%.

Inorganic chemical data were qualified as estimated and not detected (UJ) because the MS %R was greater than 10% but less than the LAL of 75%.

The rejected data do not substantially affect the assessment of risk or nature and extent at this site.

E-3.1.2 AOC 18-005(b)

Samples were collected at AOC 18-005(b) and submitted for the analysis of TAL metals, perchlorate, cyanide, and nitrate.

Two selenium results were rejected because the MS %R was less than 10%.

Inorganic chemical data were qualified as estimated (J) because

- the inorganic chemical was detected in the method blank but the concentration was greater than 5 times the sample result or
- the detected concentration is between the MDL and EDL.

Inorganic chemical data were qualified as estimated biased high (J+) because

- the MS %R exceeded the UAL.

Inorganic chemical data were qualified as estimated biased low (J-) because

- the MS %R was greater than 10% but less than the LAL of 75%.

Inorganic chemical data were qualified as estimated and not detected (UJ) because the MS %R was greater than 10% but less than the LAL of 75%.

The rejected data do not substantially affect the assessment of risk or nature and extent at this site.

E-3.1.3 AOC 18-005(c)

Samples were collected at AOC 18-005(c) and submitted for the analysis of TAL metals, perchlorate, cyanide, and nitrate.

Eight selenium results were rejected because the MS %R was less than 10%.

Inorganic chemical data were qualified as estimated (J) because

- the inorganic chemical was detected in the method blank but the concentration was greater than 5 times the sample result or
- the detected concentration is between the MDL and EDL.

Inorganic chemical data were qualified as estimated biased high (J+) because

- the MS %R exceeded the UAL.

Inorganic chemical data were qualified as estimated biased low (J-) because

- the MS %R was greater than 10% but less than the LAL of 75%.

Inorganic chemical data were qualified as estimated and not detected (UJ) because the MS %R was greater than 10% but less than the LAL of 75%.

The rejected data do not substantially affect the assessment of risk or nature and extent at this site.

E-3.1.4 AOC 54-007(d)

Samples were collected at AOC 54-007(d) and submitted for the analysis of TAL metals, cyanide, and nitrate.

Two selenium results were rejected because the MS %R was less than 10%.

Inorganic chemical data were qualified as estimated (J) because

- the inorganic chemical was detected in the method blank but the concentration was greater than 5 times the sample result or
- the detected concentration is between the MDL and EDL.

Inorganic chemical data were qualified as estimated biased high (J+) because

- the MS %R exceeded the UAL.

Inorganic chemical data were qualified as estimated biased low (J-) because

- the MS %R was greater than 10% but less than the LAL of 75%.
- Inorganic chemical data were qualified as estimated and not detected (UJ) because the MS %R was greater than 10% but less than the LAL of 75%.

Cyanide results were qualified as not detected (U) because the sample result was less than 5 times the concentration in the preparation blank. Thallium results were qualified as not detected (U) because the sample result was less than 5 times the concentration in the initial calibration blank or continuing calibration blank.

Inorganic chemical data were qualified as estimated and not detected (UJ) because the associated MS %Rs were greater than 10% but less than the LAL of 75%.

The rejected data do not substantially affect the assessment of risk or nature and extent at this site.

E-4.0 ORGANIC CHEMICAL ANALYSES

Soil and tuff samples collected during the investigations were analyzed by one or more of the following organic chemical methods: high explosives (HEXP), polychlorinated biphenyls (PCBs), pesticides, semivolatile organic compounds (SVOCs), and volatile organic compounds (VOCs). Samples were analyzed using SW-846 Methods 8081/8081A (pesticides), 8082/8082A (PCBs), 8260/8260B (VOCs), 8270/8270C (SVOCs), and 8321A (HEXP). All QC procedures were followed as required by the analytical laboratory SOWs (LANL 1995, 049738; LANL 2000, 071233). The analytical methods used are listed in Table E-3.0-1.

Tables B-5.0-1 and B-6.0-1 in Appendix B summarize the samples collected and the organic chemical analyses requested. All organic chemical results are included in Appendix F.

E-4.1 Organic Chemical QA/QC Samples

The QC samples are designed to produce a qualitative measure of the reliability of a specific part of an analytical procedure. The methods for validating organic chemical results on the basis of the various QA/QC sample types are specified in the SOPs. Some of the historical analyses may have been performed before the current SOW was implemented (LANL 1995, 049738; LANL 2000, 071233).

Calibration verifications, LCSs, method blanks, surrogates, and internal standards were analyzed to assess the accuracy and precision of organic chemical analyses. Each of these QA/QC sample types is defined in the analytical services SOWs (LANL 1995, 049738; LANL 2000, 071233) and the applicable analytical methods and is summarized below.

Calibration verification is the establishment of a quantitative relationship between the response of the analytical instrument and the concentration of the target analyte. There are two aspects of calibration verification: initial and continuing. The initial calibration verifies the linearity of the calibration curve as well as the individual calibration standards used to perform the calibration. The continuing calibration verifies the initial calibration is still linear and valid. The continuing calibration also serves to determine that analyte identification criteria, such as retention times and spectral matching, are being met.

The LCS is a sample of the same matrix spiked with the target analytes and serves to monitor the overall performance. Following Laboratory SOP guidance, analytical results were qualified according to EPA National Functional Guidelines (EPA 1999, 066649) if the individual LCS recoveries were not within method-specific acceptance criteria.

A method blank is an analyte-free matrix to which all reagents are added in the same volumes or proportions as those used in the environmental sample processing and is extracted and analyzed in the same manner as the corresponding environmental samples. Method blanks are used to assess the potential for sample contamination during extraction and analysis.

A surrogate compound (surrogate) is an organic chemical used in the analyses of organic target analytes. The surrogate is similar in composition and behavior to the target analytes but is not normally found in environmental samples. Surrogates are added to every blank, sample, and spike to evaluate the efficiency with which analytes are recovered during extraction and analysis. The recovery percentage of the surrogates must be within specified ranges, or the sample may be rejected or assigned a qualifier.

Internal standards are chemical compounds added to every blank, sample, and standard extract at a known concentration. Internal standards are used as the basis for quantitation of target analytes. The %R for internal standards should be within the range of 50%–200%.

Details regarding the quality of the organic chemical analytical data are summarized in the following subsections.

E-4.1.1 AOC 51-001

Samples were collected at AOC 51-001 and submitted for the analysis of VOCs and SVOCs. One sample from 1995 was also analyzed for pesticides and PCBs.

The VOC results in one sample were rejected because the extraction/analytical holding time was exceeded by more than twice the published method holding time. The rejected data do not substantially affect the assessment of risk or nature and extent at this site.

The VOC data were qualified as estimated (J) because

- the associated internal standard area counts are less than 50% or greater than 200% of the previous continuing calibration standard or
- the detected concentration is between the MDL and estimated quantitation limit (EQL).

The VOC results were qualified as estimated and not detected (UJ) because either (1) the associated internal standard area counts are less than 50% but greater than 10% of the previous continuing calibration, (2) the initial calibration curve exceeded the percent relative standard deviation (%RSD) criteria and/or the associated multipoint calibration correlation coefficient is <0.995, or (3) the initial calibration verification and/or continuing calibration verification were recovered outside the method-specific limits.

The VOC results were qualified as not detected (U) because either (1) the sample result is less than 5 times or 10 times the concentration in the method blank or (2) the sample result is less than 5 times the concentration in the trip blank, rinsate blank, or equipment blank.

No SVOC data were rejected.

SVOC results were qualified as estimated and not detected (UJ) because either (1) at least one surrogate is greater than the UAL and one surrogate is less than the LAL, (2) the initial calibration curve exceeded the %RSD criteria and/or the associated multipoint calibration correlation coefficient is <0.995, or (3) the initial calibration verification and/or continuing calibration verification were recovered outside the method-specific limits.

Pesticides and PCB data did not have any QA issues.

E-4.1.2 AOC 18-005(b)

Samples were collected at AOC 18-005(b) and submitted for the analysis of explosive compounds and SVOCs.

No organic chemical data were rejected (R).

The explosive compound data were qualified as estimated and not detected (UJ) because the initial calibration verification and/or continuing calibration verification were recovered outside the method-specific limits.

The SVOC results were qualified as estimated and not detected (UJ) because either (1) the LCS %R was less than the LAL but greater than 10%, (2) the initial calibration curve exceeded the %RSD criteria and/or the associated multipoint calibration correlation coefficient is <0.995, or (3) the initial calibration verification and/or continuing calibration verification were recovered outside the method-specific limits.

E-4.1.3 AOC 18-005(c)

Samples were collected at AOC 18-005(c) and submitted for the analysis of explosive compounds and SVOCs.

No organic chemical data were rejected (R).

The explosive compound data were qualified as estimated and not detected (UJ) because the initial calibration verification and/or continuing calibration verification were recovered outside the method-specific limits.

SVOC results were qualified as estimated and not detected (UJ) because either (1) the LCS percent recovery was less than the LAL but greater than 10%, (2) the initial calibration curve exceeded the %RSD criteria and/or the associated multipoint calibration correlation coefficient is <0.995, or (3) the initial calibration verification and/or continuing calibration verification were recovered outside the method-specific limits.

E-4.1.4 AOC 54-007(d)

Samples were collected at AOC 54-007(d) and submitted for the analysis of VOCs, SVOCs, pesticides, and PCBs.

No organic chemical data were rejected (R).

- The VOC data were qualified as estimated (J) because the concentration is between the MDL and EQL.
- The VOC data were qualified as estimated biased high (J+) because the surrogate recovery was greater than the UAL.

The VOC results were qualified as estimated and not detected (UJ) because either (1) the associated LCS recovery was less than the LAL but greater than 10%, (2) the associated internal standard area counts are less than 50% but greater than 10% of the previous continuing calibration, (3) the initial calibration curve exceeded the %RSD criteria and/or the associated multipoint calibration correlation coefficient is <0.995, or (4) the initial calibration verification and/or continuing calibration verification were recovered outside the method-specific limits.

The VOC results were qualified as not detected (U) because either (1) the sample result is less than 5 times or 10 times the concentration in the method blank or (2) the sample result is less than 5 times the concentration in the trip blank, rinsate blank, or equipment blank.

- The SVOC data were qualified as estimated (J) because the concentration is between the MDL and EQL.
- The SVOC results were qualified as estimated and not detected (UJ) because either (1) the associated internal standard area counts are less than 50% but greater than 10% of the previous continuing calibration, (2) at least one surrogate is greater than the UAL and one surrogate is less than the LAL, (3) the initial calibration curve exceeded the %RSD criteria and/or the associated multipoint calibration correlation coefficient is <0.995, or (4) the initial calibration verification and/or continuing calibration verification were recovered outside the method-specific limits.

The PCB data were qualified as estimated (J) because the concentration is between the MDL and EQL.

Pesticide results were qualified as estimated and not detected (UJ) because either (1) the associated LCS recovery was less than the LAL but greater than 10% or (2) the initial calibration verification and/or continuing calibration verification were recovered outside the method-specific limits.

E-5.0 RADIONUCLIDE ANALYSES

Soil and tuff samples collected during the investigations were analyzed by one or more of the following radionuclide methods: (1) gamma spectroscopy (EPA Method 901.1 and generic gamma spectroscopy); (2) isotopic uranium and isotopic plutonium (HASL Method 300); (3) strontium-90 (EPA Method 905); and (4) tritium (EPA Method 906). The analytical methods used are listed in Table E-3.0-1.

Tables B-5.0-1 and B-6.0-1 in Appendix B summarize the samples collected and the radionuclide analyses requested. All radionuclide results are included in Appendix F.

E-5.1 Radionuclide QA/QC Samples

The minimum detectable concentration (MDC) for each radionuclide in PBs, method blanks, laboratory duplicates, tracer/carrier recovery, LCSs, and MS samples were analyzed to assess the accuracy and precision of radionuclide analyses. These QA/QC qualifiers and sample types for radionuclides are defined in the analytical services SOWs (LANL 1995, 049738; LANL 2000, 071233), are described in the applicable SOPs, and are discussed briefly below. The validation of radionuclide data using QA/QC

samples and other methods may have resulted in the rejection of data or the assignment of various qualifiers to individual sample results.

The MDC for each radionuclide is defined as the minimum activity concentration that the analytical laboratory equipment can detect in 95% of the analyzed samples and is used to assess analytical performance.

The PBs and method blanks are used to measure bias and assess potential cross-contamination of samples during preparation and analysis. Blank results should be less than the MDC for each radionuclide.

Laboratory duplicates are used to assess or demonstrate acceptable laboratory method precision at the time of analysis as well as to assess the long-term precision of an analytical method on various matrices. For radionuclide analyses, duplicate results are used to calculate a duplicate error ratio (DER). The DER is based on 1 standard deviation of the sample and the duplicate sample and should be less than 4.

The LCS serves as a monitor of the overall performance of each step during the analysis, and the acceptance criteria for LCSs are method specific. For radionuclide methods, LCS %Rs should fall into the control limits of 80%–120%.

The accuracy of radionuclide analyses is also assessed using MS samples. These samples are designed to provide information about the effect of the sample matrix on the sample preparation procedures and analytical technique. The MS %Rs should be within the acceptance range of 75%–125%; however, if the sample result is more than 4 times the amount of the spike added, these acceptance criteria do not apply.

Details of the quality of the radionuclide data are summarized in the following subsections.

E-5.1.1 AOC 51-001

Samples collected during the investigation were analyzed by gamma spectroscopy and analyzed for isotopic uranium, isotopic plutonium, strontium-90, and tritium.

No radionuclide data were rejected.

Isotopic uranium data were qualified as estimated (J) because the radionuclide was detected in the method blank but the concentration was greater than 5 times the sample result.

Isotopic uranium data were qualified as estimated biased low (J-) because the tracer recovery is less than the LAL but greater than 10%.

E-5.1.2 AOC 18-005(b)

Samples were not analyzed for radionuclides.

E-5.1.3 AOC 18-005(c)

Samples were not analyzed for radionuclides.

E-5.1.4 AOC 54-007(d)

Samples collected during the investigation were analyzed for isotopic uranium.

No radionuclide data were rejected.

Isotopic uranium data were qualified as estimated and biased low (J-) or estimated not detected (UJ) because the tracer recovery is less than the LAL but greater than 10%.

E-6.0 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 number. This information is also included in text citations. ER ID numbers 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 New Mexico Environment Department Hazardous Waste Bureau; the U.S. Department of Energy–Los Alamos Site Office; EPA Region 6; 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.

EPA (U.S. Environmental Protection Agency), February 1994. "USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review," EPA-540/R-94/013, Office of Emergency and Remedial Response, Washington, D.C. (EPA 1994, 048639)

EPA (U.S. Environmental Protection Agency), October 1999. "USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review," EPA540/R-99/008, Office of Emergency and Remedial Response, Washington, D.C. (EPA 1999, 066649)

LANL (Los Alamos National Laboratory), July 1995. "Statement of Work (Formerly Called "Requirements Document") - Analytical Support, (RFP number 9-XS1-Q4257), (Revision 2 - July, 1995)," Los Alamos National Laboratory, Los Alamos, New Mexico. (LANL 1995, 049738)

LANL (Los Alamos National Laboratory), March 1996. "Quality Assurance Project Plan Requirements for Sampling and Analysis," Los Alamos National Laboratory document LA-UR-96-441, Los Alamos, New Mexico. (LANL 1996, 054609)

LANL (Los Alamos National Laboratory), December 2000. "University of California, Los Alamos National Laboratory (LANL), I8980SOW0-8S, Statement of Work for Analytical Laboratories," Rev. 1, Los Alamos National Laboratory, Los Alamos, New Mexico. (LANL 2000, 071233)

Table E-3.0-1
Analytical Methods for Inorganic Chemical, Organic Chemical, and Radionuclide Analyses

Analytical Method	Analytical Description	Analytical Suite
EPA SW-846: 6010A and 6010B	Inductively coupled plasma emission spectroscopy—atomic emission spectroscopy	Aluminum, antimony, arsenic, barium, beryllium, calcium, cadmium, cobalt, chromium, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, selenium, silver, sodium, thallium, vanadium, and zinc
EPA SW-846:6020	Inductively coupled plasma mass spectrometry	Aluminum, antimony, arsenic, barium, beryllium, calcium, cadmium, cobalt, chromium, copper, iron, lead, magnesium, manganese, nickel, potassium, selenium, silver, sodium, thallium, vanadium, and zinc
EPA SW-846:6850	Liquid chromatography–mass spectrometry/mass spectrometry	Perchlorate
EPA SW-846: 9012A	Automated colorimetric/off-line distillation	Total cyanide
EPA SW-846:7060A	Graphite furnace atomic absorption (GFAA)	Arsenic
EPA SW-846:7421	GFAA	Lead
EPA SW-846:7740	GFAA	Selenium
EPA SW-846:7871	GFAA	Thallium
EPA SW-846:7471A	Cold vapor atomic absorption (CVAA)	Mercury
EPA Method: 300	Ion chromatography	Nitrate
EPA SW-846: 8260 and 8260B	Gas chromatography-mass spectrometry (GC/MS)	VOCs
EPA SW-846: 8270 and 8270C	GC/MS	SVOCs
EPA-SW-846: 8081	GC	Pesticides
EPA-SW-846: 8081A	GC	Pesticides
EPA-SW-846: 8082	GC	PCBs
EPA-SW-846: 8082A	GC	PCBs
EPA SW-846: 8321A	High performance liquid chromatography	HEXP
EPA Method: 901.1	Gamma spectroscopy	Cesium-134, cesium-137, cobalt-60, europium-152, ruthenium-106, sodium-22
Generic: Gamma spectroscopy	Gamma spectroscopy	Americium-241, cesium-134, cesium-137, cobalt-60, europium-152, ruthenium-106, sodium-22, strontium-90, uranium-235
HASL Method 300	Chemical separation alpha spectrometry	Isotopic uranium, isotopic plutonium
EPA Method: 905	Gas Proportional Counting	Strontium-90
EPA Method: 906	Liquid scintillation	Tritium

Appendix F

Analytical Suites and Results and Analytical Reports
(on DVD included with this document)

Appendix G

Investigation-Derived Waste Management

G-1.0 INTRODUCTION

This appendix contains the available waste management documentation for waste streams generated during the 2008 Middle Cañada del Buey Aggregate Area investigation conducted by Los Alamos National Laboratory (the Laboratory). The waste characterization strategy form (WCSF) was prepared to identify the anticipated waste streams, characterization method, on-site waste management, and final disposition options. The waste profile forms (WPFs) and chemical waste disposal request (CWDR) forms will be prepared for the waste streams generated as soon waste characterization data is received.

G-2.0 SUMMARY OF WASTE GENERATION AND MANAGEMENT

The waste streams generated at the Middle Cañada del Buey Aggregate Area during the 2008 investigation activities are outlined in Table G-2.0-1. (Note: Since fieldwork was implemented in December 2008, waste management is still in progress for all of the waste streams, and final documentation has not yet been generated.)

All investigation-derived waste (IDW) is currently stored on-site in a Resource Conservation and Recovery Act (RCRA)-compliant less-than-90-d storage area, surrounded by gated and locked 8-ft chainlink fencing, pending completion of waste characterization.

G-3.0 WCSF

The WCSF was prepared before IDW generation following Standard Operating Procedure (SOP) EP-ERSS-SOP-5022, “Management and Characterization of Environmental Restoration (ER) Project Waste.” WCSF EP2008-0637 (dated November 26, 2008) describes the waste generated during borehole drilling, soil sampling, field screening, and other waste-generating field activities conducted during the 2008 Middle Cañada del Buey investigation. A copy of the approved WCSF is included in Attachment G-1.

Table G-2.0-1
Summary of IDW Generation and Management

Waste Stream	Waste Type	Volume	Characterization Method	On-Site Management	Disposition
Contact IDW	TBD[a]	2 yd^3	Acceptable Knowledge(AK) (methods of generation and analytical results from site investigation samples)	55-gal. drums	TBD
Borehole cuttings and core	TBD	3 yd^3	Direct sampling	Wrangler bags	TBD
Spent solvent/soil mixture from RDX/TNT test kits	Hazardous	200 mL	AK (process generating waste and Material Safety Data Sheets provided with test kits)	5-gal. U.S. Department of Transportation container	Intended path: off-site approved RCRA-permitted treatment, storage , and disposal facility

[a] TBD = To be determined.

[b] RDX = Hexahydro-1,3,5-trinitro-1,3,5-triazine ; TNT = 2.4.6-trinitrotoluene.

Attachment G-1

Waste Characterization Strategy Form
for Middle Cañada del Buey Aggregate Area

Waste Characterization Strategy Form

Project Title	**Middle Cañada del Buey Aggregate Area Investigation Work Plan, Revision 1**
Solid Waste Management Unit or Area of Concern #	**AOCs 18-005(b), 18-005(c), 51-001, and 54-007(d)**
Activity Type	**Drilling and Hand Auger Sampling at TA-54, 18 and 51**
Field Team Leader	**Steve Paris**
Field Waste Management Coordinator	**Selene Martinez**
Completed by	**Pattie Baucom**
Date	**November 26, 2008**

Description of Activity: The current field sampling investigation at Middle Cañada del Buey is being implemented to complete the requirements specified in the Investigation Work Plan for Middle Cañada del Buey Aggregate Area, Revision 1 (EP2007-0788) (Figure 1). The drilling and hand auger sampling campaign will be conducted at AOCs 18-005(b), 18-005(c), 51-001, and 54-007(b), located at TA-51 and TA-54 West (Figure 2). All work will be performed under the statement of work (SOW) and in accordance with the Compliance Order on Consent (2005) between the New Mexico Environment Department (NMED) and the United States Department of Energy (DOE)/LANL, and the NMED approved work plan (EP2007-0788).

The inventory of hazardous constituents present at SWMUs and AOCs within Middle Cañada del Buey Aggregate Area includes inorganic chemicals, organic chemicals, and radionuclides. The four AOCs to be investigated under this approved work plan have small waste inventories, but are potentially contaminated with both hazardous and radioactive components.

AOCs 18-005(b) and 18-005(c) consist of former explosives magazines that were destroyed by burning. The inventory for these sites is expected to be limited to residue remaining from combustion of the structures (Figure 2).

AOCs 51-001 and 54-007(d) consist of former septic systems. Both AOCs underwent VCAs to remove the septic tanks and plug drainlines, and any remaining inventory is expected be limited to contaminants discharged to the subsurface (Figure 2).

The waste-generating activities addressed in this Waste Characterization Strategy Form (WCSF) consist of sampling and field screening activities at Middle Cañada del Buey. Two samples each from 8 hand auger locations and 24 borehole locations (for a total of 64 samples at 32 locations) will be collected from Middle Canada del Buey. Specifically 8 samples will be collected from 4 hand auger locations each at AOC 18-005(b) and AOC 18-005(c), 14 samples from 7 boreholes will be collected from AOC 51-001, and 35 samples from 17 boreholes will be collected from 54-007(d). RDX and TNT field screening will be conducted on hand auger samples collected from AOCs 18-005(b) and 18-005(c). All samples will be screened for VOCs and radiological contamination. Dry decontamination methods will be employed on core barrels, hand augers, and stainless steel bowls and scoops, etc, as needed; therefore decontamination water will not be generated during this investigation.

The following waste streams are anticipated for the Middle Cañada del Buey Aggregate Area:

- Waste Stream #1-Contact IDW (includes PPE)
- Waste Stream #2-Borehole Cuttings
- Waste Stream #3-Spent Solvent/Soil Mixture from TNT/RDX test kits
- Waste Stream #4-Municipal Solid Waste (MSW)
- Waste Stream #5-New Mexico Special Waste (NMSW)

Relevant Site History and Description: Middle Cañada del Buey Aggregate Area is located in the central portion of Cañada del Buey and Mesita del Buey and incorporates parts of TA-51 and TA-54 West (Figure 1). The western part of TA-54 on Mesita del Buey associated with Middle Cañada del Buey Aggregate Area houses the former radiation exposure facility that was used to conduct biomedical research on animal exposure to radiation. This facility was operated from 1962 to the mid-1970s. TA-54 West is now used to conduct waste characterization and packaging operations associated with shipment of transuranic wastes (Figure 1).

The first operations in the current TA-51 began in 1980 with construction of the Experimental Engineering Test Facility (EETF). This facility was constructed to support research to develop effective isolation techniques for burial of waste in semiarid climates. Support offices were constructed on site in 1986. TA-51 is currently used for research and experimental studies on the long-term impacts of radioactive materials on the environment, including the effectiveness of waste isolation barriers (LANL 1992, 007669, pp. 2-1–2-4).

All SWMUs and AOCs within the Middle Cañada del Buey Aggregate Area are located on the mesa top (figure 2). Middle Cañada del Buey Aggregate Area consists of 23 SWMUs and AOCs (Figure 2). However, only four AOCs will be investigated under this work scope and addressed in this WCSF. The AOCs addressed as part of this investigation are discussed below:

AOC 51-001 at TA-51 was an inactive/abandoned septic system that served the EETF and the transportable offices for buildings 51-25, 51-26, and 51-27. The septic system consisted of a 1000-gal. concrete septic tank, drainlines, and a 4-ft-wide by 50-ft-deep seepage pit. In 2001, a VCA to remove the septic system was conducted at AOC 51-001 and involved removing the septic tank contents and the septic tank and plugging the drainlines. Confirmation samples were collected in 2001 from six locations within the septic tank excavation, beneath the inlet drainline connection, and adjacent to the seepage pit. Two VOCs (2-butanone and trichlorofluoromethane) were detected at low concentrations at two locations below EQLs. Bromomethane was detected at a concentration below the estimated quantitation limit (EQL) in the deepest sample collected at location 51-10001. No SVOCs, pesticides or PCBs were detected. Cesium-137 was detected in one fill sample at 0.0761 pCi/g at location 51-0002 at a depth of 5.5 to 6.5 ft bgs..

AOC 18-005(b) and AOC 18-005(c) at TA-54 West were both wooden structures with dimensions of 11 ft by 9 ft by 8 ft tall. These structures were surrounded by earthen berms on three sides and on top. These sites have not been investigated previously. The inventory for these sites is expected to be limited to residue remaining from combustion of the structures.

AOC 54-007(d) was an inactive/abandoned septic system that served the Radiation Exposure Facility at TA-54 West. The septic system consisted of a 1500-gal. concrete septic tank, drainlines, a distribution box, and a split drain field. A 4-in. drainline from the septic tank connected to a reinforced concrete distribution box, which diverted the effluent east and west into the drain field. The drain field consists of two 60-ft-long, 4-in.-diameter tile drainlines running east and west from the distribution box. A VCA was

conducted at AOC 54-007(d) in 2001 to remove the septic tank contents and the septic tank and plug the drainlines. Confirmation samples were collected in 2001 from six locations within the septic tank excavation, beneath the inlet drainline connection, and from the drain field. Detected organic chemicals are benzene, bis(2-ethylhexyl) phthalate; bromomethane; 2-butanone; isopropylbenzene; 4-isopropyltoluene; 4-methyl-2-pentanone; toluene; trichlorofluoromethane; and trimethylbenzene[1,2,4-]. These organic chemicals were detected at concentrations less than or slightly above their respective EQLs in one or more samples. None of these organic chemicals were detected in the contents of the septic tank (LANL 2001, 071473). At most locations, the concentrations of organic chemicals decreased slightly with depth or remained unchanged.

CHARACTERIZATION STRATEGY

All wastes will be managed in accordance with EP-ERSS-SOP-5022, Characterization and Management of Environmental Restoration Project Waste, and every effort shall be made to recycle/reuse any appropriate waste stream. Returned samples and associated PPE may be included with a waste stream at the time of disposal, if appropriate. An amendment to this strategy form shall be prepared and submitted for review and approval if any of the waste streams change in description or characterization approach. Also, unanticipated waste streams generated as a result of this activity shall be subject to inclusion in an amendment to this strategy upon discovery or generation of the waste.

If analyses indicate the presence of listed constituents that are not identified from historical processes, a due diligence may be performed to determine whether or not the constituents are from a listed source. If a listed constituent is identified that can be traced to a listed source but the levels are below screening levels and Land Disposal Restriction Treatement Standards, a No-Longer-Contained-In request may be made to NMED in order to drop the listed code from the waste stream. A copy of either the ENV-RCRA approved due diligence (showing there was no documentation that the source of contaminants was listed) or the NMED no-longer-contained-in approval must accompany all waste profiles prepared for the subject waste(s).

Waste #1: Contact IDW - This waste stream is comprised of PPE and other solid waste generated during the course of investigation activities which comes into contact with contaminated media. This includes but is not limited to: plastic sheeting (e.g., tarps, visquen, and liners), gloves, coveralls, booties, paper towels, plastic and glass sample bottles, and disposable sampling supplies (filters, tubing, plastic bags). It is estimated that a total of approximately 55 gallons of contact IDW will be generated during this investigation.

Anticipated Regulatory Status: The possible classifications of this solid waste stream and the anticipated regulatory status include: industrial, low-level radioactive waste (LLW), hazardous waste, and mixed low-level waste (MLLW).

Characterization Approach: Characterization of this waste stream will be performed through acceptable knowledge (AK) of the waste materials, the methods of generation, the extent of contamination of the contact waste, and the analytical results from the sampling of the environmental media with which the materials were in contact.

Storage and Disposal Method: The Laboratory expects these wastes to be designated as nonhazardous, nonradioactive solid waste that will be disposed of at an off-site industrial waste disposal facility. The potential exists for LLW. This waste will be managed as hazardous waste pending analysis and stored in either a Satellite Accumulation Area (SAA) or a <90 Day Hazardous Waste Accumulation

Area depending on waste volume until a waste determination can be made. If this waste is characterized other than hazardous, it will be relabeled, managed and disposed of in the appropriate manner for its classification. If this waste stream is characterized as hazardous or LLW, it will be managed as such and treated/disposed of at an authorized off site facility or disposed of at TA-54, Area G

Waste # 2: Borehole Cuttings- This waste stream will consist of soil and rock cuttings from boreholes. It is estimated that approximately 5 cubic yards of borehole cuttings will be generated during this investigation,

Anticipated Regulatory Status: The possible classifications of this solid waste stream and the anticipated regulatory status include: industrial waste, LLW, hazardous waste, and MLLW.

Characterization Approach: Waste characterization will be based upon the analytical results obtained from the direct sampling of containerized waste.

Storage and Disposal Method: Based on the results of previous investigations, the Laboratory expects these wastes to be designated as nonhazardous, nonradioactive solid waste that will be disposed of at an off-site industrial waste disposal facility. The potential exists for LLW but this waste type is not expected. Cuttings will be managed as hazardous waste pending analysis and stored either a Satellite Accumulation Area (SAA) or a <90 Day Hazardous Waste Accumulation Area depending on waste volume until a waste determination can be made. If this waste is characterized other than hazardous, it will be relabeled, managed as such and disposed of in the manner appropriate with its classification. The cuttings may be land applied if they meet the criteria in the NMED-approved Notice of Intent (NOI) Decision Tree for Land Application of Investigation Derived Waste Solids from Construction of Wells and Boreholes. If they cannot be land applied, they will be treated/disposed of at an authorized facility. Based on existing data, the Laboratory expects drill cuttings that cannot be land applied to be designated as industrial waste or LLW. The LLW will be disposed of at TA-54, Area G or sent to an authorized off-site radioactive waste facility. The industrial waste is expected to be disposed of at an authorized off-site industrial waste landfill. The approximate volume of waste generated is expected to be less than yd^3.

Waste #3: Spent solvent (acetone) and Spent Solvent/Soil Mixture from RDX/TNT test kits- This waste stream will consist of spent acetone mixed with and soil/crushed tuff. High explosives soil/crushed tuff screening with DTech test kits uses acetone as a solvent to extract the HE compounds from the media. Approximately 20 ml of waste containing spent acetone, mixed with soil/tuff, is generated per test. The volume of the acetone/soil mixture is estimated to be less than 1 liter.

Anticipated Regulatory Status: RCRA hazardous waste. Acetone, as a spent solvent, is a listed hazardous waste (EPA Hazardous Waste Number F003) and exhibits the characteristic of ignitability (D001). The regulatory status will also be affected by the waste classification of the soil/tuff with which it is mixed.

Characterization Approach: AK of the process generating the waste and the material used in this process (see Attachment #1).

Storage and Disposal Method: This waste will be packaged in a sealed inner container, and stored inside an approved hazardous waste container, such as a drum or clamshell, within a registered Satellite Accumulation Area (SAA) and in accordance with 20 NMAC 4.1, Subpart III, Section 300, Generator Requirements. The SAA will be located at or near the point of generation. Treatment/disposal of this waste stream will be at an approved offsite treatment, storage, or disposal facility (TSDF).

Waste #4: Municipal Solid Waste (MSW) – This waste stream primarily consists of non contact trash including but not limited to paper, cardboard, wood, plastic, food and beverage containers, and empty solution containers, that are derived from project activities . It is estimated that approximately 1 cubic yard of MSW will be generated.

Anticipated Regulatory Status: Non-hazardous, non-radioactive, municipal solid waste

Characterization Approach: MSW will be characterized based on AK or if necessary direct sampling of containerized waste.

Management and Disposal Method: MSW will be segregated from all other waste streams. It is anticipated that the waste will be stored in plastic trash bags or other appropriate containers and disposed of at the County of Los Alamos Landfill or other authorized facility.

Waste #5: NMSW: Petroleum Contaminated Soils (PCS), Spilled Chemical Substance or Commercial Product, or Regulated Asbestos Waste (potential) -
NMSW may be generated from the accidental release of commercial products such as hydraulic fluid, motor oil, unleaded gasoline, or diesel fuel (e.g. from the rupture of hydraulic or fuel hoses, or spills during maintenance etc.), spills of chemicals or products used during project operations (e.g. drilling fluid additives), onto the ground, or regulated asbestos wastes generated during project activities. This waste stream may also include absorbent padding, paper towels, spill pillows or other absorbent material used to contain the released material.

Anticipated Regulatory Status: NMSW

Characterization Approach: NMSW will be characterized based on AK using the MSDS and/or direct sampling. PCS will be sampled and analyzed for total petroleum hydrocarbons (TPH), diesel range and gasoline range (DRO/GRO); benzene; ethyl benzene; toluene; xylene; and total lead. Suspect asbestos will be sampled by authorized personnel and analyzed at an approved asbestos laboratory.

Management and Disposal Method: NMSW will be managed in approved containers, staged in a designated NMSW storage area, and disposed of at an authorized NMSW facility. If PCS have contaminant levels below the NMSW standards, they will be handled as an industrial waste.

TABLE 1: CHARACTERIZATION TABLE

Waste Description	Waste # 1 Contact IDW	Waste #2 Borehole cuttings	Waste #3 Spent Solvent/Acetone	Waste #4 MSW
Volume	55 gallons	5 cy	<0.5 liters	<55 gallons
Packaging -	Drums, Waste Wranglers	Drums, Waste Wranglers, Roll-off Containers	Container with secondary containment, stored in a secure outer container	Lined trash cans
Regulatory classification:				
Radioactive	X	X	—	—
Municipal Solid				X
Hazardous	X	X	X	—
Mixed (hazardous and radioactive)	X	X	—	—
Toxic Substances Control Act (TSCA)	—	—	—	—
New Mexico Special Waste	—	—	—	—
Industrial	X	X	—	X
Characterization Method				
Acceptable knowledge (AK): Existing Data/Documentation	X	—	X	X
AK: Site Characterization	—	—	—	—
Direct Sampling of Containerized Waste	—	X	—	—
Analytical Testing				
Volatile Organic Compounds (EPA 8260-B)	—	X	—	—
Semivolatile Organic Compounds (EPA 8270-C)	—	X	—	—
Organic Pesticides (EPA 8081-A)	—	X	—	—
Organic Herbicides (EPA 8151-A)	—	X	—	—
PCBs (EPA 8082)	—	X	—	—
Total Metals (EPA 6010-B/7471-A)	—	X	—	—
Total Cyanide (EPA 9012-A)	—	X	—	—
High Explosives Constituents (EPA 8330/8321-A)	—	X if needed	—	—
Asbestos	—	—	—	—
Total petroleum hydrocarbon (TPH)-GRO (EPA 8015-M)	—	X	—	—
TPH-DRO (EPA 8015-M)	—	X	—	—
Toxicity characteristic leaching procedure (TCLP) Metals (EPA 1311/6010-B)	—	X	—	—
TCLP Organics (EPA 1311/8260-B & 1311/8270-C)	—	X	—	—
TCLP Pest. & Herb. (EPA 1311/8081-A/1311/8151-A)	—	X	—	—
Gross Alpha (alpha counting) (EPA 900)	—	X	—	—
Gross Beta (beta counting) (EPA 900)	—	X	—	—
Tritium (liquid scintillation) (EPA 906.0)	—	X	—	—
Gamma spectroscopy (EPA 901.1)	—	X	—	—
Isotopic plutonium (chem. separation/alpha spec.) (HASL-300)	—	X	—	—
Isotopic uranium (chem. separation/alpha spec.) (HASL-300)	—	X	—	—
Total uranium (6020 inductively coupled plasma mass spectroscopy [ICPMS])	—	—	—	—
Strontium-90 (EPA 905)	—	X	—	—

TABLE 1: CHARACTERIZATION TABLE

Waste Description	Waste # 1 Contact IDW	Waste #2 Borehole cuttings	Waste #3 Spent Solvent/Acetone	Waste #4 MSW
Volume	55 gallons	5 cy	<0.5 liters	<55 gallons
Packaging	Drums, Waste Wranglers	Drums, Waste Wranglers, Roll-off Containers	container with secondary containment, stored in a secure outer container	Lined trash cans
Americium-241 (chem. separation/alpha spec.) (HASL-300)	—	X	—	—
Waste Profile Form #	TBD	TBD	TBD	TBD

Waste Description	Waste #5 NMSW (PCS)	Waste #6 NA	Waste #7 NA	Waste #8 NA
Volume	None Anticipated	gal	cy	cy
Packaging	Drum, Waste Wrangler			
Regulatory classification:				
Radioactive	—			
Municipal Solid				
Hazardous	—			
Mixed (hazardous and radioactive)	—			
Toxic Substances Control Act (TSCA)	—			
New Mexico Special Waste	X			
Industrial	—			
Characterization Method				
Acceptable knowledge (AK): Existing Data/Documentation	X			
AK: Site Characterization	—			
Direct Sampling of Containerized Waste	X			
Analytical Testing				
Asbestos	IF NEEDED			
Volatile Organic Compounds (EPA 8260-B)	X			
Semivolatile Organic Compounds (EPA 8270-C)	X			
Organic Pesticides (EPA 8081-A)	—			
Organic Herbicides (EPA 8151-A)	—			
PCBs (EPA 8082)	—			
Total Metals (EPA 6010-B/7471-A)	X			
Total Cyanide (EPA 9012-A)	X			
High Explosives Constituents (EPA 8330/8321-A)	X			
Asbestos	—			
Total petroleum hydrocarbon (TPH)-GRO (EPA 8015-M)	X			
TPH-DRO (EPA 8015-M)	X			
Toxicity characteristic leaching procedure (TCLP) Metals (EPA	X[1]			

1311/6010-B)				
TCLP Organics (EPA 1311/8260-B & 1311/8270-C)[1]	—			
TCLP Pest. & Herb. (EPA 1311/8081-A/1311/8151-A)[1]	—			
Gross Alpha (alpha counting) (EPA 900)	—			
Gross Beta (beta counting) (EPA 900)	—			
Tritium (liquid scintillation) (EPA 906.0)	—			
Gamma spectroscopy (EPA 901.1)	—			
Isotopic plutonium (them.. Separation/alpha spec.) (HASL-300)	—			
Isotopic uranium (them.. Separation/alpha spec.) (HASL-300)	X			
Total uranium (6020 inductively coupled plasma mass spectroscopy [ICPMS])	—			
Strontium-90 (EPA 905)	—			
Americium-241 (them.. Separation/alpha spec.) (HASL-300)	—			
Waste Profile Form #	TBD			

[1] **Note: Section 1.2 of the TCLP method 1311 states "If a total analysis of the waste demonstrates that individual analytes are not present in the waste, or that they are present but at such low concentrations that the appropriate regulatory levels could not possibly be exceeded, the TCLP need not be run." The methodology for using total waste analyses determination for the 40 TC constituents is as follows;**

Liquids – Wastes containing less than 0.5% filterable solids do not require extraction and therefore by filtering the waste and measuring the total constituent levels of the filtrate and comparing those levels to regulatory levels is appropriate.

Solids – Constituent concentrations from the extraction fluid of wastes that are 100% physical solids are divided by 20 (reflecting the 20 to 1 ratio of TCLP extraction) and then compared to the regulatory levels. If the theoretical levels do not equal or exceed the regulatory levels, the TCLP need not be run. If the levels do equal or exceed the regulatory levels, the generator may either declare the waste hazardous or run TCLP analyses.

References

ER-ERSS-SOP-5022, *Management of Environmental Restoration Project Waste.*

Waste Characterization Strategy Form (continued)

Signatures	Date
WES-RS Project Leader (Print name and then sign below.) Steve Paris/Pat Valerio	12/2/08
ERSS Waste Management Coordinator (Print name and then sign below.) Gordon Jio	12/3/08
ENV-RCRA Representative (Print name and then sign below.) Ann Sherrard	12/3/08
WES-WA Representative (Print name and then sign below.) Andy Elicio	12/04/08

	Los Alamos National Laboratory **ENV-ERSS**

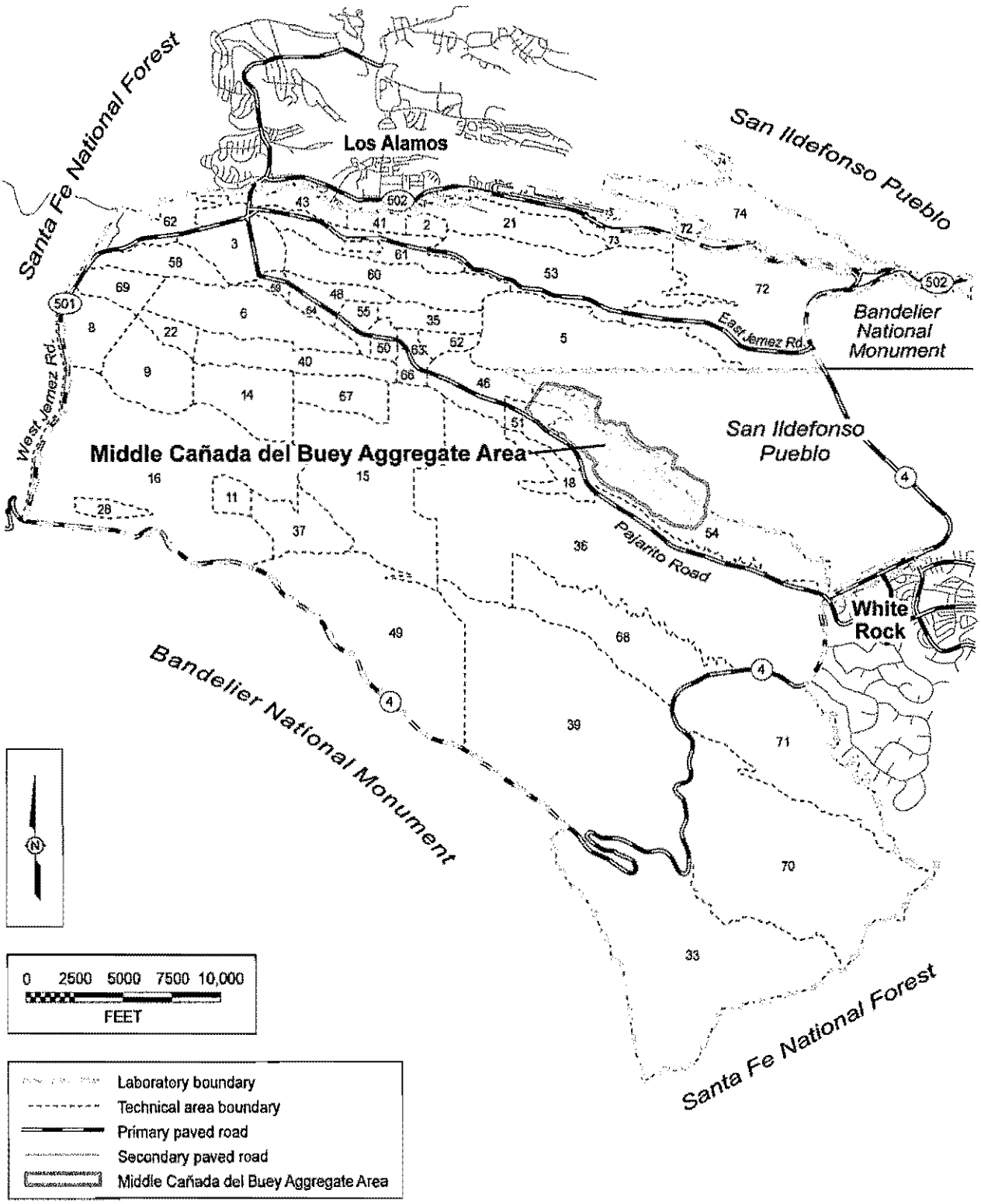

Figure 1: Location of Middle Canada del Buey Aggregate Area with respect to LANL.

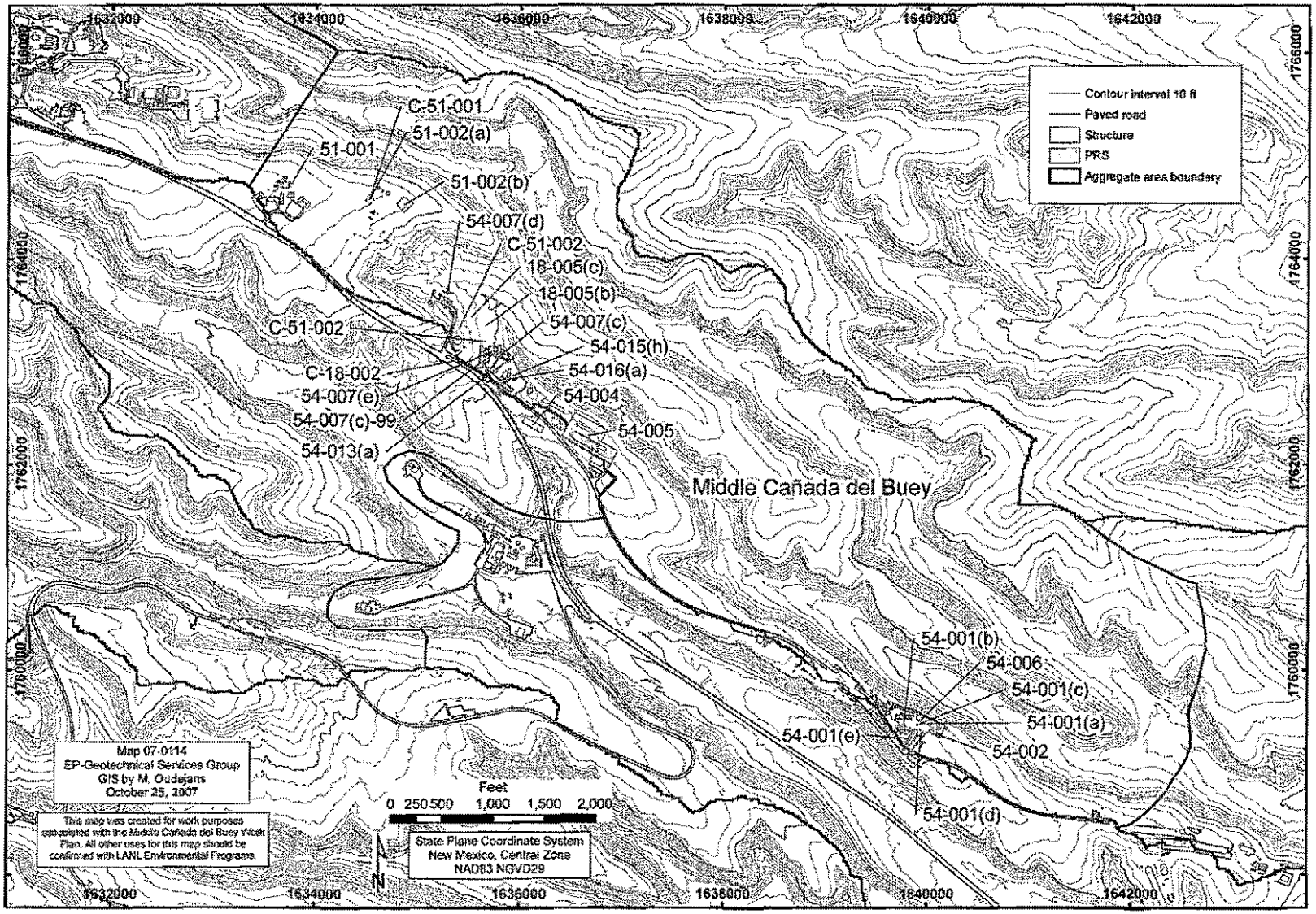

Figure 2: SWMUs and AOCs in Middle Canada Buey.

Attachment 1: MSDSs for TNT/RDX extraction pack and test kits

Material Safety Data Sheet

TNT Extraction Pac

MATERIAL IDENTIFICATION

Manufacturer/Distributor:	Strategic Diagnostics Inc. 111 Pencader Drive Newark, DE 19702	
Phone Number:	1-(302) 456-6789	
Trade Names and Synonyms:	TNT Extraction Pac (TK-1001S-1)	
NFPA Ratings	Health: Flammability: Reactivity:	2 3 1

OSHA HAZARD DETERMINATION

Hazardous Ingredients	CAS Number	Weight Percent
Acetone	67-64-1	≤ 100

PHYSICAL DATA

Plastic kit containing small amounts of various liquids and powders.

HAZARDOUS REACTIVITY

Instability — Stable - Reactivity not expected with the product.

FIRE AND EXPLOSION DATA

Fire and Explosion Hazards — Acetone has a flash point of - 4°F and an autoignition temperature of 33°F.

Extinguishing Media — Use media appropriate for surrounding material.

Special Fire Fighting Instructions — Firefighters should wear appropriate protective gear and a self – contained breathing apparatus.

HEALTH HAZARD INFORMATION

Primary Route(s) of Exposure/Entry: Skin, Eyes and Inhalation. Wash thoroughly after handling and if victim exposed to vapors or mists, remove to fresh air.

Signs and Symptoms of Exposure/Medical Conditions Aggravated by Exposure:
Eye contact with acetone may cause irritation characterized by redness, burning sensation, tearing, inflammation, and possible corneal injury. Skin contact with acetone may cause irritation, dryness, redness, and inflammation. Ingestion of acetone may cause digestive tract irritation, central nervous system depression, kidney damage and liver damage. Symptoms may include : headache, nausea, excitement, fatigue, vomiting, stupor, and coma. Inhalation may cause liver and kidney damage, motor incoordination and speech abnormalities.

Carcinogenicity: None of the components in this material is listed by IARC, NTP, OSHA, or ACGIH as a

carcinogen.

Applicable Exposure Limits

Acetone

OSHA / PEL: TWA 1000 ppm
2400 mg/m3

ACGIH /TLV: STEL 1000 ppm
2380 mg/m3

FIRST AID

Inhalation Remove victim to fresh air. If victim is not breathing, give artificial respiration. Consult a physician immediately.

Skin Contact Flush skin with plenty of water for at least 15 minutes. Get medical attention if irritation persists.

Eye Contact In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Call a physician immediately.

Ingestion The compound is toxic by ingestion. If victim is conscious, give 2 to 4 cups of water or milk. Call a physician immediately.

PROTECTION INFORMATION

General Control Measures and Precautions: Ventilation - Natural ventilation.

Personal Protective Equipment: Respiratory Protection: None required.

Protective Gloves: Gloves are required to limit skin exposure.

Eye Protection: Safety glasses with side shields are required.

Other Protective Equipment: A lab coat or other long sleeved garment is required. Access to a safety shower and eyewash station is required.

SPILL, LEAK AND DISPOSAL INFORMATION

Spill, Leak, or Release Review FIRE AND EXPLOSION HAZARDS and SAFETY PRECAUTIONS before proceeding with clean up.

Use appropriate PERSONAL PROTECTIVE EQUIPMENT during clean up.

No special clean up practices are required.

Waste Disposal Dispose of as solid waste in accordance with any applicable federal, state, and local requirements.

SHIPPING INFORMATION

DOT	Proper Shipping Name	Not DOT regulated.
IATA/IMO	Proper Shipping Name	Not restricted.

TITLE III HAZARD CLASSIFICATION

Acute	No
Chronic	No

Fire	No
Reactivity	No
Pressure	No

REGULATORY INFORMATION

OSHA HAZARD DETERMINATION: This material is not known to be hazardous as defined by OSHA's Hazard Communication Standard, 29 CFR 1910.1200

EPA DETERMINATIONS:
COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION, & LIABILITY ACT (CERCLA/SUPERFUND), 40 CFR 302 - This material is not known to contain hazardous substances in sufficient quantity to make it subject to CERCLA regulations.

TOXIC SUBSTANCES CONTROL ACT (TSCA), 40 CFR 710
The material is a mixture as defined by TSCA. The chemical ingredients in this material are in the Section 8(b) Chemical Substance Inventory and/or are otherwise in compliance with TSCA. In the case of ingredients obtained from other manufacturers, Strategic Diagnostics, Inc. relies on the assurance of responsible third parties in providing this statement.

RESOURCE CONSERVATION AND RECOVERY ACT (RCRA), 40 CFR 261, SUBPARTS C AND D
The material, when discarded or disposed of, is not specifically listed as a hazardous waste in Federal regulations; however, it could be considered hazardous if it meets criteria for being toxic, corrosive, ignitable or reactive according to U.S. EPA definitions (40 CFR 261). This material could also become a hazardous waste if it is mixed with or comes in contact with a listed hazardous waste. If it is a hazardous waste, regulations 40 CFR 262-266 and 268 may apply.

HAZARDOUS MATERIALS TRANSPORTATION REGULATIONS, 49 CFR 171-178 - This material is not known to contain hazardous substances in sufficient quantity to make it subject to the Regulations.

FOREIGN REGULATIONS: CANADIAN HAZARDOUS PRODUCTS ACT (WHMIS)
The material is not a WHMIS Controlled Product.

STATE REGULATIONS:
CALIFORNIA SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT OF 1986 ("PROPOSITION 65")
The material is not known to contain any ingredients (s) subject to the Act.

PENNSYLVANIA WORKER AND COMMUNITY RIGHT TO KNOW ACT
This material is not known to contain any ingredient(s) subject to the Act. Non-hazardous ingredient(s) information is withheld as trade secret in accordance with Section 11 of the Pennsylvania Worker and Community Right to Know Act.

The above data are based on tests, experience, and other information which Strategic Diagnostics Inc. believes reliable and are supplied for informational purposes only. However, some ingredients may have been purchased or obtained from third-party manufacturers. In these instances, Strategic Diagnostics, Inc., in good faith, relies on information provided by those third parties. Since conditions of use are outside our control, STRATEGIC DIAGNOSTICS INC. DISCLAIMS ANY LIABLITITY FOR DAMAGE OR INJURY WHICH RESULTS FROM USE OF THE ABOVE DATA. NOTHING CONTAINED HEREIN SHALL CONSTITUTE A GUARANTEE, WARRANTY (INCLUDING WARRANTY OF MERCHANTABILITY) OR REPRESENTATION (INCLUDING FREEDOM FROM PATENT LIABILITY) BY STRATEGIC DIAGNOSTICS, INC. WITH RESPECT TO THE DATA, THE MATERIAL DESCRIBED, OR ITS USE FOR ANY SPECIFIC PURPOSE, EVEN IF THAT PURPOSE IS KNOWN TO STRATEGIC DIAGNOSTICS INC.

Responsibility for MSDS: Strategic Diagnostics Inc.

111 Pencader Drive
Newark, DE 19702
(302) 456-6789

* End of MSDS *

Material Safety Data Sheet

RDX Test Kit

MATERIAL IDENTIFICATION

Manufacturer/Distributor:	Strategic Diagnostics Inc. 111 Pencader Drive Newark, DE 19702	
Phone Number:	1-(302) 456-6789	
Trade Names and Synonyms:	RDX Test Kit (TK-1004-1)	
NFPA Ratings	Health:	1
	Flammability:	0
	Reactivity:	0

OSHA HAZARD DETERMINATION

Hazardous Ingredients	CAS Number	Weight Percent
Sodium Azide	26628-22-8	≤ 0.1

PHYSICAL DATA

Plastic kit containing small amounts of various liquids and powders.

HAZARDOUS REACTIVITY

Instability — Stable - Reactivity not expected with the product.

FIRE AND EXPLOSION DATA

Fire and Explosion Hazards	Not a fire and explosion hazard.
Extinguishing Media	Use media appropriate for surrounding material.
Special Fire Fighting Instructions	Fire and explosion not expected to be a problem with the product. Wear appropriate protective clothing and self-contained breathing apparatus.

HEALTH HAZARD INFORMATION

Primary Route(s) of Exposure/Entry: Skin, Eyes and Mouth. Wash thoroughly after handling. The compound may cause irritation of skin, eyes and mucous membranes. Flush skin and eyes with large amounts of water for at least 15 minutes. If inhaled or ingested, seek medical attention.

Signs and Symptoms of Exposure/Medical Conditions Aggravated by Exposure:
Overexposure to sodium azide can cause skin or eye irritation; other effects may include headache, fall in blood pressure, sweating, weakness, faintness, blurred vision, shortness of breath, flushing of skin, confusion, nausea, decreased blood pressure, fluid buildup in lungs, bronchitis, stuffiness, dizziness or collapse, unconsciousness, heart palpitation, and death from respiratory failure.

Sodium azide produced tumors when given orally to rats; however, the statistical significance was influenced by an abnormally low incidence of tumors in control animals, so sodium azide is not felt to pose a significant carcinogenic hazard.
Carcinogenicity: None of the components in this material is listed by IARC, NTP, OSHA, or ACGIH as a

carcinogen.

Applicable Exposure Limits

Sodium Azide

TLV (ACGIH)	0.11 ppm, 0.3 mg/m3 (Ceiling)
PEL (OSHA)	0.1 ppm, skin, as HN3 (Ceiling); 0.3 mg/m3, skin, as NaN3 (Ceiling)

FIRST AID

Inhalation Intervention is necessary as the compound is likely to be hazardous by inhalation. Material should be handled or transferred in an approved fume hood or with adequate ventilation. Consult a physician if necessary.

Skin Contact The compound is not likely to be hazardous by skin contact, but may cause irritation. If irritation should occur, flush skin with large amounts of water immediately.

Eye Contact In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Call a physician.

Ingestion The compound is toxic by ingestion. If victim is conscious, give water freely. Call a physician.

PROTECTION INFORMATION

General Control Measures and Precautions: Ventilation - Natural ventilation.

Personal Protective Equipment:

Respiratory Protection: None required.

Protective Gloves: Are highly recommended.

Eye Protection: Safety glasses are required.

Other Protective Equipment: Lab coat or other long –sleeved garment required. Access to a safety shower and eyewash required.

SPILL, LEAK AND DISPOSAL INFORMATION

Spill, Leak, or Release Review FIRE AND EXPLOSION HAZARDS and SAFETY PRECAUTIONS before proceeding with clean up.

Use appropriate PERSONAL PROTECTIVE EQUIPMENT during clean up. Contain spill and collect in a suitable waste container.

No special clean up practices are required.

Waste Disposal Dispose of as solid waste in accordance with any applicable federal, state, and local requirements.

SHIPPING INFORMATION

DOT	Proper Shipping Name	Not DOT regulated.
IATA/IMO	Proper Shipping Name	Not restricted.

TITLE III HAZARD CLASSIFICATION

Acute No

Chronic	No
Fire	No
Reactivity	No
Pressure	No

REGULATORY INFORMATION

OSHA HAZARD DETERMINATION: This material is not known to be hazardous as defined by OSHA's Hazard Communication Standard, 29 CFR 1910.1200

EPA DETERMINATIONS:
COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION, & LIABILITY ACT (CERCLA/SUPERFUND), 40 CFR 302 - This material is not known to contain hazardous substances in sufficient quantity to make it subject to CERCLA regulations.

TOXIC SUBSTANCES CONTROL ACT (TSCA), 40 CFR 710
The material is a mixture as defined by TSCA. The chemical ingredients in this material are in the Section 8(b) Chemical Substance Inventory and/or are otherwise in compliance with TSCA. In the case of ingredients obtained from other manufacturers, Strategic Diagnostics, Inc. relies on the assurance of responsible third parties in providing this statement.

RESOURCE CONSERVATION AND RECOVERY ACT (RCRA), 40 CFR 261, SUBPARTS C AND D
The material, when discarded or disposed of, is not specifically listed as a hazardous waste in Federal regulations; however, it could be considered hazardous if it meets criteria for being toxic, corrosive, ignitable or reactive according to U.S. EPA definitions (40 CFR 261). This material could also become a hazardous waste if it is mixed with or comes in contact with a listed hazardous waste. If it is a hazardous waste, regulations 40 CFR 262-266 and 268 may apply.

HAZARDOUS MATERIALS TRANSPORTATION REGULATIONS, 49 CFR 171-178 - This material is not known to contain hazardous substances in sufficient quantity to make it subject to the Regulations.

FOREIGN REGULATIONS: CANADIAN HAZARDOUS PRODUCTS ACT (WHMIS)
The material is not a WHMIS Controlled Product.

STATE REGULATIONS:
CALIFORNIA SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT OF 1986 ("PROPOSITION 65")
The material is not known to contain any ingredients (s) subject to the Act.

PENNSYLVANIA WORKER AND COMMUNITY RIGHT TO KNOW ACT
This material is not known to contain any ingredient(s) subject to the Act. Non-hazardous ingredient(s) information is withheld as trade secret in accordance with Section 11 of the Pennsylvania Worker and Community Right to Know Act.

The above data are based on tests, experience, and other information which Strategic Diagnostics Inc. believes reliable and are supplied for informational purposes only. However, some ingredients may have been purchased or obtained from third-party manufacturers. In these instances, Strategic Diagnostics, Inc., in good faith, relies on information provided by those third parties. Since conditions of use are outside our control, STRATEGIC DIAGNOSTICS INC. DISCLAIMS ANY LIABLITITY FOR DAMAGE OR INJURY WHICH RESULTS FROM USE OF THE ABOVE DATA. NOTHING CONTAINED HEREIN SHALL CONSTITUTE A GUARANTEE, WARRANTY (INCLUDING WARRANTY OF MERCHANTABILITY) OR REPRESENTATION (INCLUDING FREEDOM FROM PATENT LIABILITY) BY STRATEGIC DIAGNOSTICS, INC. WITH RESPECT TO THE DATA, THE MATERIAL DESCRIBED, OR ITS USE FOR ANY SPECIFIC PURPOSE, EVEN IF THAT PURPOSE IS KNOWN TO STRATEGIC DIAGNOSTICS INC.

Responsibility for MSDS:

Strategic Diagnostics Inc.
111 Pencader Drive
Newark, DE 19702
(302) 456-6789

* End of MSDS *

Material Safety Data Sheet

TNT Test Kit

MATERIAL IDENTIFICATION

Manufacturer/Distributor:	Strategic Diagnostics Inc. 111 Pencader Drive Newark, DE 19702	
Phone Number:	1-(302) 456-6789	
Trade Names and Synonyms:	TNT Test Kit (TK-1005-1)	
NFPA Ratings	Health:	1
	Flammability:	0
	Reactivity:	0

OSHA HAZARD DETERMINATION

Hazardous Ingredients	CAS Number	Weight Percent
Sodium Azide	26628-22-8	≤ 0.1 %

PHYSICAL DATA

Plastic kit containing small amounts of various liquids and powders.

HAZARDOUS REACTIVITY

Instability Stable - Reactivity not expected with the product.

FIRE AND EXPLOSION DATA

Fire and Explosion Hazards Not a fire and explosion hazard.

Extinguishing Media Use media appropriate for surrounding material.

Special Fire Fighting Instructions Fire and explosion not expected to be a problem with the product.

HEALTH HAZARD INFORMATION

Primary Route(s) of Exposure/Entry: Skin, Eyes. Wash thoroughly after handling

Signs and Symptoms of Exposure/Medical Conditions Aggravated by Exposure:
Overexposure to sodium azide can cause skin or eye irritation; other effects may include headache, fall in blood pressure, sweating, weakness, faintness, blurred vision, shortness of breath, flushing of skin, confusion, nausea, decreased blood pressure, fluid buildup in lungs, bronchitis, stuffiness, dizziness or collapse, unconsciousness, heart palpitation, and death from respiratory failure.

Sodium azide produced tumors when given orally to rats; however, the statistical significance was influenced by an abnormally low incidence of tumors in control animals, so sodium azide is not felt to pose a significant carcinogenic hazard.

Carcinogenicity: None of the components in this material is listed by IARC, NTP, OSHA, or ACGIH as a carcinogen.

Applicable Exposure Limits

Sodium Azide

TLV (ACGIH)	0.11 ppm, 0.3 mg/m3 (Ceiling)
PEL (OSHA)	0.1 ppm, skin, as HN3 (Ceiling); 0.3 mg/m3, skin, as NaN3 (Ceiling)

FIRST AID

Inhalation No specific intervention is indicated as the compound is not likely to be hazardous by inhalation. Consult a physician if necessary.

Skin Contact The compound is not likely to be hazardous by skin contact, but cleansing the skin after use is advisable.

Eye Contact In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Call a physician.

Ingestion The compound is toxic by ingestion. Call a physician.

PROTECTION INFORMATION

General Control Measures and Precautions: Ventilation - Natural ventilation.

Personal Protective Equipment: Respiratory Protection: Material should be handled or transferred in an approved fume hood or with adequate ventilation.

Protective Gloves: Are highly recommended.

Eye Protection: Safety glasses are required.

Other Protective Equipment: Eye wash and safety equipment should be readily available. Lab coat or other long – sleeved garment is required.

SPILL, LEAK AND DISPOSAL INFORMATION

Spill, Leak, or Release Review FIRE AND EXPLOSION HAZARDS and SAFETY PRECAUTIONS before proceeding with clean up.

Use appropriate PERSONAL PROTECTIVE EQUIPMENT during clean up. Eliminate any ignition sources until the area is determined to be free from explosion or fire hazard. Contain and collect spill in suitable waste container.

No special clean up practices are required.

Waste Disposal Dispose of as solid waste in accordance with any applicable federal, state, and local requirements.

SHIPPING INFORMATION

DOT	Proper Shipping Name	Not DOT regulated.
IATA/IMO	Proper Shipping Name	Not restricted.

TITLE III HAZARD CLASSIFICATION

Acute No

Chronic	No
Fire	No
Reactivity	No
Pressure	No

REGULATORY INFORMATION

OSHA HAZARD DETERMINATION: This material is not known to be hazardous as defined by OSHA's Hazard Communication Standard, 29 CFR 1910.1200

EPA DETERMINATIONS:
COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION, & LIABILITY ACT (CERCLA/SUPERFUND), 40 CFR 302 - This material is not known to contain hazardous substances in sufficient quantity to make it subject to CERCLA regulations.

TOXIC SUBSTANCES CONTROL ACT (TSCA), 40 CFR 710
The material is a mixture as defined by TSCA. The chemical ingredients in this material are in the Section 8(b) Chemical Substance Inventory and/or are otherwise in compliance with TSCA. In the case of ingredients obtained from other manufacturers, Strategic Diagnostics, Inc. relies on the assurance of responsible third parties in providing this statement.

RESOURCE CONSERVATION AND RECOVERY ACT (RCRA), 40 CFR 261, SUBPARTS C AND D
The material, when discarded or disposed of, is not specifically listed as a hazardous waste in Federal regulations; however, it could be considered hazardous if it meets criteria for being toxic, corrosive, ignitable or reactive according to U.S. EPA definitions (40 CFR 261). This material could also become a hazardous waste if it is mixed with or comes in contact with a listed hazardous waste. If it is a hazardous waste, regulations 40 CFR 262-266 and 268 may apply.

HAZARDOUS MATERIALS TRANSPORTATION REGULATIONS, 49 CFR 171-178 - This material is not known to contain hazardous substances in sufficient quantity to make it subject to the Regulations.

FOREIGN REGULATIONS: CANADIAN HAZARDOUS PRODUCTS ACT (WHMIS)
The material is not a WHMIS Controlled Product.

STATE REGULATIONS:
CALIFORNIA SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT OF 1986 ("PROPOSITION 65")
The material is not known to contain any ingredients (s) subject to the Act.

PENNSYLVANIA WORKER AND COMMUNITY RIGHT TO KNOW ACT
This material is not known to contain any ingredient(s) subject to the Act. Non-hazardous ingredient(s) information is withheld as trade secret in accordance with Section 11 of the Pennsylvania Worker and Community Right to Know Act.

The above data are based on tests, experience, and other information which Strategic Diagnostics Inc. believes reliable and are supplied for informational purposes only. However, some ingredients may have been purchased or obtained from third-party manufacturers. In these instances, Strategic Diagnostics, Inc., in good faith, relies on information provided by those third parties. Since conditions of use are outside our control, STRATEGIC DIAGNOSTICS INC. DISCLAIMS ANY LIABLITITY FOR DAMAGE OR INJURY WHICH RESULTS FROM USE OF THE ABOVE DATA. NOTHING CONTAINED HEREIN SHALL CONSTITUTE A GUARANTEE, WARRANTY (INCLUDING WARRANTY OF MERCHANTABILITY) OR REPRESENTATION (INCLUDING FREEDOM FROM PATENT LIABILITY) BY STRATEGIC DIAGNOSTICS, INC. WITH RESPECT TO THE DATA, THE MATERIAL DESCRIBED, OR ITS USE FOR ANY SPECIFIC PURPOSE, EVEN IF THAT PURPOSE IS KNOWN TO STRATEGIC DIAGNOSTICS INC.

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* End of MSDS *

Appendix H

Risk Assessments

CONTENTS

Figure

Tables

H-1.0 INTRODUCTION

This appendix presents the results of the human health and ecological risk screening evaluations conducted by Los Alamos National Laboratory (the Laboratory) in support of environmental characterization of the Middle Cañada del Buey Aggregate Area. The aggregate area consists of 23 sites in 2 technical areas. Four sites were investigated in accordance with the work plan and the New Mexico Environment Department (NMED) direction; Areas of Concern (AOCs) 51-001, 54-007(d), 18-005(b), and 18-005(c) (Figure 1.0-2 of the investigation report). Summary descriptions of the AOCs are included in section 2 of the investigation report.

H-2.0 BACKGROUND

This section presents background information related to the four AOCs in the Middle Cañada del Buey Aggregate Area presented in this investigation report. This information includes the operational histories and summaries of the results of previous investigations.

H-2.1 Site Description and Operational History

The Middle Cañada del Buey Aggregate Area is located in the central portion of Cañada del Buey and Mesita del Buey and incorporates parts of Technical Area 51 (TA-51) and TA-54. The aggregate area consists of the canyon bottom and the portion of the mesa top and canyon slope that drains to the north into the canyon. All sites within the Middle Cañada del Buey Aggregate Area are located on the mesa top. Mesita del Buey is a finger-shaped mesa between Pajarito Canyon and Cañada del Buey that trends southeast. The southern boundary of the aggregate area along Mesita del Buey is approximated by Pajarito Road from the west boundary of the aggregate area to the intersection of Pajarito Road and Mesita del Buey Road east of this intersection.

Four sites were investigated as part of the Middle Cañada del Buey Aggregate Area in accordance with the work plan and NMED direction. The four sites investigated are located in portions of TA-51 and TA-54 West.

H-2.1.1 TA-51

The first operations in the current TA-51 began in 1980 with construction of the Experimental Engineering Test Facility (EETF). This facility was constructed to support research to develop effective isolation techniques for burial of waste in semiarid climates. Experimental facilities include buried caissons used to conduct flow and transport studies. Support offices were constructed on site in 1986. TA-51 is currently used for research and experimental studies on the long-term impacts of radioactive materials on the environment, including the effectiveness of waste isolation barriers (LANL 1992, 007669, pp. 2-1–2-4).

AOC 51-001 was an inactive/abandoned septic system that served the EETF (buildings 51-0011 and 51-0012) and the transportable office buildings 51-0025, 51-0026, and 51-0027. The septic system consisted of a 1000-gal. concrete septic tank (structure 51-0030), drainlines, and a 4-ft-wide by 50-ft-deep seepage pit (structure 51-0031).

H-2.1.2 TA-54 West

The western part of TA-54 on Mesita del Buey that is associated with the Middle Cañada del Buey Aggregate Area houses the former radiation exposure facility that was used to conduct biomedical

research on animal exposure to radiation. This facility was operated from 1962 to the mid-1970s. Before it was designated TA-54, a portion of TA-54 West was included in TA-18. The first structures located at this site were constructed in 1944 and 1945 and consisted of two explosives magazines [AOCs 18-005(b) and 18-005(c)], an assembly building, a carpenter shop, and a lumber storage building. These structures were associated with explosives testing performed at TA-18 and TA-27 in the mid-1940s. By the early 1960s, these structures had been removed or destroyed (LANL 1993, 015310, p. 2-4) and the site was incorporated as part of TA-54 (LANL 1993, 015310). The 1990 solid waste management unit report incorrectly lists the two former explosives magazines as being located within TA-51 (LANL 1990, 007512).

AOC 18-005(b) (structure 18-11) and AOC 18-005(c) (structure 18-12) were wood structures with dimensions of 11 ft by 9 ft by 8 ft tall. These structures were surrounded by earthen berms on three sides and on top. AOC 18-005(b) was located approximately 200 ft north of current structure 54-1014. AOC 18-005(c) was located approximately 200 ft north of a Laboratory water-supply storage tank (LANL 1990, 007512).

AOC 54-007(d) was an inactive/abandoned septic system that served the Radiation Exposure Facility located in buildings 54-1001, 54-1002, 54-1003, and 54-1004 at TA-54 West. The septic system consisted of a 1500-gal. concrete septic tank (structure 54-1016 [formerly structure 54-4]), drainlines, a distribution box, and a split drain field. A 4-in. drainline from the septic tank connected to a reinforced concrete distribution box, which diverted the effluent east and west into the drain field. The drain field consists of two 60-ft-long, 4-in.-diameter tile drainlines running east and west from the distribution box. The septic system was left in place in 1992 when the building it served was tied to a new sewer line installed as part of the Laboratory's sanitary wastewater system consolidation.

H-2.2 Summary of Historical Investigations

H-2.2.1 AOCs 18-005(b) and 18-005(c), Former Storage Areas

The AOCs have not been previously investigated.

H-2.2.2 AOC 51-001, Former Septic System

The septic tank contents and seepage pit were sampled during the 1995 Phase I Resource Conservation and Recovery Act facility investigation (RFI) (LANL 1992, 007669). Antimony, cyanide, mercury, selenium, and silver were retained as COPCs because their detection limits were greater than BVs. No organic chemicals were detected. Waste characterization data for samples collected of the septic tank contents in 2000 showed low concentrations of inorganic chemicals, isotopes of uranium and plutonium, tritium, nitrate, and three organic chemicals (LANL 2001, 071473).

In 2001, a voluntary corrective action (VCA) was conducted to remove the septic tank and its contents as well as to plug the drainlines. Confirmation samples were collected from six locations within the septic tank excavation, beneath the inlet drainline connection, and next to the seepage pit. In accordance with the approved VCA plan, confirmation samples were not analyzed for inorganic chemicals because they were not detected above BVs in the 1995 RFI samples (LANL 2000, 070658). Organic chemicals detected in these samples are included bromomethane, 2-butanone, and trichlorofluoromethane. No semivolatile organic compounds (SVOCs), pesticides, or polychlorinated biphenyls (PCBs) were detected. Cesium-137 was detected in one fill sample at 0.0761 pCi/g, which is below the soil fallout value of 1.65 pCi/g.

H-2.2.3 AOC 54-007(d), Former Septic System

The septic system was investigated during the 1995 Phase I RFI. Concentrations of Aroclor-1254 (0.25 mg/kg), DDE ([dichlorophenyltrichloroethylene] 0.0053 mg/kg), and DDT ([dichlorodiphenyltrichloroethane] 0.0046 mg/kg) were detected in a single near-surface soil sample collected at the eastern edge of the drain field. Analytical data from the 1995 RFI presented in the 2001 VCA completion report (LANL 2001, 071473) was reevaluated and determined to be screening-level data. As part of the RFI, the contents of the septic tank were sampled and analyzed. Waste characterization data for samples collected from the septic tank contents in 2000 showed low concentrations of inorganic chemicals, organic chemicals, nitrate, and isotopes of uranium; however, pesticides/PCBs were not detected (LANL 2001, 071473).

A VCA was conducted in 2001 to remove the septic tank and its contents as well as to plug the drainlines. Detected organic chemicals included benzene, bis(2-ethylhexyl)phthalate; bromomethane; 2-butanone; isopropylbenzene; 4-isopropyltoluene; 4-methyl-2-pentanone; toluene; trichlorofluoromethane; and 1,2,4-trimethylbenzene. None of these organic chemicals were detected in the contents of the septic tank (LANL 2001, 071473).

H-2.3 Investigation Sampling

The data used to identify chemicals of potential concern (COPCs) and to evaluate potential risks to human health and the environment consist of all qualified analytical results compiled from both historical sampling activities and the 2008 investigation. Only data determined to be of sufficient quality, following the data-quality assessment (Appendix E), is included in the data sets evaluated in Appendix B and in this risk appendix.

H-2.4 COPC Determination

The analytical data review and COPC determination are summarized in Appendix B. Table B-3.4-1 presents the COPCs identified at each site investigated.

Tables H-2.4-1 to H-2.4-7 summarize the COPCs evaluated for human health and ecological risk at each site. Only COPCs identified in Appendix B that were detected above background (inorganic chemicals and radionuclides), had detection limits above background (inorganic chemicals), or were detected (inorganic and organic chemicals and radionuclides) were retained.

The list of COPCs at each site was modified from the list in Appendix B based upon the receptors evaluated and the depth interval associated with the potential exposures. The industrial scenario and the ecological evaluation typically utilize data for samples collected from 0–1 ft bgs and 0–5 ft below ground surface (bgs), respectively. The construction worker and residential scenarios typically use data for samples collected from 0–10 ft bgs. However, sampling depths may overlap the lower bounds; therefore, all samples with a starting depth above the lower bound of the interval for each scenario were included in the risk assessments. Some of the COPCs identified in Appendix B may not be evaluated for potential risk under one or more scenarios because they were only reported as above background (inorganic chemicals and radionuclides) or detected (inorganic and organic chemicals and radionuclides) below the depth interval associated with a given scenario.

H-3.0 CONCEPTUAL SITE MODEL

The primary mechanisms of contaminant release for the sites are related to the historical operations and releases. Surface soil and/or subsurface soil and tuff are the only media containing residual contamination. Weathering of tuff is the only viable natural process that may result in the exposure of receptors to COPCs in tuff; because of the slow rate of weathering expected for tuff, exposure to COPCs in tuff is negligible, although it is included in the risk screening assessments.

The limited saturated conditions in the area restrict the horizontal and vertical migration of contaminants. No perched groundwater has been identified in the areas associated with the sites. A complete pathway to groundwater, including the regional aquifer, which is located more than 1000 ft bgs, does not exist. No permanent surface water exists at any of the sites. Occasional surface water runoff occurs as a result of brief but often intense seasonal thunderstorms. Runoff may also be generated as a result of snow melt. Surface runoff is most likely to occur as sheet.

H-3.1 Receptors and Pathways

The conceptual site model for contaminant exposure to human receptors is shown in Figure H-3.1-1. The areas for each site are entirely industrial and the industrial scenario is the current and reasonably foreseeable future land use. However, the industrial scenario was evaluated only for AOCs 18-005(b) and 18-005(c) because these sites have a surface exposure (0–1 ft bgs), while AOCs 51-001 and 54-007(d) have only a subsurface exposure. Therefore, all four sites were evaluated using the construction worker scenario. The residential scenario was also evaluated for each site as required by the March 1, 2005, Compliance Order on Consent (the Consent Order). Primary exposure media for human receptors include surface soil or subsurface soil/tuff. The potential pathways for human exposure to surface soil are dermal contact, inhalation of vapors or fugitive dust, incidental soil ingestion, and external irradiation. Pathways from subsurface contamination to potential human receptors are complete only if contaminated soil or tuff were excavated and brought to the surface. The potential pathways are similar to those from surface soil (i.e., dermal contact, inhalation of vapors or fugitive dust, and incidental soil ingestion).

The conceptual site model for contaminant exposure for ecological receptors is also shown in Figure H-3.1-1 as well as in the ecological scoping checklists (Attachment H-1). A 0- to 5-ft-depth interval was used to assess risk to terrestrial ecological receptors. All soil and tuff samples from these depth intervals were included in the assessments. Exposure pathways to surface soil and subsurface soil and tuff that apply for ecological receptors include root uptake by plants, dermal contact, inhalation of vapors or dust, incidental ingestion of soil, and food web transport. Dietary exposures include soil ingestion and food-web transport and are the primary pathways for wildlife. Surface water is an unlikely exposure pathway for ecological receptors because of its ephemeral and transient occurrence.

H-3.2 Environmental Fate and Transport

The evaluation of environmental fate addresses the chemical processes affecting the persistence of a chemical in the environment; the evaluation of transport addresses the physical processes affecting mobility of a contaminant along a migration pathway. Migration through soil and tuff depends on properties such as soil pH, rate of precipitation or snowmelt, soil moisture content, soil/tuff hydraulic properties, and properties of the COPCs. Migration into and through tuff also depends on the unsaturated flow properties of the tuff and the presence of joints and fractures.

The most important factor with respect to the potential for COPCs to migrate to groundwater is the presence of saturated conditions. Downward migration in the vadose zone is also limited by a lack of

hydrostatic pressure as well as the lack of a source for the continued release of contamination. Without sufficient moisture and a source, little or no potential migration of materials through the vadose zone to groundwater occurs.

Contamination at depth is addressed in the discussion of nature and extent (Appendix B). Results from the deepest samples collected showed either no detected concentrations of COPCs or low or trace-level concentrations of only a few inorganic, radionuclide, and/or organic COPCs in tuff. The limited extent of contamination is related to the absence of the key factors that facilitate migration, as mentioned above. Given how long the contamination has been present in the subsurface, physical and chemicals properties of the COPCs, and the lack of saturated conditions, the potential for contaminant migration to groundwater is very low.

Guidance from NMED (2006, 092513) contains screening levels that consider the potential for contaminants in soil to result in groundwater contamination. These screening levels consider equilibrium partitioning of contaminants among solid, aqueous, and vapor phases and account for dilution and attenuation in groundwater through the use of dilution attenuation factors (DAFs). These DAF soil screening levels (SSLs) can be used to identify chemical concentrations in soil that have the potential to contaminate groundwater (EPA 1996, 059902). However, screening contaminant concentrations in soil against these DAF SSLs do not provide an indication of the potential for contaminants to migrate to groundwater. The assumptions used to develop these DAF SSLs include an assumption of uniform contaminant concentrations from the contaminant source to the water table (i.e., it is assumed that migration to groundwater has already occurred). Furthermore, this assumption is inappropriate for cases such as the Middle Cañada del Buey Aggregate Area where sampling has shown that contamination is vertically bounded and the distance from the surface to the water table is large. For these reasons, screening of contaminant concentrations in soil against the DAF SSLs was not performed.

The best indication of the potential for future contaminant migration to groundwater is the current vertical distribution of contaminants in the subsurface. Releases at the Middle Cañada del Buey Aggregate Area are historical (i.e., they occurred decades ago). The regional aquifer beneath the sites is greater than 1000 ft bgs. Therefore, for migration of contaminants to occur from shallow soil to the regional aquifer in a meaningful time frame (e.g., 100 to 1000 yr), significant vertical migration should have already occurred. Sampling has shown that this migration has not occurred, indicating a very low potential for future contaminant migration to groundwater.

The relevant release and transport processes of the COPCs are a function of chemical-specific properties that include the relationship between the physical form of the constituents and the nature of the constituent transport processes in the environment. Specific properties include the degree of saturation, the potential for ion exchange or sorption, and the potential for natural bioremediation. The transport of volatile organic compounds (VOCs) occurs primarily in the vapor phase by diffusion or advection in subsurface air. The chemical and physical properties of the Middle Cañada del Buey Aggregate Area COPCs are presented in Tables H-3.2-1, H-3.2-2, and H-3.2-3.

The primary release and transport mechanisms that may lead to the potential exposure of receptors in the Middle Cañada del Buey Aggregate Area include

- dissolution and/or particulate transport of surface contaminants from precipitation and runoff,
- airborne transport of contaminated surface soil or particulates,
- continued dissolution and advective/dispersive transport of chemical and radiological contaminants contained in subsurface soil and bedrock,

- biotic perturbation and/or translocation of contaminants in subsurface contaminated media, and
- uptake of contaminants from soil and water by biota.

Contaminant distributions at the sites indicate that after the initial deposition of contaminants from operational activities and historical remediation efforts, elevated levels of contaminants tend to remain concentrated in the vicinity of the original release points.

H-3.2.1 Inorganic Chemicals

In general, and particularly in a semiarid climate such as that found at the sites within the Middle Cañada del Buey Aggregate Area, inorganic chemicals are not highly soluble or mobile in the environment. The primary physical and chemical factors that determine and describe the distribution of inorganic COPCs within the soil and tuff are the water solubility of the inorganic chemical and the soil-water partition coefficient (K_d). Other factors besides the K_d values, such as speciation in soil and oxidation/reduction potential (Eh) potential and pH, also play a role in the likelihood that inorganic chemicals will migrate. The K_d values provide a general assessment of the potential for migration through the subsurface; chemicals with higher K_d values are less likely to be mobile than those with lower K_d values. Inorganic chemicals with K_d values greater than 40 are very unlikely to migrate through soil towards the water table (Kincaid et al. 1998, 093270). Table H-3.2-1 presents the K_d values for the inorganic COPCs identified at the Middle Cañada del Buey Aggregate Area sites. Based on this criterion, antimony, barium, cadmium, chromium, mercury, and zinc have a low potential to mobilize and migrate through soil and the vadose zone.

The K_d values for arsenic, nitrate, perchlorate, and selenium are less than 40 and may indicate that these inorganic chemicals have a greater potential to mobilize and migrate through soil and the vadose zone. These COPCs are discussed further below. Information about the fate and transport properties of inorganic chemicals was obtained from individual chemical profiles published by the Agency for Toxic Substances and Disease Registry (ATSDR) (ATSDR 1997, 056531). Information for these inorganic chemicals is also available from the ATSDR website at http://www.atsdr.cdc.gov/toxpro2.html.

- Arsenic may undergo a variety of reactions including oxidation-reduction reactions, ligand exchange, precipitation, and biotransformation. Arsenic forms insoluble complexes with iron, aluminum, and magnesium oxides commonly found in soil, and in this form, arsenic is relatively immobile. However, under low pH and reducing conditions, arsenic can become soluble and may potentially leach into groundwater or result in runoff of arsenic into surface waters. Arsenic is expected to have low mobility under the environmental conditions (average soil pH is 7.1 and 7.4 where arsenic is a COPC) present in the Middle Cañada del Buey Aggregate Area.
- Nitrate (and to a lesser degree perchlorate) is highly soluble in water and may migrate with water molecules in saturated soil. As noted above, the subsurface material beneath the Middle Cañada del Buey Aggregate Area sites has low moisture content, which would inhibit the mobility of nitrate and perchlorate as well as most other inorganic chemicals. In addition, the extent for these inorganic chemicals is defined.
- Selenium is not often found in the environment in its elemental form but is usually combined with sulfide minerals or with silver, copper, lead, and nickel minerals. In soil, pH and Eh are determining factors in the transport and partitioning of selenium. In soil with a pH of greater than 7.5, selenates, which have high solubility and a low tendency to adsorb onto soil particles, are the major selenium species and are very mobile. The average soil pH is 7.9 and selenium was not detected at the site where it is a COPC, which indicates selenium is not likely to migrate in this soil.

H-3.2.2 Organic Chemicals

Table H-3.2-2 presents the physical and chemical properties (organic carbon-water partition coefficient [K_{oc}], logarithm to the base 10 octanol/water partition coefficient [log K_{ow}], and solubility) of the organic COPCs identified. Physical and chemical properties of organic chemicals are important when evaluating their fate and transport. The following physical- and chemical- property information illustrates some aspects of the fate and transport tendencies of the Middle Cañada del Buey Aggregate Area COPCs. The information is summarized from Ney (1995, 058210).

Water solubility may be the most important chemical characteristic used to assess the mobility of organic chemicals. The higher the water solubility of a chemical, the more likely it is to be mobile and the less likely it is to accumulate, bioaccumulate, volatilize, or persist in the environment. A highly soluble chemical (water solubility greater than 1000 mg/L) is prone to biodegradation and metabolism that may detoxify the parent chemical. Bromomethane, butanone[2-], methyl-2-pentanone[4-], and methylene chloride have water solubilities greater than 1000 mg/L, while trichlorofluoromethane has water solubility of approximately 1000 mg/L.

The lower the water solubility of a chemical, especially below 10 mg/L, the more likely it will be immobilized by adsorption. Chemicals with lower water solubilities are more likely to accumulate or bioaccumulate and persist in the environment, to be slightly prone to biodegradation, and to be metabolized in plants and animals. The COPCs identified as having water solubilities less than 10 mg/L are Aroclor-1242, Aroclor-1254, Aroclor-1260, and bis[2-ethylhexyl]phthalate, while isopropylbenzene, isopropyltoluene[4-], and toluene have water solubilities greater than 10 mg/L but less than 1000 mg/L.

Vapor pressure is a chemical characteristic used to evaluate the tendency of organic chemicals to volatize. Chemicals with vapor pressure greater than 0.01 millimeters of mercury (mm Hg) are likely to volatilize, and therefore, concentrations at the site are reduced over time; vapors of these chemicals are more likely to travel toward the atmosphere and not migrate toward groundwater. Bromomethane, butanone[2-], isopropylbenzene, isopropyltoluene[4-], methyl-2-pentanone[4-], methylene chloride, trichlorofluoromethane, and trimethylbenzene[1,2,4-] have vapor pressures greater than 0.01 mm Hg.

Chemicals with vapor pressures less than 0.000001 mm Hg are less likely to volatilize and, therefore, tend to remain immobile. Aroclor-1254 and bis[2-ethylhexyl]phthalate have vapor pressures less than 0.000001 mm Hg, while Aroclor-1242 and Aroclor-1260 have vapor pressures slightly greater than 0.000001 mm Hg but less than 0.00001 mm Hg.

The K_{ow} is an indicator of a chemical's potential to bioaccumulate or bioconcentrate in the fatty tissues of living organisms. The unitless K_{ow} value is an indicator of water solubility, mobility, sorption, and bioaccumulation. The higher the K_{ow} is above 1000, the greater the affinity the chemical has for bioaccumulation in the food chain, the greater its potential for sorption in the soil, and the lower its mobility (Ney 1995, 058210). The COPCs with a K_{ow} greater than 1000 include Aroclor-1242, Aroclor-1254, Aroclor-1260, bis[2 ethylhexyl]phthalate, isopropylbenzene, isopropyltoluene[4-], and trimethylbenzene[1,2,4-]. A K_{ow} of less than 500 indicates high water solubility, high mobility, little to no affinity for bioaccumulation, and degradability by microbes, plants, and animals. Bromomethane, butanone[2-], methyl-2-pentanone[4-], methylene chloride, toluene, and trichlorofluoromethane have a K_{ow} less than 500.

The K_{oc} measures the tendency of a chemical to adsorb to organic carbon in soil. K_{oc} values above 500 L/kg indicate a strong tendency to adsorb to soil, leading to low mobility (NMED 2006, 092513). Aroclor-1242, Aroclor-1254, Aroclor-1260, bis[2-ethylhexyl]phthalate, isopropylbenzene, isopropyltoluene[4-], and trimethylbenzene[1,2,4-] have K_{oc} values above 500 L/kg, indicating a very low

potential to migrate toward groundwater. The COPCs with K_{oc} values less than 500 L/kg are bromomethane, butanone[2-], methyl-2-pentanone[4-], methylene chloride, toluene, and trichlorofluoromethane.

Aroclor-1242, Aroclor-1254, Aroclor-1260, bis[2-ethylhexyl]phthalate, and trimethylbenzene[1,2,4-] are the least mobile and the most likely to bioaccumulate. The more soluble and volatile COPCs include bromomethane, butanone[2-], methyl-2-pentanone[4-], methylene chloride, toluene, and trichlorofluoromethane are more mobile but are also more likely to travel toward the atmosphere and not migrate toward groundwater. Because the organic COPCs were detected at low concentrations and the extent is defined, they are not likely to migrate to groundwater.

H-3.2.3 Radionuclides

Radionuclides are generally not highly soluble or mobile in the environment, particularly in the semiarid climate of the Laboratory. The physical and chemical factors that determine the distribution of radionuclides within soil and tuff are the K_d, the pH of the soil and other soil characteristics (e.g., sand or clay content), and the Eh. The interaction of these factors is complex, but K_d values provide a general assessment of the potential for migration through the subsurface: chemicals with higher K_d values are less likely to be mobile than those with lower values. Radionuclides with K_d values greater than 40 are very unlikely to migrate through soil towards the water table (Kincaid et al. 1998, 093270).

Table H-3.2-3 presents the physical and chemical properties of the radionuclide COPCs identified at the Middle Cañada del Buey Aggregate Area sites. Based on K_d values, cesium-137 has a very low potential to migrate towards groundwater. The K_d values for uranium-235 and tritium are less than 40 and indicate a potential to migrate towards groundwater.

- Uranium-235 is the only uranium isotope retained as a COPC at the Middle Cañada del Buey Aggregate Area sites. Uranium-235 was detected slightly above the background value (BV) (0.098 pCi/g compared to the BV of 0.09 pCi/g), and the extent is defined. Uranium-235 is present at naturally occurring levels at depth and is not migrating to groundwater.
- Tritium's initial behavior in the environment is determined by the source. If it is released as a gas or vapor to the atmosphere, substantial dispersion can be expected, and the rapidity of deposition is dependent on climatic factors. If tritium is released in liquid form, it is diluted in water and is subject to physical dispersion, percolation, and evaporation (Whicker and Schultz 1982, 058209, p. 147). Tritium concentrations are very low (<0.01 pCi/g), indicating that the area is not a significant source of tritium, although this radionuclide is relatively mobile. Because tritium migrates in association with moisture, the low moisture content of the subsurface limits the potential for tritium to migrate to groundwater.

H-3.3 Exposure Point Concentration Calculations

The exposure point concentrations (EPCs) represent upper bound concentrations of COPCs. For comparison to SSLs and screening action levels (SALs), the upper confidence limit (UCL) of the arithmetic mean was calculated when possible and used as the EPC. If an appropriate UCL of the mean could not be calculated or if the UCL exceeded the maximum concentration, the maximum detected concentration of the COPC was used as the EPC. Calculation of UCLs of the mean concentrations was done using the ProUCL 4.00.02 software (EPA 2007, 096530), which is based on U.S. Environmental Protection Agency (EPA) guidance (EPA 2002, 085640). The ProUCL program calculates a data distribution and a variety of 95%, 97.5%, and 99% UCLs. The ProUCL software performs distributional tests on the data set for each COPC and recommends the most appropriate UCL based on the

distribution of the data set (normal, lognormal, gamma approximate gamma, or nonparametric) and the decision criteria, as explained in the technical guidance for the software (EPA 2007, 096530). The ProUCL recommended UCL was used as the EPC when the number of detections in a data set was five or more and did not exceed the maximum concentration. Key aspects of the current version of ProUCL are that it tests data against an expanded range of distribution types, contains a larger suite of statistical tests, and performs analyses on datasets with nondetected values.

The ProUCL documentation strongly recommends against using the maximum detected concentration for the EPC. However, it also cautions against using statistical values calculated on less than four to six detected results in a large data set. Therefore, the maximum detected concentration was used to represent the EPC for COPCs with less than five detected values, because the resultant statistical estimate may not be reliable. In these cases, if the observations are highly skewed and result in significant risk due to use of the maximum detected concentration the COPC is further assessed in the uncertainty section of this document. The summary statistics, including the EPC for each COPC for the human health and the ecological risk screening assessments and the distribution used for the calculation, are presented in Tables H-2.4-1 to H-2.4-7. Input and output data files for ProUCL calculations are presented in Attachment H-2 (provided on CD).

H-4.0 HUMAN HEALTH RISK SCREENING ASSESSMENTS

The human health risk screening assessments were conducted for each of the four sites within the Middle Cañada del Buey Aggregate Area. All sites were screened for the residential scenario per the Consent Order using data from 0–10 ft bgs. AOCs 18-005(b) and 18-005(c) were also screened using the industrial and construction worker scenarios, while AOCs 51-001 and 54-007(d) were evaluated using only the construction worker scenario. The industrial scenario uses data from 0–1 ft bgs, while the construction worker scenario uses data from 0-10 ft bgs. For AOCs 18-005(b) and 18-005(c), samples were collected only to a depth of 3 ft bgs, so the construction worker and residential scenarios at these sites use data from 0-3 ft bgs.

H-4.1 Soil Screening Levels

Human health risk screening assessments for chemical COPCs were conducted using SSLs for the industrial, construction worker, and residential scenarios obtained from NMED guidance (NMED 2006, 092513). The NMED SSLs are based on a target noncarcinogenic hazard quotient (HQ) of 1.0 and a target cancer risk of 1×10^{-5} (NMED 2006, 092513). If SSLs were not available from NMED guidance, EPA regional screening levels (available at http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/pdf/composite_sl_table_run_12SEP2008.pdf) were used. The EPA SSLs for carcinogens were multiplied by 10 to adjust from a 10^{-6} cancer risk level to the NMED target cancer risk level of 10^{-5}. Exposure parameters used to calculate the industrial, construction worker, and residential SSLs are presented in Table H-4.1-1.

Surrogate chemicals were used for some COPCs without a SSL based on structural similarity or because the COPC is a breakdown product (NMED 2003, 081172). In addition, some VOCs have saturation limit (C_{sat}) SSLs rather than the risk-based values in the NMED guidance (NMED 2006, 092513) and EPA regional screening levels (EPA 2007, 099314). The screening assessments used risk-based values obtained from EPA regional screening levels for the industrial worker and resident.

Radionuclide SALs are used for comparison with radionuclide COPC concentrations and were derived using the residual radioactive (RESRAD) model, Version 6.21 (LANL 2005, 088493). The SALs are based on a 15-mrem/yr dose per U.S. Department of Energy (DOE) guidance (DOE 2000, 067489). Exposure

parameters used to calculate the industrial, construction worker, and residential SALs are presented in Tables H-4.1-2 and H-4.1-3.

H-4.2 Results of the Human Health Risk Screening Evaluations

The EPC of each COPC in soil was compared with the SSLs for the appropriate scenario(s). The EPCs for carcinogenic COPCs were divided by the SSL and multiplied by 1×10^{-5}. The sum of the cancer risks were compared with the NMED target cancer risk level of 1×10^{-5}. An HQ was generated for each noncarcinogenic COPC by dividing the EPC by the SSL. The HQs were summed to generate a hazard index (HI). The HI was compared with the NMED target HI of 1.0. The radionuclide EPCs were divided by the SAL and multiplied by 15 mrem/yr. The sum of the doses were compared the DOE target level of 15 mrem/yr (DOE 2000, 067489). The results of the human health screening evaluations for the Middle Cañada del Buey Aggregate Area sites are presented in Tables H-4.2-1 to H-4.2-16.

H-4.2.1 AOC 51-001

The results of the risk/dose screening assessments for the construction worker scenario are presented in Tables H-4.2-1 and H-4.2-2. Some site COPCs were not detected or were not above background in the 0–10 ft depth interval used to evaluate the construction worker scenario; these COPCs (arsenic, barium, cadmium, mercury, silver, bromomethane, butanone[2-], and trichlorofluormethane) were excluded from the assessment. No carcinogens were retained as COPCs in the 0-10 ft depth interval. The construction worker HI is approximately 0.009, which is below the NMED target HI of 1.0 (NMED 2006, 092513). The total dose for the construction worker scenario is 0.1 mrem/yr, which is below the DOE target dose limit of 15 mrem/yr (DOE 2000, 067489).

The results risk/dose screening assessments for the residential scenario are presented in Tables H-4.2-3 and H-4.2-4. Some site COPCs were not detected or were not above background in the 0–10 ft depth interval used to evaluate the residential scenario; these COPCs (arsenic, barium, cadmium, mercury, silver, bromomethane, butanone[2-], and trichlorofluormethane) were excluded from the assessment. No carcinogens were retained as COPCs in the 0–10 ft depth interval. The residential HI is 0.03, which is below the NMED target HI of 1.0 (NMED 2006, 092513). The total dose for the residential scenario is 0.3 mrem/yr, which is below the DOE target dose limit of 15 mrem/yr (DOE 2000, 067489).

H-4.2.2 AOC 18-005(b)

The results of the risk screening assessments for the industrial scenario are presented in Table H-4.2-5. Barium was not above background in the depth interval of 0–1 ft bgs used to evaluate the industrial scenario and was excluded from the screening evaluation. No carcinogens were retained as COPCs in the 0–1-ft-depth interval. The industrial HI is 0.004, which is below the NMED target HI of 1.0 (NMED 2006, 092513). No radionuclide COPCs were included in the screening for this site.

The results of the risk screening assessments for the construction worker scenario are presented in Table H-4.2-6. No COPCs in the depth interval of 0–3 ft bgs used to evaluate the construction worker scenario were excluded from the screening evaluation. No carcinogens were retained as COPCs in the 0–3-ft-depth interval. The construction worker HI is 0.01, which is below the NMED target HI of 1.0 (NMED 2006, 092513). No radionuclide COPCs were included in the screening for this site.

The results of the risk screening assessments for the residential scenario are presented in Table H-4.2-7. No COPCs in the depth interval of 0–3 ft bgs used to evaluate the residential scenario were excluded from the screening evaluation. No carcinogens were retained as COPCs in the 0-3 ft depth interval. The

HI is 0.05, which is below the NMED target HI of 1.0 (NMED 2006, 092513). No radionuclide COPCs were included in the screening for this site.

H-4.2.3 AOC 18-005(c)

The results of the risk screening assessments for the industrial scenario are presented in Table H-4.2-8. Some site COPCs were not above background in the depth interval of 0–1 ft used to evaluate the industrial scenario; these COPCs (arsenic, barium, and chromium) were excluded from the screening evaluation. No carcinogens were retained as COPCs in the 0–1-ft–depth interval. The industrial HI is 0.004, which is below the NMED target HI of 1.0 (NMED 2006, 092513). No radionuclide COPCs were included in the screening for this site.

The results of the risk screening assessments for the construction worker scenario are presented in Tables H-4.2-9 and H-4.2-10. No COPCs in the depth interval of 0–3 ft bgs used to evaluate the construction worker scenario were excluded from the screening evaluation. The total excess cancer risk is 9×10^{-9}, which is below the NMED target risk level of 1×10^{-5} (NMED 2006, 092513). The construction worker HI is 0.09, which is below the NMED target HI of 1.0 (NMED 2006, 092513). No radionuclide COPCs were included in the screening for this site.

The results of the risk screening assessments for the residential scenario are presented in Tables H-4.2-11 and H-4.2-12. No COPCs in the depth interval of 0–3 ft bgs used to evaluate the residential scenario were excluded from the screening evaluation. The total excess cancer risk is 2×10^{-5}, which is slightly above the NMED target risk level of 1×10^{-5} (NMED 2006, 092513). The elevated cancer risk is primarily from arsenic. The HI is 0.05, which is below the NMED target HI of 1.0 (NMED 2006, 092513). No radionuclide COPCs were included in the screening for this site.

H-4.2.4 AOC 54-007(d)

The results of the risk screening assessments for the construction worker scenario are presented in Tables H-4.2-13 and H-4.2-14. No COPCs in the depth interval of 0–10 ft bgs used to evaluate the construction worker scenario were excluded from the screening evaluation. The total excess cancer risk is 2×10^{-7}, which is below the NMED target risk level of 1×10^{-5} (NMED 2006, 092513). The construction worker HI is approximately 0.2, which is below the NMED target HI of 1.0 (NMED 2006, 092513). Isotopic uranium was not identified as a COPC at this site.

The results of the risk screening assessments for the residential scenario are presented in Tables H-4.2-15 and H-4.2-16. No COPCs in the depth interval of 0–10 ft bgs used to evaluate the residential scenario were excluded from the screening evaluation. The total excess cancer risk is 2×10^{-5}, which is slightly above the NMED target risk level of 1×10^{-5} (NMED 2006, 092513). The elevated cancer risk is primarily from arsenic. The residential HI is 0.2, which is below the NMED target HI of 1.0 (NMED 2006, 092513). Isotopic uranium was not identified as a COPC at this site.

H-4.3 Uncertainty Analysis

The human health risk screening assessments are subject to varying degrees and types of uncertainty. Aspects of data evaluation and COPC identification, exposure assessment, toxicity assessment, and the additive approach all contribute to uncertainties in the risk-evaluation process. Each or all of these uncertainties may affect the evaluation results.

H-4.3.1 Data Evaluation and COPC Identification Process

A primary uncertainty associated with the COPC identification process is the possibility that a chemical may be inappropriately identified as a COPC when it is actually not a COPC or that a chemical may not be identified as a COPC when it actually should be identified as a COPC. Inorganic chemicals are appropriately identified as COPCs because those chemicals that are detected or that have detection limits above background are retained for further analysis. However, established BVs may not accurately represent certain subunits of the Bandelier Tuff (e.g., fractured, clay-rich material) encountered during sampling because such data are not included in the background data set. There are no established BVs for organic chemicals, and all detected organic chemicals are identified as COPCs and are retained for further analysis.

Other uncertainties may include errors in sampling, laboratory analysis, and data analysis. However, because concentrations used in the risk screening evaluations include those detected less than estimated quantitation limits and nondetects above BVs, data evaluation uncertainties are expected to have little effect on the risk screening results.

H-4.3.2 Exposure Assessment

The following exposure assessment uncertainties were identified for the risk assessment: (1) the applicability of the standard scenarios, (2) the assumptions underlying the exposure pathways, and (3) the depth over which SSLs based on the exposure scenario were applied and the derivation of EPCs.

A worker may be subject to exposures in a different manner than the exposure assumptions used to derive the industrial SSLs. The assumptions for the industrial SSLs are that the potentially exposed individual is outside on-site for a full work day, for 225 d/yr and 25 yr (NMED 2006, 092513). For the sites evaluated, workers would not be on-site for that frequency and duration. Therefore, the industrial scenario overestimates the exposure and risk/dose and is protective of a worker. The construction worker scenario assumes that the receptor is exposed for 250 d/yr and 1 yr (NMED 2006, 092513), which may also not reflect actual time spent on the site and may overestimate the potential risk/dose. The residential scenario is based on exposure of 24 h/d, 350 d/yr and 30 yr (NMED 2006, 092513) and may overestimate the potential risk/dose but is protective.

A number of assumptions are made relative to exposure pathways, including input parameters, whether or not a given pathway is complete, the contaminated media to which an individual may be exposed, and intake rates for different routes of exposure. In the absence of site-specific data, the exposure assumptions used were consistent with default values (NMED 2006, 092513). When several upper-bound values (as are found in NMED 2006, 092513) are combined to estimate exposure for any one pathway, the resulting risk can exceed the 99th percentile and, therefore, can exceed the range of risk that may be reasonably expected. Also, the assumption that residual concentrations of COPCs in the tuff are available and cause exposure in the same manner as if they were in soil overestimates the potential risk to receptors.

Uncertainty is introduced in the concentration aggregation of data for estimating the EPCs at a site. The use of a UCL is intended to provide a protective, upper-bound estimate of the COPC concentration and is assumed to be representative of the average exposure to a COPC across the entire site. Potential risk and exposure from a single location or area with relatively high COPC concentrations may be overestimated if a representative, sitewide value is used. The use of the maximum detected concentration for the EPC overestimates the exposure to contamination because receptors are not consistently exposed to the maximum detected concentration across the site.

AOCs 18-005(c) and 54-007(d) have potential risks that exceed the NMED target level for the residential scenario. These potential risks may be overestimated because of uncertainties associated with the EPCs for the primary COPC (arsenic) at these sites.

AOC 18-005(c)

The total excess cancer risk for residential exposure is 2×10^{-5} from arsenic (cancer risk from chromium is 3 orders of magnitude less). The maximum arsenic concentrations are in soil and are less than the maximum soil background concentration (9.3 mg/kg). The EPC is based on a UCL of 6.89 mg/kg, which is within the range of soil background concentrations and less than twice the maximum background concentration (5 mg/kg) of units 2, 3, and 4 of the Bandelier Tuff (LANL 1998, 059730). Arsenic was not detected above background in soil and was detected in only one sample slightly above the maximum tuff background concentration at 5.27 mg/kg. Therefore, exposure to arsenic across the site is similar to background. The total excess cancer risk without arsenic is approximately 4×10^{-8}, which is below the NMED target risk level of 1×10^{-5}.

AOC 54-007(d)

The total excess cancer risk for residential exposure is 2×10^{-5} from arsenic (cancer risks from other COPCs are two to five orders of magnitude less). The EPC is based on a UCL of 9.54 mg/kg, which is slightly above the maximum soil background concentration (9.3 mg/kg) and less than twice the maximum background concentration (5 mg/kg) of units 2, 3, and 4 of the Bandelier Tuff (LANL 1998, 059730). Therefore, exposure to arsenic across the site is similar to background. The total excess cancer risk without arsenic is approximately 6×10^{-7}, which is below the NMED target risk level of 1×10^{-5}.

H-4.3.3 Toxicity Assessment

The primary uncertainty associated with the screening values is related to the derivation of toxicity values used in their calculation. Toxicity values (slope factors [SFs] and reference doses [RfDs]) were used to derive the risk-based screening values used in the screening evaluation (NMED 2006, 092513). Uncertainties were identified in six areas with respect to the toxicity values: (1) extrapolation from other animals to humans, (2) extrapolation from one route of exposure to another route of exposure, (3) interindividual variability in the human population, (4) the derivation of RfDs and SFs, (5) the chemical form of the COPC, and (6) the use of surrogate chemicals.

Extrapolation from Animals to Humans: The SFs and RfDs are often determined by extrapolation from animal data to humans, which may result in uncertainties in toxicity values because differences exist between animals and humans in chemical absorption, metabolism, excretion, and toxic responses. Differences in body weight, surface area, and pharmacokinetic relationships between animals and humans are taken into account to address these uncertainties in the dose-response relationship. However, conservatism is usually incorporated in each of these steps, resulting in the overestimation of potential risk.

Extrapolation from One Route of Exposure to Another Route of Exposure: The SFs and RfDs often contain extrapolations from one exposure route to another that result in additional conservatism in the risk calculations. The extrapolation from the oral route to the inhalation and/or the dermal route is used in the derivation of some screening values (NMED 2006, 092513). Differences between the two exposure pathways contribute to the uncertainty in the estimation of potential risk.

Individual Variability in the Human Population: For noncarcinogenic effects, the degree of variability in human physical characteristics is important both in determining the risks that can be expected at low exposures and in defining the no-observed-adverse-effect level (NOAEL). The NOAEL uncertainty factor approach incorporates a 10-fold factor to reflect individual variability within the human population that can contribute to uncertainty in the risk assessment. This factor of 10 is generally considered to result in a conservative estimate of risk to noncarcinogenic COPCs.

Derivation of RfDs and SFs: The SFs and RfDs are often determined by extrapolation from animal data to humans, which may result in uncertainties in toxicity values because differences exist between other animals and humans in chemical absorption, metabolism, excretion, and toxic response. Differences in body weight, surface area, and pharmacokinetic relationships between animals and humans are taken into account to address these uncertainties in the dose-response relationship. However, conservatism is usually incorporated into each of these steps, resulting in the overestimation of potential risk.

Chemical Form of the COPC: COPCs may be bound to the environmental matrix and not available for absorption into the human body. However, the exposure scenarios default to the assumption that the COPCs are bioavailable. This assumption can lead to an overestimation of the total risk.

Use of Surrogate Chemicals: The use of surrogates for chemicals that do not have EPA-approved or provisional toxicity values also contributes to uncertainty in risk assessment. A surrogate (isopropylbenzene) was used to provide SSLs for isopropyltoluene[4-] based on structural similarity. The overall impact of the surrogate on the risk assessments is minimal because the COPC was detected at low concentrations (less than 0.01 mg/kg).

H-4.3.4 Additive Approach

For noncarcinogens, the effects of exposure to multiple chemicals are generally unknown and possible interactions could be synergistic or antagonistic, resulting in either an overestimation or underestimation of the potential risk. Additionally, RfDs used in the risk calculations typically are not based on the same endpoints with respect to severity, effects, or target organs. Therefore, the potential for noncarcinogenic effects may be overestimated for individual COPCs that act by different mechanisms and on different target organs but are addressed additively.

H-4.4 Interpretation

AOC 51-001

No carcinogenic COPCs were identified within the 0–10-ft-depth interval evaluated by the construction worker and residential scenarios at this site. The HIs are 0.009 and 0.03, respectively, and are below the NMED target HI of 1.0 (NMED 2006, 092513). The total doses are 0.1 and 0.3 mrem/yr, respectively, and are below the DOE target dose limit of 15 mrem/yr (DOE 2000, 067489). The total doses are equivalent to total risks of 1×10^{-7} and 5×10^{-7} for the construction worker and residential scenarios, based on a comparison to EPA's outdoor worker and residential preliminary remediation goals (PRGs) for radionuclides (http://epa-prgs.ornl.gov/radionuclides/), respectively.

Based on the screening assessment results, there are no potential unacceptable risks or doses from COPCs for the construction worker and residential scenarios.

AOC 18-005(b)

No carcinogenic COPCs were identified within the 0–1-ft- and 0–3-ft-depth intervals evaluated by the industrial, construction worker, and residential scenarios at this site. The HIs are 0.004, 0.01 and 0.05, respectively, and are below the NMED target HI of 1.0 (NMED 2006, 092513).

Based on the screening assessment results, there are no potential unacceptable risks from COPCs for the industrial, construction worker, and residential scenarios.

AOC 18-005(c)

No carcinogenic COPCs were identified within the 0–1 ft depth interval evaluated by the industrial scenario at this site. The total excess cancer risks for the construction worker and residential scenarios are 9×10^{-9} and 2×10^{-5}, respectively. The cancer risk for the construction worker scenario is below the NMED target risk level of 1×10^{-5} (NMED 2006, 092513), while the residential cancer risk is slightly above the NMED target risk level of 1×10^{-5} (NMED 2006, 092513). The elevated residential cancer risk is primarily from arsenic. However, based on the results of the uncertainty analysis (section H-4.3.2), the arsenic levels and EPC are similar to background concentrations, and the residential cancer risk without arsenic (4×10^{-8}) is less than the NMED target risk level (NMED 2006, 092513).The HIs are 0.004, 0.09, and 0.05, respectively, and are below the NMED target HI of 1.0 (NMED 2006, 092513).

Based on the screening assessment results, there are no potential unacceptable risks from COPCs for the industrial, construction worker, and residential scenarios.

AOC 54-007(d)

The total excess cancer risks for the construction worker and residential scenarios are 2×10^{-7} and 2×10^{-5}, respectively. The cancer risk for the construction worker scenario is below the NMED target risk level of 1×10^{-5} (NMED 2006, 092513), while the residential cancer risk is slightly above the NMED target risk level of 1×10^{-5} (NMED 2006, 092513). The elevated residential cancer risk is primarily from arsenic. However, based on the results of the uncertainty analysis (section H-4.3.2), the arsenic levels and EPC are similar to background concentrations, and the residential cancer risk without arsenic (6×10^{-7}) is less than the NMED target risk level (NMED 2006, 092513). The HIs are 0.2 for both scenarios and are below the NMED target HI of 1.0 (NMED 2006, 092513).

Based on the screening assessment results, there are no potential unacceptable risks from COPCs for the construction worker and residential scenarios.

H-5.0 ECOLOGICAL SCREENING ASSESSMENT

The approach used to evaluate ecological risk is described in “Screening Level Ecological Risk Assessment Methods, Revision 2” (LANL 2004, 087630). The assessment consists of four parts: (1) a scoping evaluation; (2) a screening evaluation; (3) an uncertainty analysis; and (4) an interpretation of the results.

H-5.1 Scoping Evaluation

The scoping evaluation establishes the breadth and focus of the ecological screening assessment. The ecological checklists (Attachment H-1) organize existing ecological information about the sites for the

scoping evaluation and forms the basis for the determination of key aspects of the conceptual site model—habitat type and quality, potential receptor exposure, and contaminant transport pathways.

The sites are highly disturbed and consist primarily of bare soil and rock and/or roadways and regraded areas where demolition and removal actions have taken place. The dominant overstory vegetation type surrounding the area is ponderosa pine, with minor vegetation components of juniper and piñon. The site contains mostly native and nonnative grasses and ruderal species indicative of disturbance. Habitat fragmentation at the site is high. The general habitat quality in disturbed areas is poor but sufficient to support grazing and foraging by terrestrial receptors. No threatened and endangered (T&E) species habitat is present at any of the sites.

The scoping portion of the assessment indicated that terrestrial receptors were appropriate for evaluating the concentrations of contaminants in soil and tuff samples. Aquatic receptors were not evaluated because no aquatic communities and no aquatic habitat or perennial source of water exist at any of the four sites within the aggregate area. The depth of the regional aquifer (greater than 1000 ft bgs) and the semiarid climate limit the transport to groundwater. The potential exposure pathways for terrestrial receptors in soil and tuff are root uptake, inhalation, soil ingestion, dermal contact, external irradiation, and food-web transport (Figure H-3.1-1). The weathering of tuff is the only viable natural process that may result in the exposure of receptors to contaminants in tuff. Because of the slow rate of weathering expected for tuff, exposure in tuff is negligible, although it is included in the assessment. Plant exposure in tuff is largely limited to fractures near the surface, which does not produce sufficient biomass to support an herbivore population. Consequently, the contaminants in tuff are unavailable to receptors.

The potential risk was evaluated in the risk screening assessments for the following ecological receptors representing several trophic levels:

- a plant,
- soil-dwelling invertebrates (represented by the earthworm),
- the deer mouse (mammalian omnivore),
- the montane shrew (mammalian insectivore),
- the desert cottontail (mammalian herbivore),
- the red fox (mammalian carnivore),
- the American robin (avian insectivore, avian omnivore, and avian herbivore), and
- the American kestrel (avian intermediate carnivore and avian carnivore (surrogate for T&E species).

The rationale for these receptors is presented in “Screening Level Ecological Risk Assessment Methods, Revision 2” (LANL 2004, 087630). The ecological screening levels (ESLs) are derived for each of three receptors where information was available. The ESLs are based on similar species and are derived from experimentally determined NOAELs, lowest-observed-adverse-effect levels (LOAELs), or doses determined lethal to 50% of the test population. Information relevant to the calculation of ESLs, including concentration equations, dose equations, bioconcentration factors, transfer factors, and toxicity reference values (TRVs), are presented in the ECORISK Database, Version 2.3 (LANL 2008, 103352).

H-5.2 Assessment Endpoints

An assessment endpoint is an explicit expression of the environmental value to be protected. These endpoints are ecologically relevant and help sustain the natural structure, function, and biodiversity of an ecosystem or its components (EPA 1998, 062809). In a screening-level assessment, assessment endpoints are attributes of ecological receptors that may be adversely affected by exposure to hazardous wastes from past operations (EPA 1997, 059370), wherein receptors are populations and communities (EPA 1999, 070086).

The ecological screening assessment is designed to protect populations and communities of biota rather than individual organisms, except for listed or candidate T&E species or treaty-protected species (EPA 1999, 070086). The protection of individual organisms within these designated protected species could also be achieved at the population level; the populations of these species tend to be small, and the loss of an individual adversely affects the species.

In accordance with this guidance, the Laboratory developed generic assessment endpoints to ensure that values at all levels of the food chain are considered in the ecological screening process (LANL 1999, 064137). These general assessment endpoints can be measured using impacts on reproduction, growth, and survival to represent categories of effects that may adversely impact populations. In addition, specific receptor species were chosen to represent each functional group. The receptor species were chosen because of their presence at the site, their sensitivity to the COPCs, and their potential for exposure to those COPCs. These categories of effects and the chosen receptor species were used to select the types of effects seen in toxicity studies considered in the development of the TRVs. Toxicity studies used in the development of TRVs included only those in which the evaluated adverse effect affected reproduction, survival, and/or growth.

The selection of receptors and assessment endpoints are designed to be protective of both the representative species used as screening receptors and the other species within their feeding guilds and the overall food web for the terrestrial and aquatic ecosystems. Focusing the assessment endpoints on the general characteristics of species that affect populations (rather than the biochemical and behavioral changes that may affect only the studied species) also ensures applicability to the ecosystem of concern.

H-5.3 Screening Evaluation

The ecological risk screening assessments identify chemicals of potential ecological concern (COPECs) based on the comparison of EPCs (determined from samples collected between 0 and 5 ft bgs) with ESLs in accordance with Laboratory guidance (LANL 2004, 087630). For AOCs 18-005(b) and 18-005(c), samples were collected only from the depth interval of 0–3 ft bgs, so all of these data are used in the ESL comparisons for these sites. The ecological EPCs are presented in Tables H-2.4-3, H-2.4-5, and H-2.4-7, and the calculations are summarized in section H-3.3 Input and output data files for ProUCL calculations are provided on CD as Attachment H-2. The ESLs were obtained from the ECORISK Database, Version 2.3 (LANL 2008, 103352) and are presented in Table H-5.3-1 for all COPCs and receptors evaluated.

The risk screening assessments involve the calculation of HQs for all COPECs and all screening receptors (LANL 2004, 087630). The HQs are the ratios of the EPCs to the ESLs. The EPCs consist of UCLs calculated using ProUCL 4.00.02 or the maximum detected concentrations. The analysis begins with a comparison of the minimum ESL to the EPC for each COPC. The COPCs with HQs greater than 0.3 are identified as COPECs and are evaluated further. The COPECs are evaluated by receptor with individual HQs for a receptor summed to produce an HI. For the purposes of the ecological screening, it is assumed that nonradionuclides have common toxicological effects. An HI greater than 1.0 requires further assessment to determine if exposure to multiple COPECs results in potential adverse impacts to a

given receptor population. The HQ and HI analysis is a conservative indication of potential adverse effects and is designed to minimize the potential of overlooking possible COPECs at the site. COPCs without ESLs are retained as COPECs and evaluated further in the uncertainty section.

Nitrate and perchlorate do not have ESLs for any receptors. As a result, these analytes are retained as COPECs and discussed in the uncertainty section.

The HIs for the terrestrial receptors are discussed below for each site within the aggregate area.

H-5.3.1 AOC 51-001

No COPCs were detected or were above background within the depth interval of 0–5 ft bgs that was used to evaluate potential ecological risk. Therefore, there are no complete pathways for exposure of ecological receptors at AOC 51-001, and no screening evaluation was conducted.

H-5.3.2 AOC 18-005(b)

The results of the minimum ESL comparisons are presented in Table H-5.3-2. The COPCs at this site with HQs greater than 0.3 are antimony and barium. Antimony and barium are retained as COPECs.

Table H-5.3-3 presents the HQs and HIs for each receptor/COPEC at AOC 18-005(b). The kestrel, robin, cottontail, earthworm, and red fox have HIs less than 1.0. The plant, deer mouse, and montane shrew have HIs greater than 1.0 and are discussed further in the uncertainty analysis.

Nitrate and perchlorate do not have ESLs and are retained as COPECs. They are discussed further in the uncertainty analysis.

H-5.3.3 AOC 18-005(c)

The results of the minimum ESL comparisons are presented in Table H-5.3-4. The COPCs at this site with HQs greater than 0.3 are antimony, arsenic, barium, and chromium. Antimony, arsenic, barium, and chromium are retained as COPECs.

Table H-5.3-5 presents the HQs and HIs for each receptor/COPEC at AOC 18-005(c). The kestrel, robin, cottontail, and red fox have HIs less than 1.0. The plant, earthworm, deer mouse, and montane shrew have HIs greater than 1.0 and are discussed further in the uncertainty analysis.

Nitrate and perchlorate do not have ESLs and are retained as COPECs. They are discussed further in the uncertainty analysis.

H-5.3.4 AOC 54-007(d)

The results of the minimum ESL comparisons are presented in Table H-5.3-6. There are no COPCs at this site with HQs greater than 0.3. Benzene and butanone[2-] have HQs less than 0.3 and are not retained as COPECs.

H-5.4 Uncertainty Analysis

The uncertainty analysis describes the key sources of uncertainty related to the screening evaluations. This analysis can result in either adding or removing chemicals from the list of COPECs. The following is a qualitative uncertainty analysis of the issues relevant to evaluating potential ecological risk at each site.

H-5.4.1 Chemical Form

The assumptions used in the ESL derivations are conservative and not necessarily representative of actual conditions. These assumptions include maximum chemical bioavailability, maximum receptor ingestion rates, minimum body weight, and additive effects of multiple COPECs. These factors tend to result in conservative ESL estimates, which may lead to an overestimation of the potential risk. The assumption of additive effects for multiple COPECs may result in an over- or underestimation of the potential risk to receptors.

The chemical form of the individual COPCs was not determined as part of the investigation. Toxicological data are typically based on the most toxic and bioavailable chemical species, which are not typically found in the environment. Inorganic, radionuclide, and organic COPECs are generally not 100% bioavailable to receptors in the natural environment because of interference from other natural processes, such as the adsorption of chemical constituents to matrix surfaces (e.g., soil) or rapid oxidation or reduction changes that render harmful chemical forms unavailable to biotic processes. The ESLs were calculated to ensure a conservative indication of potential risk (LANL 2004, 087630), and the values are biased toward overestimating the potential risk to receptors.

H-5.4.2 Exposure Assumptions

The EPCs used in the calculations of HQs are the UCLs or the maximum detected concentrations in the soil/fill/tuff to depths of 5 ft bgs [3 ft bgs for AOCs 18-005(b) and 18-005(c)] and are conservative estimates of exposure to each COPEC. The sampling efforts focused on areas of known contamination, and receptors were assumed to ingest 100% of their food and spend 100% of their time at the site. These exposure assumptions for terrestrial receptors in the Middle Cañada del Buey Aggregate Area are likely to overestimate potential ecological exposure and risk.

The plant HIs at AOCs 18-005(b) and 18-005(c) are elevated (45 and 36, respectively). However, field observations made during the site visit and while conducting field activities found no indication of adverse impacts on the plant community (Attachment H-1). This finding is also true of AOCs 51-001 and 54-007(d). The plants within the AOC boundaries are typical of disturbed areas, consisting of weeds and grasses. As a result, the root zones are shallow and do not encounter the subsurface contamination at AOCs 51-001 and 54-007(d). This condition is likely to remain in the future given the location and nature of the sites within an industrial area. The plant communities in the areas surrounding the AOCs are less disturbed and consist of grasses, shrubs, and trees. Based on the site conditions and observations, the potential exposure and risks to plants at these AOCs are overestimated and are not likely to result in adverse effects.

H-5.4.3 Toxicity Values

The HQs were calculated using ESLs, which are based on NOAELs as threshold effect levels; actual risk for a given COPEC/receptor combination occurs at a higher level, somewhere between the NOAEL-based threshold and the threshold based on the LOAEL. The use of NOAELs leads to an overestimation of potential risk to ecological receptors. ESLs are based on laboratory studies requiring extrapolation to wildlife receptors. Laboratory studies are typically based on artificial and maintained populations with genetically similar individuals and are limited to single chemical exposures in isolated and controlled conditions using a single exposure pathway. Wild species are concomitantly exposed to a variety of chemical and environmental stressors, potentially rendering them more susceptible to chemical stress. On the other hand, wild populations are probably more genetically diverse than laboratory populations,

making wild populations, as a whole, less sensitive to chemical exposure than laboratory populations. The uncertainties associated with the ESLs tend to lead to an overestimation of potential risk.

H-5.4.4 Comparison with Background Concentrations

H-5.4.4.1 AOC 18-005(b)

The ecological screening assessment for this site is based on the exposure of ecological receptors to contamination to a depth of 3 ft bgs. The EPCs for the inorganic COPECs are similar to background concentrations for soil and tuff, indicating that exposure to these inorganic chemicals across the site is similar to background (Table H-5.4-1).

- The EPC for antimony is 1.14 mg/kg compared to a maximum soil background concentration of 1 mg/kg. The antimony concentrations above BV range from 0.91 mg/kg to 1.3 mg/kg, all equivalent to or slightly greater than the maximum soil background concentration.
- The EPC for barium is 273.1 mg/kg compared to a maximum soil background concentration of 410 mg/kg. The only barium concentration above background is 420 mg/kg, slightly above the maximum soil background concentration.

Therefore, antimony and barium are eliminated as COPECs because exposure to these inorganic chemicals is similar to background.

H-5.4.4.2 AOC 18-005(c)

The ecological screening assessment for this site is based on the exposure of ecological receptors to contamination to a depth of 3 ft bgs. The EPCs for the inorganic COPECs are similar to background concentrations for soil and tuff, indicating that exposure to these inorganic chemicals across the site is similar to background (Table H-5.4-2).

- The EPC for antimony is 1.47 mg/kg compared to the maximum soil background concentration of 1 mg/kg. The maximum concentration above soil background is 1.58 mg/kg, which is less than twice the maximum background concentration. Antimony concentrations in the tuff samples did not exceed the tuff BV for antimony.
- The EPC for arsenic is 6.89 mg/kg compared to the maximum tuff background concentration of 5 mg/kg; arsenic was not detected above background in soil. Arsenic was detected in only one sample above the maximum tuff background concentration at 5.27 mg/kg.
- The barium EPC is 100.5 mg/kg compared to the maximum tuff background concentration of 51.6 mg/kg; barium was not detected above background in soil. Barium concentrations in three samples were above the tuff BV, but only two concentrations were greater than the maximum tuff background concentration. The two barium concentrations above background were slightly above the maximum tuff background concentration at 53.7 mg/kg and 91.3 mg/kg, both less than twice the maximum.
- The EPC for chromium is 12.4 mg/kg compared to the maximum tuff background concentration of 13 mg/kg; chromium was not detected above background in soil. Chromium was detected in only one sample above the maximum tuff background concentration at 16.3 mg/kg, less than twice the maximum background concentration.

Therefore, antimony, arsenic, barium, and chromium are eliminated as COPECs because exposure to these inorganic chemicals is similar to background.

H-5.4.4.3 ESLs and Background

In addition to the similarity of inorganic COPEC EPCs to background, many inorganic ESLs are below background. Because the ESLs are developed from studies in the peer reviewed literature and are the result of laboratory exposures, the concentrations resulting in NOAELs and LOAELs may be very low and not representative of actual toxicity levels.

The elevated HIs presented in Tables H-5.4-2 and H-5.4-4 reflect ESLs for the deer mouse and montane shrew (antimony), the earthworm (barium and chromium), and the plant (antimony, barium, and chromium) that are either less than BVs or within the range of background concentrations. This results in HIs above 1.0, which are not representative of actual exposure and effects, and greatly overestimate the potential ecological risks.

H-5.4.5 COPECs without ESLs

Two COPECs (nitrate and perchlorate) do not have ESLs for any receptor. Without ESLs, these chemicals cannot be assessed quantitatively for potential ecological risk. Nitrate and perchlorate also do not have background data.

In the absence of a chemical-specific ESL, COPEC concentrations can be compared to a surrogate chemical or to residential human health SSLs. Comparison to a surrogate ESL provides an estimate of potential effects of a chemically related compound and a line of evidence to indicate the likelihood that ecological receptors are potentially impacted. The comparison of COPEC concentrations to residential human health SSLs is a viable alternative for several reasons. The inference that humans and animals are similar, on average, in intrinsic susceptibility to chemicals and the fact that, in many cases, data from animals are used as surrogates for data from humans, is the basic premise of modern toxicology (EPA 1989, 008021). In addition, toxicity values derived for the calculation of human health SSLs are often based on potential effects that are more sensitive than the ones used to derive ESLs (e.g., cellular effects for humans versus survival or reproductive effects for terrestrial animals). The EPA also applies uncertainty factors or modifying factors to ensure that the toxicity values are protective (i.e., they are adjusted by uncertainty factors to values much lower than the study results). COPEC concentrations compared with these values are an order of magnitude or more below the SSLs, which corresponds to uncertainty factors of 10 or more. Therefore, it is assumed that the differences in toxicity would not be more than an order of magnitude for any given chemical. The relative difference between values provides a weight of evidence that the potential toxicity of the COPC is likely to be low or very low to the receptor(s). The COPECs without ESLs are discussed below for each site.

H-5.4.5.1 AOC 51-001

Nitrate was detected in 10 samples with a maximum concentration of 10.5 mg/kg. The NMED residential SSL for nitrate is 100,000 mg/kg, indicating that potential toxicity is very low. In addition, nitrate is naturally occurring and the detected concentrations likely reflect natural levels. Because of the potentially very low toxicity and naturally occurring concentrations, nitrate is eliminated as a COPEC.

H-5.4.5.2 AOC 18-005(b)

Nitrate was detected in eight samples with a maximum concentration of 32.7 mg/kg. The NMED residential SSL for nitrate is 100,000 mg/kg, indicating that potential toxicity is very low. In addition, nitrate is naturally occurring and the detected concentrations likely reflect natural levels. Because of the potentially very low toxicity, nitrate is eliminated as a COPEC.

Perchlorate was detected in two samples with a maximum detected concentration of 0.000756 mg/kg. The EPA regional screening level for residential is 55 mg/kg, which indicates that the potential toxicity of perchlorate is low. Because of the potentially low toxicity, the low concentrations, and the infrequent detection, perchlorate is not retained as a COPEC.

H-5.4.5.3 AOC 18-005(c)

Nitrate was detected in two samples with a maximum concentration of 3.19 mg/kg. The NMED residential SSL for nitrate is 100,000 mg/kg, indicating that potential toxicity is very low. In addition, nitrate is naturally occurring and the detected concentrations likely reflect natural levels. Because of the potentially very low toxicity, the infrequent detection, and naturally occurring concentrations, nitrate is eliminated as a COPEC.

Perchlorate was detected in six samples with a maximum detected concentration of 0.00312 mg/kg. The EPA regional screening level for residential is 55 mg/kg, which indicates that the potential toxicity of perchlorate is low. Because of the potentially low toxicity, the low concentrations, and the infrequent detection, perchlorate is not retained as a COPEC.

H-5.4.5.4 AOC 54-007(d)

Nitrate was detected in 20 samples with a maximum concentration of 8.42 mg/kg. The NMED residential SSL for nitrate is 100,000 mg/kg, indicating that potential toxicity is very low. In addition, nitrate is naturally occurring and the detected concentrations likely reflect natural levels. Because of the potentially very low toxicity and naturally occurring concentrations, nitrate is eliminated as a COPEC.

H-5.4.6 Comparison with Results of Previous Field and Laboratory Studies

Biota investigations have been conducted in canyon reaches in Los Alamos/Pueblo Canyon (LANL 2004, 087390) and Mortandad Canyon (LANL 2006, 094161; LANL 2007, 098279). Field and laboratory studies included collecting and analyzing soil, sediment, and water samples; cavity-nesting bird monitoring and analysis of eggs; small mammal trapping and analysis of whole organisms; earthworm bioaccumulation tests—measures of growth and survival, and analysis of whole organisms; and seedling germination tests.

The field and laboratory results on small mammals, birds, earthworms, and plants included reaches with similar or higher COPEC concentrations as detected at sites within the Middle Cañada del Buey Aggregate Area. The studies found no effects from exposure to COPECs in any of the canyon reaches further supporting the conclusion that there is no potential ecological risk at these sites.

H-5.5 Interpretation

H-5.5.1 Receptor Lines of Evidence

Based on the ecological risk screening assessments, several COPECs (including COPECs without ESLs) were identified at the Middle Cañada del Buey Aggregate Area sites. Receptors were evaluated using several lines of evidence: minimum ESL comparisons, HI analyses, comparison to background concentrations, the relative toxicity, infrequency of detection, and comparisons to previous field and laboratory canyon investigations.

H-5.5.1.1 Kestrel (Top Carnivore)

- For AOC 54-007(d), the initial screening using the minimum ESLs eliminated all COPECs because the HQs for all of the receptors, including the kestrel (top carnivore), were less than 0.3.
- For AOC 51-001, no COPCs were detected or were above background within the 0–5 ft bgs depth interval used to evaluate potential ecological risk. Therefore, no complete pathways exist for exposure of ecological receptors, including the kestrel (top carnivore), and no screening evaluation was conducted.
- For AOCs 18-005(b) and 18-005(c), the HI analyses indicated that HIs for the kestrel (top carnivore) were less than 1.0.

These lines of evidence support the conclusion that no potential ecological risk to the kestrel (top carnivore) [or the Mexican spotted owl for which the kestrel (top carnivore) is a surrogate] exists at the Middle Cañada del Buey Aggregate Area sites.

H-5.5.1.2 Kestrel (Intermediate Carnivore)

- For AOC 54-007(d), the initial screening using the minimum ESLs eliminated all COPECs because the HQs for all of the receptors, including the kestrel, were less than 0.3.
- For AOC 51-001, no COPCs were detected or were above background within the depth interval of 0–5 ft bgs used to evaluate potential ecological risk. Therefore, no complete pathways exist for exposure of ecological receptors, including the kestrel, and no screening evaluation was conducted.
- For AOCs 18-005(b) and 18-005(c), the HI analyses indicated that HIs for the kestrel were less than 1.0.

These lines of evidence support the conclusion that no potential ecological risk to the kestrel (intermediate carnivore) exists at the Middle Cañada del Buey Aggregate Area sites.

H-5.5.1.3 Robin (Herbivore, Insectivore, Omnivore)

- For AOC 54-007(d), the initial screening using the minimum ESLs eliminated all COPECs because the HQs for all of the receptors, including the robin, were less than 0.3.
- For AOC 51-001, no COPCs were detected or were above background within the depth interval of 0–5 ft bgs used to evaluate potential ecological risk. Therefore, no complete pathways exist for exposure of ecological receptors, including the robin, and no screening evaluation was conducted.
- For AOCs 18-005(b) and 18-005(c), the HI analyses indicated that the HIs for the robin were less than 1.0.
- Field studies and laboratory analyses on birds in Los Alamos/Pueblo Canyon (LANL 2004, 087390) and Mortandad Canyon (LANL 2006, 094161; LANL 2007, 098279) included reaches with similar or higher concentrations and found no effects from exposure.

These lines of evidence support the conclusion that no potential ecological risk to the robin (all feeding guilds) exists at the Middle Cañada del Buey Aggregate Area sites.

H-5.5.1.4 Deer Mouse (Omnivore)

- For AOC 54-007(d), the screening using the minimum ESLs eliminated all COPECs because the HQs for all of the receptors, including the deer mouse, were less than 0.3.
- For AOC 51-001, no COPCs were detected or were above background within the depth interval of 0–5 ft bgs used to evaluate potential ecological risk. Therefore, no complete pathways exist for exposure of ecological receptors, including the deer mouse, and no screening evaluation was conducted.
- For AOCs 18-005(b) and 18-005(c), COPECs were eliminated because their EPCs were similar to background concentrations.
- Field studies and laboratory analyses on small mammals in Los Alamos/Pueblo Canyon (LANL 2004, 087390) and Mortandad Canyon (LANL 2006, 094161; LANL 2007, 098279) included reaches with similar or higher concentrations of COPECs and found no effects from exposure.
- These lines of evidence support the conclusion that no potential ecological risk to the deer mouse exists at the Middle Cañada del Buey Aggregate Area sites.

H-5.5.1.5 Desert Cottontail (Herbivore)

- For AOC 54-007(d), the initial screening using the minimum ESLs eliminated all COPECs because the HQs for all of the receptors, including the cottontail, were less than 0.3.
- For AOC 51-001, no COPCs were detected or were above background within the depth interval of 0–5 ft bgs used to evaluate potential ecological risk. Therefore, no complete pathways exist for exposure of ecological receptors, including the cottontail, and no screening evaluation was conducted.
- For AOCs 18-005(b) and 18-005(c), the HI analyses indicated that the HIs for the cottontail were less than 1.0.

These lines of evidence support the conclusion that no potential ecological risk to the cottontail exists at the Middle Cañada del Buey Aggregate Area sites.

H-5.5.1.6 Montane Shrew (Insectivore)

- For AOC 54-007(d), the screening using the minimum ESLs eliminated all COPECs because the HQs for all of the receptors, including the shrew, were less than 0.3.
- For AOC 51-001, no COPCs were detected or were above background within the depth interval of 0–5 ft bgs used to evaluate potential ecological risk. Therefore, no complete pathways exist for exposure of ecological receptors, including the shrew, and no screening evaluation was conducted.
- For AOCs 18-005(b) and 18-005(c), COPECs were eliminated because their EPCs were similar to background concentrations.
- Field studies and laboratory analyses on small mammals in Los Alamos/Pueblo Canyon (LANL 2004, 087390) and Mortandad Canyon (LANL 2006, 094161; LANL 2007, 098279) included reaches with similar or higher concentrations of COPECs and found no effects from exposure.

These lines of evidence support the conclusion that no potential ecological risk to the shrew exists at the Middle Cañada del Buey Aggregate Area sites.

H-5.5.1.7 Red Fox (Carnivore)

- For AOC 54-007(d), the initial screening using the minimum ESLs eliminated all COPECs because the HQs for all of the receptors, including the fox, were less than 0.3.
- For AOC 51-001, no COPCs were detected or were above background within the depth interval of 0–5 ft bgs used to evaluate potential ecological risk. Therefore, no complete pathways exist for exposure of ecological receptors, including the fox, and no screening evaluation was conducted.
- For AOCs 18-005(b) and 18-005(c), the HI analyses indicated that the HIs for the cottontail were less than 1.0.

These lines of evidence support the conclusion that no potential ecological risk to the fox exists at the Middle Cañada del Buey Aggregate Area sites.

H-5.5.1.8 Earthworm (Invertebrate)

- For AOC 54-007(d), the initial screening using the minimum ESLs eliminated all COPECs because the HQs for all of the receptors, including the earthworm, were less than 0.3.
- For AOC 51-001, no COPCs were detected or were above background within the depth interval of 0–5 ft bgs used to evaluate potential ecological risk. Therefore, no complete pathways exist for exposure of ecological receptors, including the earthworm, and no screening evaluation was conducted.
- For AOC 18-005(b), the HI analyses indicated that the HI for the earthworm was less than 1.0.
- For AOC 18-005(c), all COPECs were eliminated because their EPCs were similar to background concentrations.
- Laboratory studies on earthworms in Los Alamos/Pueblo Canyon (LANL 2004, 087390) and Mortandad Canyon (LANL 2006, 094161; LANL 2007, 098279) included reaches with similar or higher COPEC concentrations and found no effects from exposure.

These lines of evidence support the conclusion that no potential ecological risk to the earthworm exists at the Middle Cañada del Buey Aggregate Area sites.

H-5.5.1.9 Plant

- For AOC 54-007(d), the initial screening using the minimum ESLs eliminated all COPECs because the HQs for all of the receptors, including the plant, were less than 0.3.
- For AOC 51-001, no COPCs were detected or were above background within the depth interval of 0–5 ft bgs used to evaluate potential ecological risk. Therefore, no complete pathways exist for exposure of ecological receptors, including the plant, and no screening evaluation was conducted.
- For AOCs 18-005(b) and 18-005(c), all COPECs were eliminated because their EPCs were similar to background concentrations.
- The plant communities were evaluated at all sites during site visits. No evidence of adverse impacts of contamination to the plant communities was found based on field observations during site visits (Attachment H-1). The plant community within the AOCs is typical of a disturbed area, consisting primarily of grasses and weeds. The plant communities of the surrounding area appear healthy and consist of shrubs, grasses, and trees.

- Field and laboratory studies on plants in Los Alamos/Pueblo Canyon (LANL 2004, 087390) and Mortandad Canyon (LANL 2006, 094161; LANL 2007, 098279) included reaches with similar or higher COPEC concentrations and found no effects from exposure.

These lines of evidence support the conclusion that no potential ecological risk to the plant exists at the Middle Cañada del Buey Aggregate Area sites.

H-5.6.1.10 COPECs with No ESLs

The COPECs with no ESLs (nitrate and perchlorate) were not evaluated for each receptor. If a residential SSL was available, it was used to estimate potential toxicity. All COPECs without ESLs were eliminated based on these comparisons because the potential toxicity was determined to be low or very low.

The analysis of COPECs with no ESLs supports the conclusion that no potential ecological risk to any receptor exists at the Middle Cañada del Buey Aggregate Area sites.

H-6.0 CONCLUSIONS AND RECOMMENDATIONS

H-6.1 Human Health

The human health risk screening assessments indicated no potential unacceptable risks or doses from COPCs for the industrial scenario [AOCs 18-005(b) and 18-005(c)] and the construction worker scenarios (all AOCs) in the Middle Cañada del Buey Aggregate Area. The human health risk screening assessments indicated no potential unacceptable risks or doses for the residential scenario at two sites. AOCs 18-005(c) and 54-007(d) had potential unacceptable cancer risks for the residential scenario.

The HIs for the industrial, construction worker, and residential scenarios are less than the NMED target HI of 1.0 (NMED 2006, 092513) for all sites.

The doses for the construction worker and residential scenarios are below the DOE target dose of 15 mrem/yr at AOC 51-001. The other sites had no radionuclide COPCs. The radionuclide EPCs were also used to estimate the total risk, using EPA's radionuclide PRGs (http://epa-orgs.ornl.gov/cgi-bin/radionuclides/rprg_search) for an outdoor worker and a resident. The total risks from radionuclides are 1×10^{-7} and 5×10^{-7} for the construction worker and residential scenarios, respectively.

The total excess cancer risks were below the NMED target risk level of 1×10^{-5} (NMED 2006, 092513) for the industrial and construction worker scenarios at all sites where evaluated. The total excess cancer risks for the residential scenario were below the NMED target risk level at AOCs 18-005(b) and 51-001. The total excess cancer risks for the residential scenario were slightly above the NMED target risk level at AOCs 18-005(c) and 54-007(d).

For AOCs 18-005(c) and 54-007(d), the elevated total excess cancer risks (2×10^{-5}) are from arsenic. However, the arsenic levels and EPCs are similar to background concentrations, and arsenic is eliminated as a COPC because exposure across the site is similar to background. The total excess cancer risks without arsenic are approximately 4×10^{-8} and 6×10^{-7}, respectively, both of which are below the NMED target risk level of 1×10^{-5} (NMED 2006, 092513).

Therefore, the human health risk and dose assessments for the sites within the Middle Cañada del Buey Aggregate Area indicate that there are no potential unacceptable risks or doses under any scenario.

H-6.2 Ecology

No potential ecological risks were found for any receptor based on minimum ESL comparisons, HI analyses, comparisons to background concentrations, the relative toxicity, and the infrequency of detection. In addition, field and laboratory studies conducted and reported as part of the ecological investigations in Los Alamos and Pueblo Canyons (LANL 2004, 087390) and Mortandad Canyon (LANL 2006, 094161; LANL 2007, 098279) have found that similar or higher concentrations of COPECs have not adversely impacted small mammal, bird, earthworm, and plant populations, and individual Mexican spotted owls. These lines of evidence, discussed above for each receptor, and the analysis of COPECs with no ESLs support the conclusion that no potential ecological risks exists in the Middle Cañada del Buey Aggregate Area.

H-7.0 REFERENCES

The following list includes all documents cited in this appendix. Parenthetical information following each reference provides the author(s), publication date, and ER Identification (ID). This information is also included in text citations. ER ID numbers are assigned by the Environmental Program 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; the DOE-Los Alamos Site Office; EPA, Region 6; 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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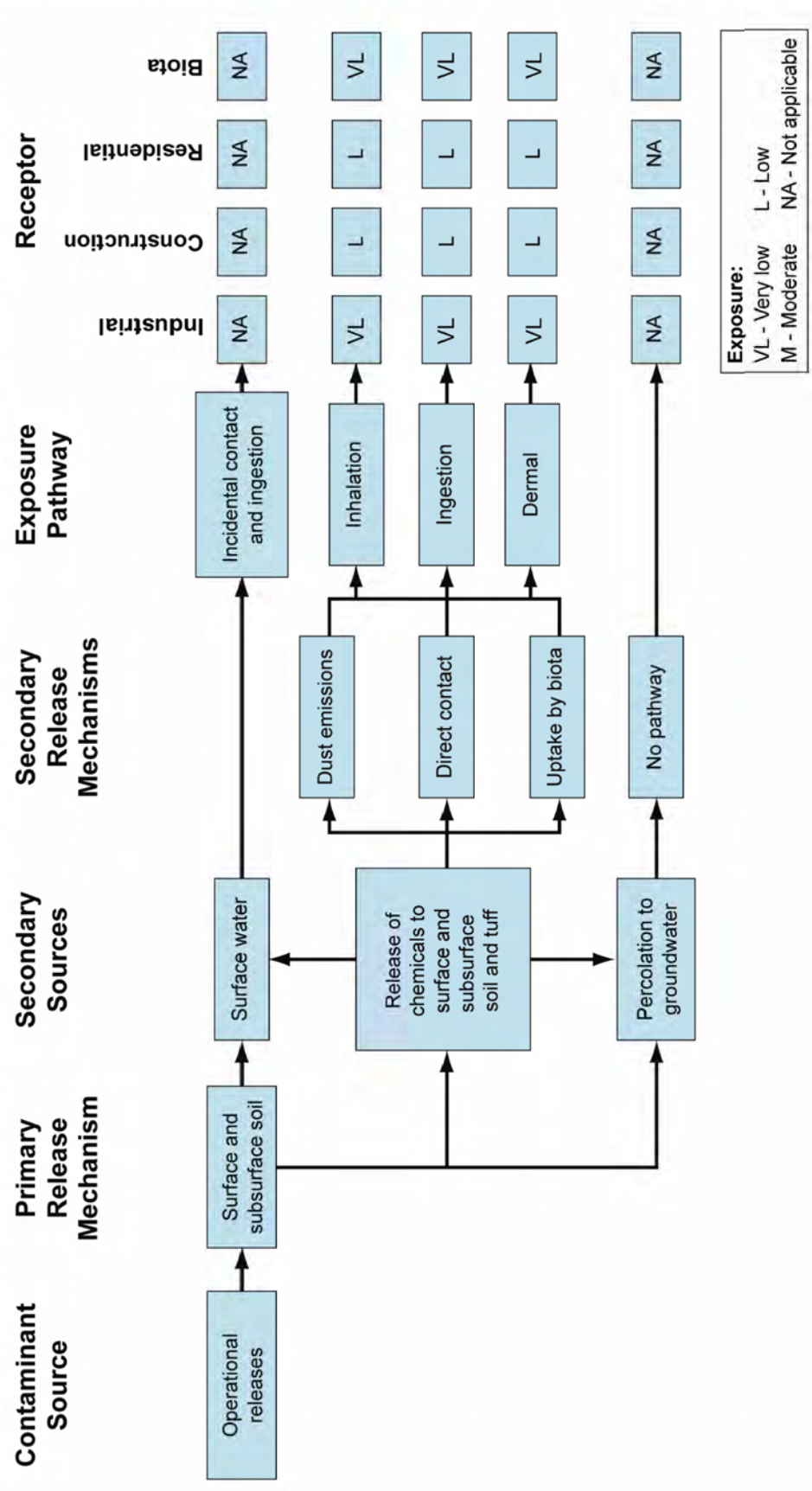


Figure H-3.1-1 Conceptual site model for Middle Cañada del Buey Aggregate Area

Table H-2.4-1
Residential and Construction Worker COPC Statistics for AOC 51-001 (0–10 ft bgs)

COPC	Number of Analyses/ Number of Detects	Minimum Result	Maximum Result	Mean Result	Standard Dev.	EPC	Distribution Type	EPC Method
Inorganic Chemicals (mg/kg)								
Antimony	4/3	0.324(J)	0.993(U)	0.562	0.306	0.563	n/a*	Maximum detected concentration
Nitrate	4/1	0.861(UJ)	1.16(J-)	0.972	n/a	1.16	n/a	Maximum detected concentration
Selenium	4/0	0.991(U)	1.04(U)	1.017	n/a	1.04	n/a	Maximum detection limit
Radionuclides (pCi/g)								
Cesium-137	12/1	0.0266(U)	0.0761	0.0514	n/a	0.0761	n/a	Maximum detected concentration
Tritium	6/1	-0.00529(U)	0.00917(U)	0.00482	n/a	0.00896	n/a	Maximum detected concentration
Uranium-235/236	4/4	0.0565	0.098	0.0768	0.0173	0.098	n/a	Maximum detected concentration

*n/a = Not applicable.

Table H-2.4-2
Industrial COPC Statistics for AOC 18-005(b) (0–1 ft bgs)

COPC	Number of Analyses/ Number of Detects	Minimum Result	Maximum Result	Mean Result	Standard Dev.	EPC	Distribution Type	EPC Method
Inorganic Chemicals (mg/kg)								
Antimony	4/4	1.04(J)	1.3	1.148	0.129	1.3	n/a*	Maximum detected concentration
Nitrate	4/4	8.25	32.7	15.88	11.41	32.7	n/a	Maximum detected concentration
Perchlorate	4/1	0.000596(J)	0.00222(U)	0.0018	n/a	0.0006	n/a	Maximum detected concentration

*n/a = Not applicable.

Table H-2.4-3
Residential, Construction Worker, and Ecological COPC Statistics for AOC 18-005(b) (0–3 ft bgs)

COPC	Number of Analyses/ Number of Detects	Minimum Result	Maximum Result	Mean Result	Standard Dev.	EPC	Distribution Type	EPC Method
Inorganic Chemicals (mg/kg)								
Antimony	8/7	0.473(J)	1.3	0.974	0.278	1.138	Nonparametric	95% KM (t)
Barium	8/8	52.2	420	153.9	126.4	273.1	Gamma	95% Approximate Gamma
Nitrate	8/8	8.25	32.7	15.46	8.353	21.05	Normal	95% Student's-t
Perchlorate	8/2	0.000596(J)	0.00238(U)	0.00187	0.0007398	0.00076	n/a*	Maximum detected concentration

*n/a = Not applicable.

Table H-2.4-4
Industrial COPC Statistics for AOC 18-005(c) (0–1 ft bgs)

COPC	Number of Analyses/ Number of Detects	Minimum Result	Maximum Result	Mean Result	Standard Dev.	EPC	Distribution Type	EPC Method
Inorganic Chemicals (mg/kg)								
Antimony	4/4	0.665(J)	1.58	1.159	0.455	1.58	n/a*	Maximum detected concentration
Nitrate	4/1	1.02(J-)	1.06(UJ)	1.045	n/a	1.02	n/a	Maximum detected concentration
Perchlorate	4/2	0.00057(J)	0.0022(U)	0.00142	0.000869	0.00078	n/a	Maximum detected concentration

*n/a = Not applicable.

Table H-2.4-5
Residential, Construction Worker, and Ecological COPC Statistics for AOC 18-005(c) (0–3 ft bgs)

COPC	Number of Analyses/ Number of Detects	Minimum Result	Maximum Result	Mean Result	Standard Dev.	EPC	Distribution Type	EPC Method
Inorganic Chemicals (mg/kg)								
Antimony	8/8	0.369(J)	1.58	0.924	0.548	1.472	Gamma	95% Approximate Gamma
Arsenic	8/8	3.67	7.79	5.793	1.631	6.885	Normal	95% Student's-t
Barium	8/8	47	121	83.6	25.22	100.5	Normal	95% Student's-t
Chromium	8/8	7.29	16.3	10.45	2.9	12.39	Normal	95% Student's-t
Nitrate	8/2	0.996(UJ)	3.19(J-)	1.305	0.762	3.19	n/a*	Maximum detected concentration
Perchlorate	8/6	0.00057(J)	0.00312	0.00158	0.0009465	0.00192	Nonparametric	95% KM (t)

*n/a = Not applicable.

Table H-2.4-6
Residential and Construction Worker COPC Statistics for AOC 54-007(d) (0–10 ft bgs)

COPC	Number of Analyses/ Number of Detects	Minimum Result	Maximum Result	Mean Result	Standard Dev.	EPC	Distribution Type	EPC Method
Inorganic Chemicals (mg/kg)								
Antimony	28/28	0.376(J)	3.75	1.962	1.064	2.838	Nonparametric	95% Chebyshev (Mean, Sd)
Arsenic	28/28	4.69	12.3	8.718	2.557	9.537	Normal	95% Modified-t
Nitrate	28/17	0.608(J-)	8.42(J-)	2.288	1.837	2.855	Nonparametric	95% KM (Percentile Bootstrap)
Zinc	28/28	24.6	195	42.59	42.64	77.71	Nonparametric	95% Chebyshev (Mean, Sd)
Polychlorinated Biphenyls (mg/kg)								
Aroclor-1242	28/1	0.0035(U)	0.0182(U)	0.00499	n/a	0.0131	n/a*	Maximum detected concentration
Aroclor-1254	28/21	0.0025(J)	0.2	0.0305	0.05	0.0899	Nonparametric	97.5% KM (Chebyshev)
Aroclor-1260	28/16	0.0035(U)	0.0877	0.016	0.0209	0.0229	Nonparametric	95% KM (t)
Semivolatile Organic Chemicals (mg/kg)								
Bis(2-ethylhexyl)phthalate	54/2	0.108(J)	0.39(UJ)	0.266	0.0932	0.31	n/a	Maximum detected concentration
Volatile Organic Chemicals (mg/kg)								
Benzene	54/6	0.00106(U)	0.0078(U)	0.00302	0.0023	0.00186	Nonparametric	95% KM (t)
Bromomethane	54/1	0.00106(U)	0.018(U)	0.00609	n/a	0.0023	n/a	Maximum detected concentration
Butanone[2-]	54/12	0.0039(J)	0.034(U)	0.0108	0.00815	0.00706	Nonparametric	95% KM (Percentile Bootstrap)
Isopropylbenzene	54/1	0.00106(U)	0.0088(U)	0.00349	n/a	0.0017	n/a	Maximum detected concentration
Isopropyltoluene[4-]	54/3	0.00106(U)	0.0088(U)	0.00347	0.00262	0.0065	n/a	Maximum detected concentration
Methyl-2-pentanone[4-]	54/3	0.0038(J+)	0.035(U)	0.0137	0.0101	0.0063	n/a	Maximum detected concentration
Methylene Chloride	54/2	0.00229(U)	0.0088(U)	0.00465	0.00187	0.00276	n/a	Maximum detected concentration
Toluene	54/3	0.00106(U)	0.0088(U)	0.00342	0.00265	0.0073	n/a	Maximum detected concentration
Trichlorofluoromethane	54/2	0.00106(U)	0.018(U)	0.00629	0.00592	0.0032	n/a	Maximum detected concentration
Trimethylbenzene[1,2,4-]	52/1	0.00106(U)	0.0088(U)	0.00344	n/a	0.0032	n/a	Maximum detected concentration

*n/a = Not applicable.

Table H-2.4-7
Ecological COPC Statistics for AOC 54-007(d) (0–5 ft bgs)

COPC	Number of Analyses/ Number of Detects	Minimum Result	Maximum Result	Mean Result	Standard Dev.	EPC	Distribution Type	EPC Method
Volatile Organic Chemicals (mg/kg)								
Benzene	1/1	0.0016(J+)	0.0016(J+)	0.0016	n/a	0.0016	n/a*	Maximum detected concentration
Butanone[2-]	1/1	0.0084(J+)	0.0084(J+)	0.0084	n/a	0.0084	n/a	Maximum detected concentration

*n/a = Not applicable.

Table H-3.2-1
Physical and Chemical Properties of Inorganic COPCs

COPC	K_d [a] (cm^3/g)	Water Solubility [a,b] (g/L)
Arsenic	29	Insoluble
Antimony	45	Insoluble
Barium	41	Insoluble
Cadmium	75	Insoluble
Chromium	850[c]	Insoluble
Mercury	52	Insoluble
Nitrate	0.0356	na[d]
Perchlorate	na	2.45E+05
Selenium	5	Insoluble
Silver	8.3	Insoluble
Zinc	62	Insoluble

[a] Information from http://rais.ornl.gov/cgi-bin/tox/TOX_select?select=nrad.

[b] Information from http://www.epa.gov/superfund/sites/npl/hrsres/tools/scdm.htm.

[c] As chromium salts.

[d] na = Not available.

Table H-3.2-2
Physical and Chemical Properties of Organic COPCs

COPC	Organic Carbon Partition Coefficient, K_{oc}* (L/kg)	Log Octanol-Water Partition Coefficient, K_{ow}*	Water Solubility (mg/L)*	Vapor Pressure* (mm Hg at 25°C)
Aroclor-1242	4.48E+04	6.29E+00	2.77E-01	8.63E-05
Aroclor-1254	7.56E+04	6.79E+00	3.40E-03	6.53E-06
Aroclor-1260	2.07E+05	8.27E+00	2.84E-04	4.05E-05
Bis(2-ethylhexyl)phthalate	1.65E+05	7.60E+00	2.70E-01	1.42E-07
Bromomethane	1.43E+01	1.19E+00	1.52E+04	1.62E+03
Butanone[2-]	3.83E+00	2.90E-01	2.23E+05	9.06E+01
Isopropylbenzene	8.17E+02	3.66E+00	6.13E+01	4.5E+00
Isopropyltoluene[4-]	1.32E+03	4.10E+00	2.34E+01	1.64E+00
Methyl-2-pentanone[4-]	1.09E+01	1.31E+00	1.90E+04	1.99E+01
Methylene chloride	2.37E+01	1.25E+00	1.30E+04	4.30E+02
Toluene	2.68E+02	2.73E+00	5.26E+02	2.84E+01
Trichlorofluoromethane	4.86E+01	2.53E+00	1.1E+03	8.03E+02
Trimethylbenzene[1,2,4-]	7.18E+02	3.63E+00	5.7E+01	2.1E+00

*Information from http://rais.ornl.gov/cgi-bin/tox/TOX_select?select=nrad, unless noted otherwise.

Table H-3.2-3
Physical and Chemical Properties of Radionuclide COPCs

COPC	Soil-Water Partition Coefficient, K_d [a] (cm^3/g)	Water Solubility[b] (g/L)
Cesium-137	1000	Insoluble
Tritium	9.9	Soluble
Uranium-235	0.4	Insoluble

[a] Information from Superfund Chemical Data Matrix (EPA 1996, 064708).

[b] Information from http://www.epa.gov/superfund/sites/npl/hrsres/tools/scdm.htm.

Table H-4.1-1
Parameters Used to Calculate Chemical SSLs

Parameters	Residential Values	Industrial Worker Values	Construction Worker Values
Target HQ	1	1	1
Target cancer risk	10^{-5}	10^{-5}	10^{-5}
Averaging time (carcinogen)	70 yr x 365 days	70 yr x 365 days	70 yr x 365 days
Averaging time (noncarcinogen)	ED x 365 days	ED x 365 days	ED x 365 days
Skin absorption factor	Semivolatile organic compound (SVOC) = 0.1; Chemical-specific	SVOC = 0.1; Chemical-specific	SVOC = 0.1; Chemical-specific
Adherence factor–child	0.2 mg/cm^2	n/a[a]	n/a
Body weight–child	15 kg (age: 0–6 years)	n/a	n/a
Cancer slope factor–oral (chemical-specific)	(mg/kg-day)$^{-1}$	(mg/kg-day)$^{-1}$	(mg/kg-day)$^{-1}$
Cancer slope factor–inhalation (chemical-specific)	(mg/kg-day)$^{-1}$	(mg/kg-day)$^{-1}$	(mg/kg-day)$^{-1}$
Exposure frequency	350 day/yr	225 day/yr	250 day/yr
Exposure duration–child	6 yr	n/a	n/a
Age-adjusted ingestion factor	114 mg-yr/kg-day	n/a	n/a
Age-adjusted inhalation factor	11 m^3-yr/kg-day	n/a	n/a
Inhalation rate–child	10 m^3/day	n/a	n/a
Soil ingestion rate–child	200 mg/day	n/a	n/a
Particulate emission factor	6.61 x 10^9 m^3/kg	6.61 x 10^9 m^3/kg	2.1 x 10^6 m^3/kg
RfD–oral (chemical-specific)	(mg/kg-day)	(mg/kg-day)	(mg/kg-day)
RfD–inhalation (chemical-specific)	(mg/kg-day)	(mg/kg-day)	(mg/kg-day)
Exposed surface area–child	2800 cm^2/day	n/a	n/a
Age-adjusted skin contact factor (carcinogens)	361 mg-yr/kg-day	n/a	n/a
VF for soil (chemical-specific)	(m^3/kg)	(m^3/kg)	(m^3/kg)
Body weight–adult	70 kg	70 kg	70 kg
Exposure duration[b]	30 yr	25 yr	1 yr
Adherence factor–adult	0.07 mg/cm^2	0.2 mg/cm^2	0.3 mg/cm^2
Soil ingestion rate–adult	100 mg/day	100 mg/day	330 mg/day
Exposed surface area–adult	5700 cm^2/day	3300 cm^2/day	3300 cm^2/day
Inhalation rate–adult	20 m^3/day	20 m^3/day	20 m^3/day

Note: Parameter values from NMED (2006, 092513).

[a] n/a = Not applicable.

[b] Exposure duration for lifetime resident is 30 yr. For carcinogens, the exposures are combined for child (6 yr) and adult (24 yr).

Table H-4.1-2
Parameters Used in the SAL Calculations for Radionuclides, Residential

Parameters	Residential, Child	Residential, Adult
Inhalation rate (m^3/yr)	3652.5[a]	7305[b]
Mass loading (g/m^3)	1.5×10^{-7} [c]	1.5×10^{-7} [c]
Outdoor time fraction	0.2236[d]	0.0599[e]
Indoor time fraction	0.7347[f]	0.8984[g]
Soil ingestion (g/yr)	73[h]	36.5[i]

[a] Calculated as [10 m^3/day x 350 day/yr] / [indoor + outdoor time fractions], where 10 m^3/day is the daily inhalation rate of a child (NMED 2006, 092513).

[b] Calculated as [20 m^3/day x 350 day/yr] / [indoor + outdoor time fractions], where 20 m^3/day is the daily inhalation rate of an adult (NMED 2006, 092513).

[c] Calculated as [1/ $6.6 \times 10^{+9}$ m^3/kg) x 1000 g/kg, where $6.6 \times 10^{+9}$ m^3/kg is the particulate emission factor (NMED 2006, 092513).

[d] Calculated as [5.6 hr/day x 350 day/yr] / 8766 hr/yr, where 5.6 hr/day is an estimate of time spent outdoors for a 3- to 11-yr-old child (EPA 1997, 066598, section 15.4-1).

[e] Calculated as [1.5 hr/day x 350 day/yr] / 8766 hr/yr, where 1.5 hr/day is an estimate of time spent outdoors for an adult 12 yr and older (EPA 1997, 066598, section 15.4-1).

[f] Calculated as [(24–5.6 hr/day x 350 day/yr] / 8766 hr/yr.

[g] Calculated as [(24–1.5 hr/day x 350 day/yr] / 8766 hr/yr.

[h] Calculated as [0.2 g/day x 350 day/yr] / [indoor + outdoor time fractions], where 0.2 g/day is the child soil-ingestion rate (NMED 2006, 092513).

[i] Calculated as [0.1 g/day x 350 day/yr] / [indoor + outdoor time fractions], where 0.1 g/day is the adult soil-ingestion rate (NMED 2006, 092513).

Table H-4.1-3
Parameters Used in the SAL Calculations for Radionuclides, Industrial and Construction Worker

Parameters	Industrial, Adult	Construction Worker, Adult
Inhalation rate (m^3/yr)	19,481[a]	19,478[b]
Mass loading (g/m^3)	1.5×10^{-7} [c]	0.0004[d]
Outdoor time fraction	0.2053[e]	0.2567[f]
Indoor time fraction	0	0
Soil ingestion (g/yr)	97.4[g]	321[h]

[a] Calculated as [20 m^3/day x 225 day/yr] / [indoor + outdoor time fractions], where 20 m^3/day is the daily inhalation rate of an adult and 225 days/yr is the exposure frequency (NMED 2006, 092513).

[b] Calculated as [20 m^3/day x 250 day/yr] / [indoor + outdoor time fractions], where 20 m^3/day is the daily inhalation rate of an adult and 250 days/yr is the exposure frequency (NMED 2006, 092513).

[c] Calculated as [1/ $6.6 \times 10^{+9}$ m^3/kg] x 1000 g/kg, where $6.6 \times 10^{+9}$ m^3/kg is the particulate emission factor (NMED 2006, 092513).

[d] Calculated as [1/ $2.1 \times 10^{+6}$ m^3/kg] x 1000 g/kg, where $2.1 \times 10^{+6}$ m^3/kg is the particulate emission factor (NMED 2006, 092513).

[e] Calculated as [8 hr/day x 225 day/yr] / 8766 hr/yr, where 8 hr/day is an estimate of the average length of the work day.

[f] Calculated as [9 hr/day x 250 day/yr] / 8766 hr/yr, where 9 hr/day is an estimate of the average length of the work day.

[g] Calculated as [0.1 g/day x 225 day/yr] / [indoor + outdoor time fractions], where 0.1 g/day is the adult soil ingestion rate (NMED 2006, 092513).

[h] Calculated as [0.33 g/day x 250 day/yr] / [indoor + outdoor time fractions], where 0.33 g/day is the adult soil ingestion rate (NMED 2006, 092513).

Table H-4.2-1
Construction Worker Noncarcinogenic Screening Evaluation for AOC 51-001

COPC	EPC[a] (mg/kg)	Construction Worker SSL[b] (mg/kg)	HQ
Antimony	0.563	124	0.0045
Cadmium	0.524[c]	154	0.0034
Nitrate	1.16	100,000	0.000012
Selenium	1.04[c]	1550	0.00067
		HI	**0.009**

[a] Maximum detected concentrations unless otherwise noted.

[b] SSL from NMED (2006, 092513), unless noted otherwise.

[c] Maximum detection limit.

Table H-4.2-2
Construction Worker Radionuclide Screening Evaluation for AOC 51-001

COPC	EPC[a] (pCi/g)	Construction Worker SAL[b] (pCi/g)	Dose (mrem/yr)
Cesium-137	0.0761	18	0.063
Tritium	0.00896	320,000	0.00000042
Uranium-235	0.098	43	0.034
		Total Dose	**0.1**

[a] Maximum detected concentrations.

[b] SALs from LANL (2005, 088493).

Table H-4.2-3
Residential Noncarcinogenic Screening Evaluation for AOC 51-001

COPC	EPC[a] (mg/kg)	Residential SSL[b] (mg/kg)	HQ
Antimony	0.563	31.3	0.018
Cadmium	0.524[c]	39	0.013
Nitrate	1.16	100,000	0.000012
Selenium	1.04[c]	391	0.0027
		HI	**0.03**

[a] Maximum detected concentrations unless otherwise noted.

[b] SSL from NMED (2006, 092513), unless noted otherwise.

[c] Maximum detection limit.

Table H-4.2-4
Residential Radionuclide Screening Evaluation for AOC 51-001

COPC	EPC[a] (pCi/g)	Residential SAL[b] (pCi/g)	Dose (mrem/yr)
Cesium-137	0.0761	5.6	0.2
Tritium	0.00896	750	0.00018
Uranium-235	0.098	17	0.086
		Total Dose	**0.3**

[a] Maximum detected concentrations.

[b] SALs from LANL (2005, 088493).

Table H-4.2-5
Industrial Noncarcinogenic Screening Evaluation for AOC 18-005(b)

COPC	EPC[a] (mg/kg)	Industrial SSL[b] (mg/kg)	HQ
Antimony	1.3	454	0.0029
Barium	76.2	100,000	0.00076
Nitrate	32.7	100,000	0.00033
Perchlorate	0.0006	720[c]	0.00000083
		HI	**0.004**

[a] Maximum detected concentration.

[b] SSL from NMED (2006, 092513), unless noted otherwise.

[c] Screening level from EPA regional screening table (http://www.epa.gov/region09/superfund/prg/pdf/master_sl_table_run_12SEP2008.pdf).

Table H-4.2-6
Construction Worker Noncarcinogenic Screening Evaluation for AOC 18-005(b)

COPC	EPC[a] (mg/kg)	Construction Worker SSL[b] (mg/kg)	HQ
Antimony	1.14	124	0.0092
Barium	273.1	60,200	0.0045
Nitrate	21.1	100,000	0.00021
Perchlorate	0.00076	720[c]	0.0000011
		HI	**0.01**

[a] UCL used.

[b] SSL from NMED (2006, 092513), unless noted otherwise.

[c] Construction worker SSL not available; industrial screening value from EPA regional screening table used for comparison (http://www.epa.gov/region09/superfund/prg/pdf/master_sl_table_run_12SEP2008.pdf).

Table H-4.2-7
Residential Noncarcinogenic Screening Evaluation for AOC 18-005(b)

COPC	EPC[a] (mg/kg)	Residential SSL[b] (mg/kg)	HQ
Antimony	1.14	31.3	0.036
Barium	273.1	15,600	0.018
Nitrate	21.1	100,000	0.00021
Perchlorate	0.00076	55[c]	0.00077
		HI	**0.05**

[a] UCL used.

[b] SSL from NMED (2006, 092513), unless noted otherwise.

[c] Screening level from EPA regional screening table (http://www.epa.gov/region09/superfund/prg/pdf/master_sl_table_run_12SEP2008.pdf).

Table H-4.2-8
Industrial Noncarcinogenic Screening Evaluation for AOC 18-005(c)

COPC	EPC[a] (mg/kg)	Industrial SSL[b] (mg/kg)	HQ
Antimony	1.58	454	0.0035
Nitrate	1.02	100,000	0.00001
Perchlorate	0.00078	720[c]	0.0000011
		HI	**0.004**

[a] Maximum detected concentration used.

[b] SSL from (NMED 2006, 092513), unless noted otherwise.

[c] Screening level from EPA regional screening table (http://www.epa.gov/region09/superfund/prg/pdf/master_sl_table_run_12SEP2008.pdf).

Table H-4.2-9
Construction Worker Carcinogenic Screening Evaluation for AOC 18-005(c)

COPC	EPC[a] (mg/kg)	Construction Worker SSL[b] (mg/kg)	Cancer Risk
Chromium	12.4	14,000	9×10^{-9}
		Total Excess Cancer Risk	**9×10^{-9}**

[a] UCL used.

[b] Construction worker SSL not available; industrial screening value from EPA regional screening table used for comparison (http://www.epa.gov/region09/superfund/prg/pdf/master_sl_table_run_12SEP2008.pdf).

Table H-4.2-10
Construction Worker Noncarcinogenic Screening Evaluation for AOC 18-005(c)

COPC	EPC[a] (mg/kg)	Construction Worker SSL[b] (mg/kg)	HQ
Antimony	1.47	124	0.012
Arsenic	6.89	85.2	0.077
Barium	100.5	60,200	0.0017
Nitrate	3.19[c]	100,000	0.000032
Perchlorate	0.0019	720[d]	0.0000026
		HI	**0.09**

[a] UCL used unless otherwise noted.

[b] SSL from NMED (2006, 092513), unless noted otherwise.

[c] Maximum detected concentration.

[d] Construction worker SSL not available; industrial screening value from EPA regional screening table used for comparison (http://www.epa.gov/region09/superfund/prg/pdf/master_sl_table_run_12SEP2008.pdf).

Table H-4.2-11
Residential Carcinogenic Screening Evaluation for AOC 18-005(c)

COPC	EPC[a] (mg/kg)	Residential SSL[b] (mg/kg)	Cancer Risk
Arsenic	6.89	3.9	2×10^{-5}
Chromium	12.4	2800[c]	4×10^{-8}
		Total Excess Cancer Risk	**2×10^{-5}**

[a] UCL used.

[b] SSL from NMED (2006, 092513), unless noted otherwise.

[c] Screening level from EPA regional screening table (http://www.epa.gov/region09/superfund/prg/pdf/master_sl_table_run_12SEP2008.pdf).

Table H-4.2-12
Residential Noncarcinogenic Screening Evaluation for AOC 18-005(c)

COPC	EPC[a] (mg/kg)	Residential SSL[b] (mg/kg)	HQ
Antimony	1.47	31.3	0.047
Barium	100.5	15,600	0.0064
Nitrate	3.19[c]	100,000	0.000032
Perchlorate	0.0019	55[d]	0.000035
		HI	**0.05**

[a] UCL used unless otherwise noted.

[b] SSL from NMED (2006, 092513), unless noted otherwise.

[c] Maximum detected concentration.

[d] Screening level from EPA regional screening table (http://www.epa.gov/region09/superfund/prg/pdf/master_sl_table_run_12SEP2008.pdf).

Table H-4.2-13
Construction Worker Carcinogenic Screening Evaluation for AOC 54-007(d)

COPC	EPC[a] (mg/kg)	Construction Worker SSL[b] (mg/kg)	Cancer Risk
Aroclor-1242	0.0131[c]	8.26[d]	2×10^{-8}
Aroclor-1254	0.0899	8.26[d]	1×10^{-7}
Aroclor-1260	0.0229	8.26[d]	3×10^{-8}
Methylene chloride	0.00276[c]	490[d]	6×10^{-11}
		Total Excess Cancer Risk	**2×10^{-7}**

[a] UCL used unless otherwise noted.

[b] SSL from NMED (2006, 092513).

[c] Maximum detected concentration.

[d] Carcinogenic construction worker SSL not available; industrial SSL from NMED (2006, 092513) used for comparison.

Table H-4.2-14
Construction Worker Noncarcinogenic Screening Evaluation for AOC 54-007(d)

COPC	EPC[a] (mg/kg)	Construction Worker SSL[b] (mg/kg)	HQ
Antimony	2.84	124	0.023
Arsenic	9.54	85.2	0.11
Nitrate	2.86	100,000	0.000029
Zinc	77.7	92,900	0.00084
Aroclor-1242	0.0131[c]	4.28	0.0031
Aroclor-1254	0.0899	4.28	0.021
Aroclor-1260	0.0229	4.28	0.0054
Benzene	0.00186	174	0.000011
Bis(2-ethylhexyl)phthalate	0.31[c]	4660	0.000067
Bromomethane	0.0023[c]	28.2	0.000082
Butanone[2-]	0.00706[c]	100,000[d]	0.00000071
Isopropylbenzene	0.0017[c]	11,000[d]	0.00000015
Isopropyltoluene[4-]	0.0065[c]	11,000[d,e]	0.00000059
Methyl-2-pentanone[4-]	0.0063[c]	52,000[d]	0.00000012
Toluene	0.0073[c]	46,000[d]	0.00000016
Trichlorofluoromethane	0.0032[c]	3400[d]	0.00000094
Trimethylbenzene[1,2,4-]	0.0032[c]	190	0.000017
		HI	**0.2**

[a] UCL used unless otherwise noted.

[b] SSL from NMED (2006, 092513), unless noted otherwise.

[c] Maximum detected concentration.

[d] Construction worker SSL is C_{sat} value; Risk-based industrial screening value obtained from EPA regional screening table (http://www.epa.gov/region09/superfund/prg/pdf/master_sl_table_run_12SEP2008.pdf) used rather than the C_{sat} value.

[e] Screening value for isopropylbenzene used as a surrogate based on structural similarity.

Table H-4.2-15
Residential Carcinogenic Screening Evaluation for AOC 54-007(d)

COPC	EPC[a] (mg/kg)	Residential SSL[b] (mg/kg)	Cancer Risk
Arsenic	9.54	3.9	2×10^{-5}
Aroclor-1242	0.0131[c]	2.2[d]	6×10^{-8}
Aroclor-1254	0.0899	2.2[d]	4×10^{-7}
Aroclor-1260	0.0229	2.2[d]	1×10^{-7}
Benzene	0.00186	10.3	2×10^{-9}
Bis(2-ethylhexyl)phthalate	0.31[c]	347	9×10^{-9}
Methylene chloride	0.00276[c]	182	2×10^{-10}
		Total Excess Cancer Risk	**2×10^{-5}**

[a] UCL used unless otherwise noted.

[b] SSL from NMED (2006, 092513), unless noted otherwise.

[c] Maximum detected concentration.

[d] Screening level obtained from EPA regional screening table (http://www.epa.gov/region09/superfund/prg/pdf/master_sl_table_run_12SEP2008.pdf).

Table H-4.2-16
Residential Noncarcinogenic Screening Evaluation for AOC 54-007(d)

COPC	EPC[a] (mg/kg)	Residential SSL[b] (mg/kg)	HQ
Antimony	2.84	31.3	0.091
Nitrate	2.86	100,000	0.000029
Zinc	77.7	23,500	0.0033
Aroclor-1242	0.0131[c]	1.12	0.012
Aroclor-1254	0.0899	1.12	0.08
Aroclor-1260	0.0229	1.12	0.02
Bromomethane	0.0023[c]	8.51	0.00027
Butanone[2-]	0.00706[c]	31,800	0.00000022
Isopropylbenzene	0.0017[c]	271	0.0000063
Isopropyltoluene[4-]	0.0065[c]	271[d]	0.000024
Methyl-2-pentanone[4-]	0.0063[c]	5510	0.0000011
Toluene	0.0073[c]	5000[e]	0.0000015
Trichlorofluoromethane	0.0032[c]	588	0.0000054
Trimethylbenzene[1,2,4-]	0.0032[c]	58	0.000055
		HI	**0.2**

[a] UCL used unless otherwise noted.

[b] SSL from NMED (2006, 092513), unless noted otherwise.

[c] Maximum detected concentration.

[d] SSL for isopropylbenzene used as a surrogate based on structural similarity.

[e] Risk-based residential screening value obtained from EPA regional screening table spreadsheet (http://www.epa.gov/region09/superfund/prg/pdf/master_sl_table_run_12SEP2008.pdf) used rather than the C_{sat} value.

Table H-5.3-1
Ecological Screening Levels for Terrestrial Receptors

COPCs	American Kestrel (Avian intermediate carnivore)	American Kestrel (Avian top carnivore)	American Robin (Avian herbivore)	American Robin (Avian insectivore)	American Robin (Avian omnivore)	Deer Mouse (Mammalian omnivore)	Desert Cottontail (Mammalian herbivore)	Earthworm (Soil-dwelling invertebrate)	Plant (Terrestrial autotroph - producer)	Montane Shrew (Mammalian insectivore)	Red Fox (Mammalian top carnivore)
Antimony	na*	na	na	na	na	0.48	2.9	78	0.05	0.26	45
Arsenic	160	1100	42	18	26	32	160	6.8	18	15	810
Barium	11,000	37,000	820	1000	930	1800	3300	330	110	1300	41,000
Chromium (total)	7700	37,000	1900	830	1100	1900	13,000	2.3	2.4	750	30,000
Nitrate	na	na	na	na	na	na	na	na	na	na	na
Perchlorate	na	na	na	na	na	na	na	na	na	na	na
Benzene	na	na	na	na	na	24	35	47	na	na	7600
Butanone[2-]	na	na	na	na	na	360	420	na	na	2600	420,000

Note: Units are mg/kg. Ecological screening levels obtained from ECORISK Database, Release 2.3 (LANL 2008, 103532).
*na = Not available.

Table H-5.3-2
Final ESL Comparison for AOC 18-005(b)

COPC	EPC (mg/kg)	ESL (mg/kg)	Receptor	HQ
Antimony	1.14	0.05	Plant	**22.8**
Barium	273.1	110	Plant	**2.5**
Nitrate	21.1	na*	na	na
Perchlorate	0.000756	na	na	na

Note: Bolded values indicate HQ greater than 0.3.
*na = Not available.

Table H-5.3-3
HI Analysis for AOC 18-005(b)

COPEC	EPC (mg/kg)	American Kestrel (Avian intermediate carnivore)	American Kestrel (Avian top carnivore)	American Robin (Avian herbivore)	American Robin (Avian insectivore)	American Robin (Avian omnivore)	Deer Mouse (Mammalian omnivore)	Desert Cottontail (Mammalian herbivore)	Earthworm (Soil-dwelling invertebrate)	Plant (Terrestrial autotroph-producer)	Montane Shrew (Mammalian insectivore)	Red Fox (Mammalian top carnivore)
Antimony	1.14	na*	na	na	na	na	**2.4**	**0.39**	0.015	**22.8**	**4.4**	0.025
Barium	273.1	0.025	0.0074	**0.33**	0.27	0.29	0.15	0.083	**0.83**	**2.5**	0.21	0.0067
HI		0.03	0.007	0.3	0.3	0.3	**3**	0.5	0.8	**45**	**5**	0.03

Note: Bolded values indicate HQs greater than 0.3 or HI greater than 1.0.
*na = Not available.

Table H-5.3-4
Final ESL Comparison for AOC 18-005(c)

COPC	EPC (mg/kg)	ESL (mg/kg)	Receptor	HQ
Antimony	1.47	0.05	Plant	**29.3**
Arsenic	6.89	6.8	Earthworm	**1.01**
Barium	100.5	110	Plant	**0.9**
Chromium	12.4	2.3	Earthworm	**5.4**
Nitrate	3.19	na*	na	na
Perchlorate	0.00192	na	na	na

Note: Bolded values indicate HQ greater than 0.3.
*na = Not available.

Table H-5.3-5
HI Analysis for AOC 18-005(c)

COPEC	EPC (mg/kg)	American Kestrel (Avian intermediate carnivore)	American Kestrel (Avian top carnivore)	American Robin (Avian herbivore)	American Robin (Avian insectivore)	American Robin (Avian omnivore)	Deer Mouse (Mammalian omnivore)	Desert Cottontail (Mammalian herbivore)	Earthworm (Soil-dwelling invertebrate)	Plant (Terrestrial autotroph-producer)	Montane Shrew (Mammalian insectivore)	Red Fox (Mammalian top carnivore)
Antimony	1.47	na*	na	na	na	na	**3.1**	**0.51**	0.019	**29.4**	**5.7**	0.033
Arsenic	6.89	0.043	0.0063	0.16	**0.38**	0.27	0.22	0.043	**1**	**0.38**	**0.46**	0.0085
Barium	100.5	0.0091	0.0027	0.12	0.1	0.11	0.056	0.03	0.3	0.91	0.077	0.0025
Chromium	12.4	0.0016	0.00034	0.0065	0.015	0.011	0.0065	0.00095	**5.4**	**5.2**	0.017	0.00041
HI		0.05	0.009	0.3	0.5	0.4	**3**	0.6	**7**	**36**	**6**	0.04

Note: Bolded values indicate HQs greater than 0.3 or HI greater than 1.0.

* na = Not available.

Table H-5.3-6
Final ESL Comparison for AOC 54-007(d)

COPC	EPC (mg/kg)	ESL (mg/kg)	Receptor	HQ
Benzene	0.0016	24	Deer mouse	0.00007
Butanone[2-]	0.0084	360	Deer mouse	0.00002

Table H-5.4-1
Comparison of 95% UCLs to Background Concentrations for AOC 18-005(b)

COPEC	EPC (mg/kg)	Soil Background Concentrations* (mg/kg)	Tuff Background Concentrations* (mg/kg)
Antimony	1.14	0.1–1.0	No tuff samples collected
Barium	273.1	21–410	No tuff samples collected

*Source: LANL 1998, 059730.

Table H-5.4-2
Comparison of 95% UCLs to Background Concentrations for AOC 18-005(c)

COPEC	EPC (mg/kg)	Soil Background Concentrations[a] (mg/kg)	Tuff Background Concentrations[a] (mg/kg)
Antimony	1.47	0.1–1.0	0.05–0.4[b]
Arsenic	6.89	0.3–9.3	0.25–5
Barium	100.5	21–410	1.4– 51.6
Chromium	12.4	1.9– 36.5	0.25–13

[a] Source: LANL 1998, 059730.

[b] Antimony concentrations did not exceed the Qbt 2,3,4 BV in any tuff samples.

Attachment H-1

Ecological Scoping Checklists for
Middle Cañada del Buey Aggregate Area

H1-1.0 AOCs 18-005(b) AND 18-005(c)

Part A—Scoping Meeting Documentation

Site ID	Cañada del Buey Aggregate Area
Form of site releases (solid, liquid, vapor). Describe all relevant known or suspected mechanisms of release (spills, dumping, material disposal, outfall, explosive testing, etc.) and describe potential areas of release. Reference locations on a map as appropriate.	The Middle Cañada del Buey Aggregate Area is located in the central portion of Cañada del Buey and Mesita del Buey and incorporates parts of TA- 51 and TA-54 West at LANL. The Middle Cañada del Buey Aggregate Area includes 23 solid waste management units (SWMU) and areas of concern (AOC) Of the 23 sites, 11 have been approved for no further action, four are Resource Conservation and Recovery Act-permitted storage units, one is a Toxic Substances Control Act-permitted storage unit, one (Material Disposal Area [MDA] J) was closed under New Mexico Environment Department solid waste regulations, and two (MDAs H and L) were investigated under separate work plans. Of the four AOCs in the Middle Cañada del Buey Aggregate Area requiring additional characterization, one is located within TA-51 (AOC 51-001) and three are located within TA-54 [AOCs 18-005(b), 18-005(c), and 54-007(d)]. These sites include two former septic systems and two former high explosives storage magazines Only the two former high explosives storage magazines (AOCs 18-005(b) and 18-005(c) mentioned above are the focus of this ecological scoping checklist and they are located on the mesa tops. AOC 18-005(b) and AOC 18-005(c) at TA-54 West were both wooden structures with dimensions of 11 ft by 9 ft by 8 ft tall that consisted of former explosives magazines and were decommissioned by burning. These structures were surrounded by earthen berms on three sides and on top. These sites have not been investigated previous to the 2008 investigation. The inventory for these sites is expected to be limited to residue remaining from combustion of the structures.
List of Primary Impacted Media **(Indicate all that apply.)**	**Surface soil** – Surface soil may contain residual high explosives from the burning of the magazine buildings at AOC 18-005(b) and AOC 18-005(c) at TA-54 West**.** **Subsurface** – There are no known or suspect contaminates in the subsurface at AOC 18-005(b) and AOC 18-005(c) at TA-54 West. **Groundwater** – Alluvial or perched groundwater is not present within in the central portion of Cañada del Buey and Mesita del Buey in the vicinity of the two AOCs and the regional groundwater table is approximately 1,200 ft bgs. **Surface water** – Permanent (year round) surface water is not present in the central portion of Cañada del Buey and Mesita del Buey in the vicinity of the two AOCs. Only water ever present is sheet flow from storm water following thunderstorms and gradual melt flow from snow pack in the spring.
FIMAD vegetation class based on Arcview vegetation coverage **(Indicate all that apply.)**	Dominant trees within the central portion of Cañada del Buey and Mesita del Buey in the vicinity of the two AOCs include: juniper and piñon and gamble oak and scattered ponderosa pine. Trees are sparse and separated by open space Dominant Shrubs include: chamisa, big sagebrush, salt bush and chokeberry. Dominant forbs and grasses include: bluegrass, mountain muhly, blue grama, pine dropseed, wormwood, false tarragon, tall lupine, and cinquefoil.

Is T&E Habitat Present? **If applicable, list species known or suspected to use the site for breeding or foraging.**	The only threatened or endangered (T&E) species known to frequent the LANL area is the Mexican spotted owl. The owl's primary habitat is densely forested canyons and it has not been observed to roost in the central portion of Cañada del Buey and Mesita del Buey in the vicinity of the two AOCs, which occupy mesa tops.
Provide list of Neighboring/ Contiguous/ Up-gradient sites, include a brief summary of COPCs and form of releases for relevant sites and reference map as appropriate. **(Use information to evaluate need to aggregate sites for screening.)**	The two AOCs occupy small isolated areas (less than ¼ acre) on a mesa top and have no neighboring relevant sites up gradient or contiguous sites.
Surface Water Erosion Potential Information **Summarize information from SOP 2.01, including the run-off subscore (maximum of 46); terminal point of surface water transport; slope; and surface water run-on sources.**	The two AOCs occupy small isolated areas (less than ¼ acre each) on flat, graded mesa top sites. The run-off evidence scores for these sites range have not been calculated, but the sites are flat, and run-off and run-on is minimal.

Part B—Site Visit Documentation

Site ID	Cañada del Buey Aggregate Area
Date of Site Visit	12/12/08
Site Visit Conducted by	Gary Stoopes and Pattie Baucom

Receptor Information:

Estimate cover	Relative vegetative cover (high, medium, low, none) = low Relative wetland cover (high, medium, low, none) = none Relative structures, asphalt, etc., cover (high, medium, low, none) = none.
Field notes on the FIMAD vegetation class to assist in ground-truthing the Arcview information	Vegetation is as noted above.
Field notes on T&E Habitat, if applicable. Consider the need for a site visit by a T&E subject matter expert to support the use of the site by T&E receptors.	The only threatened or endangered (T&E) species known to frequent the LANL area is the Mexican spotted owl. The owl's primary habitat is densely forested canyons and it has not been observed to roost in the central portion of Cañada del Buey and Mesita del Buey in the vicinity of the two AOCs, which occupy mesa tops.; however, the owl may use the surrounding area as a foraging site (LANL 2001, 071060)
Are ecological receptors present at the site? **(yes/no/uncertain)** **Describe the general types of receptors present at the site (terrestrial and aquatic), and make notes on the quality of habitat present at the site.**	Yes. The vegetation near the site is healthy and varied, no adverse affects on plants were noted during field activities, and the habitat is sufficient for supporting foraging of terrestrial receptors. Vegetative community is typical of mesa tops. The following wildlife has been observed or known to be present while conducting field work at the site: elk, mule deer, coyotes, rabbits, mice, birds, and although gophers have not been observed, their burrows are quite abundant in some areas.

Contaminant Transport Information:

Surface water transport **Field notes on the erosion potential, including a discussion of the terminal point of surface water transport (if applicable).**	Surface water transport and erosion potential is low overall and consists mainly of slow snow melt in the spring and sheet flow from thunderstorms during the summer months.
Are there any off-site transport pathways (surface water, air, or groundwater)? **(yes/no/uncertain)** **Provide explanation**	Surface Water: No Groundwater: No Air: Residual particles from the burning of building material at AOC 18-005(b) and AOC 18-005(c) at TA-54 West could have been dispersed by wind.
Interim action needed to limit off-site transport? **(yes/no/uncertain)** **Provide explanation/ recommendation to project lead for IA SMDP.**	No. Releases are predominately shallow subsurface and unlikely to move.

Ecological Effects Information:

Physical Disturbance **(Provide list of major types of disturbances, including erosion and construction activities, review historical aerial photos where appropriate.)**	No. The sites have not been physically disturbed since D&D operations. There is little evidence of disturbances or erosion on the mesa tops where the AOCs are located.
Are there obvious ecological effects? **(yes/no/uncertain)** **Provide explanation and apparent cause (e.g., contamination, physical disturbance, other).**	No. The habitat is healthy and wildlife is abundant**.**
Interim action needed to limit apparent ecological effects? **(yes/no/uncertain)** **Provide explanation and recommendations to mitigate apparent exposure pathways to project lead for IA SMDP.**	No. Releases are shallow subsurface.

No Exposure/Transport Pathways:

If there are no complete exposure pathways to ecological receptors onsite and no transport pathways to offsite receptors, the remainder of the checklist should not be completed. Stop here and provide additional explanation/justification for proposing an ecological No Further Action recommendation (if needed). At a minimum, the potential for future transport should include likelihood that future construction activities could make contamination more available for exposure or transport. Not applicable.

Adequacy of Site Characterization:

Do existing or proposed data provide information on the nature, rate and extent of contamination? **(yes/no/uncertain)** **Provide explanation** **(Consider if the maximum value was captured by existing sample data.)**	Prior to December 2008, these sites were not investigated. The current data indicate a few detections of inorganic chemicals above background values
Do existing or proposed data for the site address potential transport pathways of site contamination? **(yes/no/uncertain)** **Provide explanation** **(Consider if other sites should aggregated to characterize potential ecological risk.)**	Yes. The current investigation was designed to address potential transport pathways.

Part C—Ecological Pathways Conceptual Exposure Model

Question A:

Could soil contaminants reach receptors via vapors?

- **Volatility of the hazardous substance (volatile chemicals generally have Henry's Law constant >10^{-5} atm-me/mol and molecular weight <200 g/mol).**

Answer (likely/unlikely/uncertain): Unlikely

Provide explanation: There are no volatile chemicals detected in the surface or shallow subsurface at these sites.

Question B:

Could the soil contaminants reach receptors through fugitive dust carried in air?

- **Soil contamination would have to be on the actual surface of the soil to become available for dust.**
- **In the case of dust exposures to burrowing animals, the contamination would have to occur in the depth interval where these burrows occur.**

Answer (likely/unlikely/uncertain): Likely

Provide explanation: No high levels of surface contamination; however, contaminated near-surface soil could reach burrowing gophers.

Question C:

Can contaminated soil be transported to aquatic ecological communities (use SOP 2.01 run-off score and terminal point of surface water runoff to help answer this question)?

- **If the SOP 2.01 run-off score* for each PRS included in the site is equal to zero, this suggests that erosion at the site is not a transport pathway. (* Note that the runoff score is not the entire erosion potential score, rather it is a subtotal of this score with a maximum value of 46 points).**
- **If erosion is a transport pathway, evaluate the terminal point to see if aquatic receptors could be affected by contamination from this site.**

Answer (likely/unlikely/uncertain): Unlikely

Provide explanation: There are no nearby aquatic communities that could be impacted; runoff is minimal.

Question D:

Is contaminated groundwater potentially available to biological receptors through seeps or springs or shallow groundwater?

- **Known or suspected presence of contaminants in groundwater.**
- **The potential for contaminants to migrate via groundwater and discharge into habitats and/or surface waters.**
- **Contaminants may be taken up by terrestrial and rooted aquatic plants whose roots are in contact with groundwater present within the root zone (~1 m depth).**
- **Terrestrial wildlife receptors generally will not contact groundwater unless it is discharged to the surface.**

Answer (likely/unlikely/uncertain): Unlikely

Provide explanation: There is no alluvial or perched water beneath site and there are no springs or seeps.

Question E:

Is infiltration/percolation from contaminated subsurface material a viable transport and exposure pathway?

- **Suspected ability of contaminants to migrate to groundwater.**
- **The potential for contaminants to migrate via groundwater and discharge into habitats and/or surface waters.**
- **Contaminants may be taken up by terrestrial and rooted aquatic plants whose roots are in contact with groundwater present within the root zone (~1 m depth).**
- **Terrestrial wildlife receptors generally will not contact groundwater unless it is discharged to the surface.**

Answer (likely/unlikely/uncertain): Unlikely

Provide explanation: There is no alluvial or perched water beneath site and there are no springs or seeps.

Question F:

Might erosion or mass wasting events be a potential release mechanism for contaminants from subsurface materials or perched aquifers to the surface?

- **This question is only applicable to release sites located on or near the mesa edge.**
- **Consider the erodability of surficial material and the geologic processes of canyon/mesa edges.**

Answer (likely/unlikely/uncertain): Unlikely

Provide explanation: Mass wasting is not a release mechanism because area is not near the mesa edge. Erosion is minimal at the site.

Question G:

Could airborne contaminants interact with receptors through respiration of vapors?

- **Contaminants must be present as volatiles in the air.**
- **Consider the importance of inhalation of vapors for burrowing animals.**
- **Foliar uptake of organic vapors is typically not a significant exposure pathway.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Plants: 0

Terrestrial Animals: 0

Provide explanation: Volatile organic compounds were not detected in the surface or shallow subsurface.

Question H:

Could airborne contaminants interact with plants through deposition of particulates or with animals through inhalation of fugitive dust?

- **Contaminants must be present as particulates in the air or as dust for this exposure pathway to be complete.**
- **Exposure via inhalation of fugitive dust is particularly applicable to ground-dwelling species that would be exposed to dust disturbed by their foraging or burrowing activities or by wind movement.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Plants: 2

Terrestrial Animals: 2

Provide explanation: Deposition of particulates on plants may be an exposure pathway. Inhalation of re-suspended dust is also a pathway for surface contaminants.

Question I:

Could contaminants interact with plants through root uptake or rain splash from surficial soils?

- **Contaminants in bulk soil may partition into soil solution, making them available to roots.**
- **Exposure of terrestrial plants to contaminants present in particulates deposited on leaf and stem surfaces by rain striking contaminated soils (i.e., rain splash).**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Plants: 2

Provide explanation: Site contamination occurs in the surface and shallow subsurface at depths that could be impacted by plant roots.

Question J:

Could contaminants interact with receptors through food web transport from surficial soils?

- **The chemicals may bioaccumulate in animals.**
- **Animals may ingest contaminated food items.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Animals: 2

Provide explanation: Some contaminants are known to be bioaccumulators.

Question K:

Could contaminants interact with receptors via incidental ingestion of surficial soils?

- **Incidental ingestion of contaminated soil could occur while animals grub for food resident in the soil, feed on plant matter covered with contaminated soil or while grooming themselves clean of soil.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Animals: 2

Provide explanation: Foraging and grooming activities may result in exposure.

Question L:

Could contaminants interact with receptors through dermal contact with surficial soils?

- **Significant exposure via dermal contact would generally be limited to organic contaminants that are lipophilic and can cross epidermal barriers.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Animals: 0

Provide explanation: No organic contaminants were detected in the surface or shallow subsurface at these sites.

Question M:

Could contaminants interact with plants or animals through external irradiation?

- **External irradiation effects are most relevant for gamma emitting radionuclides.**
- **Burial of contamination attenuates radiological exposure.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Plants: 0

Terrestrial Animals: 0

Provide explanation: These AOCs are not radiological sites.

Question N:

Could contaminants interact with plants through direct uptake from water and sediment or sediment rain splash?

- **Contaminants may be taken-up by terrestrial plants whose roots are in contact with surface waters.**
- **Terrestrial plants may be exposed to particulates deposited on leaf and stem surfaces by rain striking contaminated sediments (i.e., rain splash) in an area that is only periodically inundated with water.**
- **Contaminants in sediment may partition into soil solution, making them available to roots.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Plants: 1

Provide explanation: There is minimal shallow subsurface contamination at the sites.

Question O:

Could contaminants interact with receptors through food web transport from water and sediment?

- **The chemicals may bioconcentrate in food items.**
- **Animals may ingest contaminated food items.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Animals: 0

Provide explanation: There is no persistent water on the sites and no sediment.

Question P:

Could contaminants interact with receptors via ingestion of water and suspended sediments?

- **If sediments are present in an area that is only periodically inundated with water, terrestrial receptors may incidentally ingest sediments.**
- **Terrestrial receptors may ingest water-borne contaminants if contaminated surface waters are used as a drinking water source.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Animals: 0

Provide explanation: There is no persistent water on the sites.

Question Q:

Could contaminants interact with receptors through dermal contact with water and sediment?

- **If sediments are present in an area that is only periodically inundated with water, terrestrial species may be dermally exposed during dry periods.**
- **Terrestrial organisms may be dermally exposed to water-borne contaminants as a result of wading or swimming in contaminated waters.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Animals: 0

Provide explanation: There is no persistent water on the sites.

Question R:

Could contaminants interact with plants or animals through external irradiation?

- **External irradiation effects are most relevant for gamma emitting radionuclides.**
- **Burial of contamination attenuates radiological exposure.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Plants: 0

Terrestrial Animals: 0

Provide explanation: These AOCs are not radiological sites.

Question S:

Could contaminants bioconcentrate in free floating aquatic, attached aquatic plants, or emergent vegetation?

- **Aquatic plants are in direct contact with water.**
- **Contaminants in sediment may partition into pore water, making them available to submerged roots.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Aquatic Plants/Emergent Vegetation: 0

Provide explanation: There is no persistent water on the sites.

Question T:

Could contaminants bioconcentrate in sedimentary or water column organisms?

- **Aquatic receptors may actively or incidentally ingest sediment while foraging.**
- **Aquatic receptors may be directly exposed to contaminated sediments or may be exposed to contaminants through osmotic exchange, respiration, or ventilation of sediment pore waters.**
- **Aquatic receptors may be exposed through osmotic exchange, respiration, or ventilation of surface waters.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Aquatic Animals: 0

Provide explanation: There is no persistent water on the sites.

Question U:

Could contaminants bioaccumulate in sedimentary or water column organisms?

- **Lipophilic organic contaminants and some metals may concentrate in an organism's tissues**
- **Ingestion of contaminated food items may result in contaminant bioaccumulation through the food web.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Aquatic Animals: 0

Provide explanation: There is no persistent water on the sites.

Question V:

Could contaminants interact with aquatic plants or animals through external irradiation?

- **External irradiation effects are most relevant for gamma emitting radionuclides.**
- **The water column acts to absorb radiation, thus external irradiation is typically more important for sediment dwelling organisms.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Aquatic Plants: 0

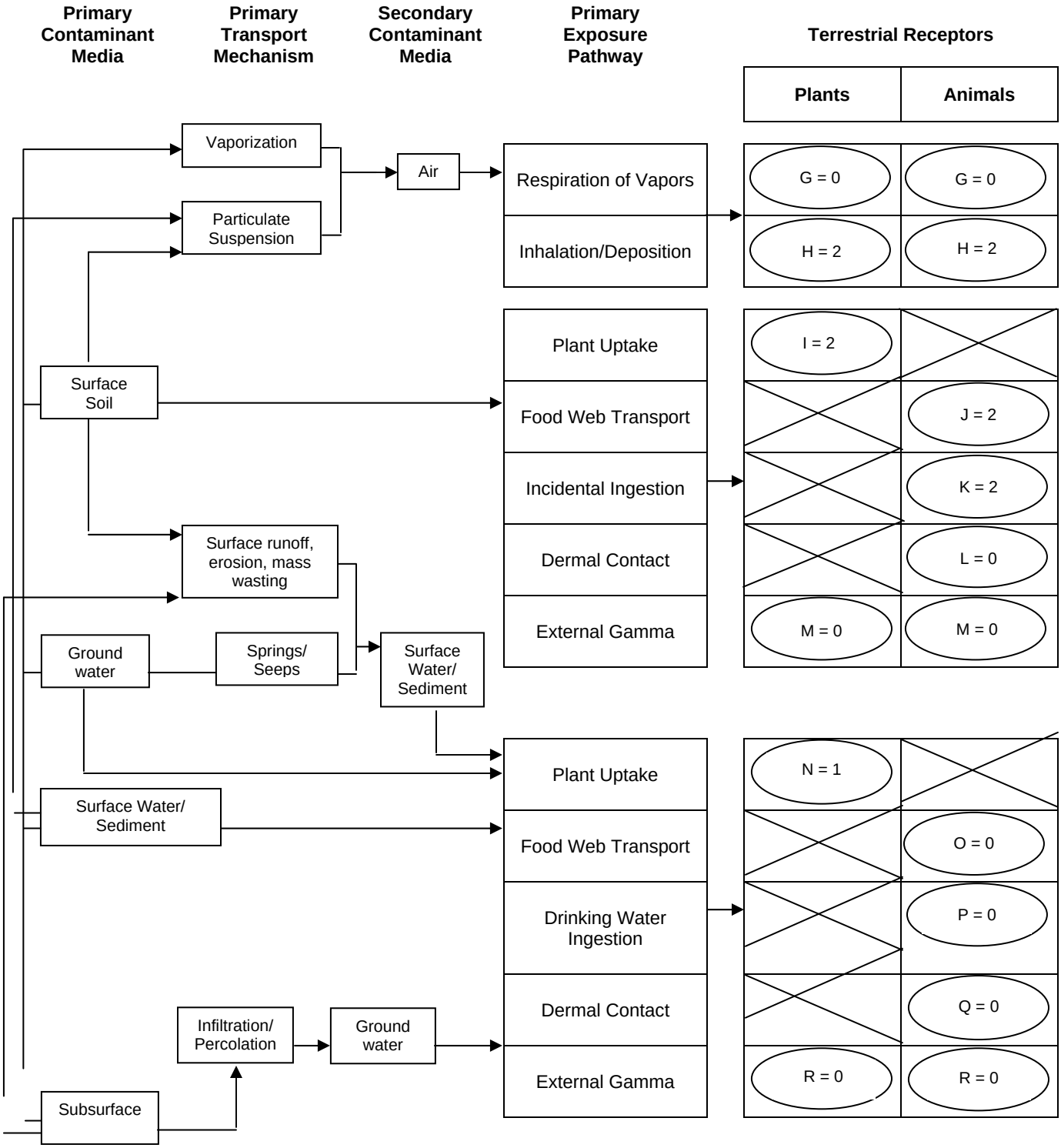
Aquatic Animals: 0

Provide explanation: There is no persistent water on the sites.

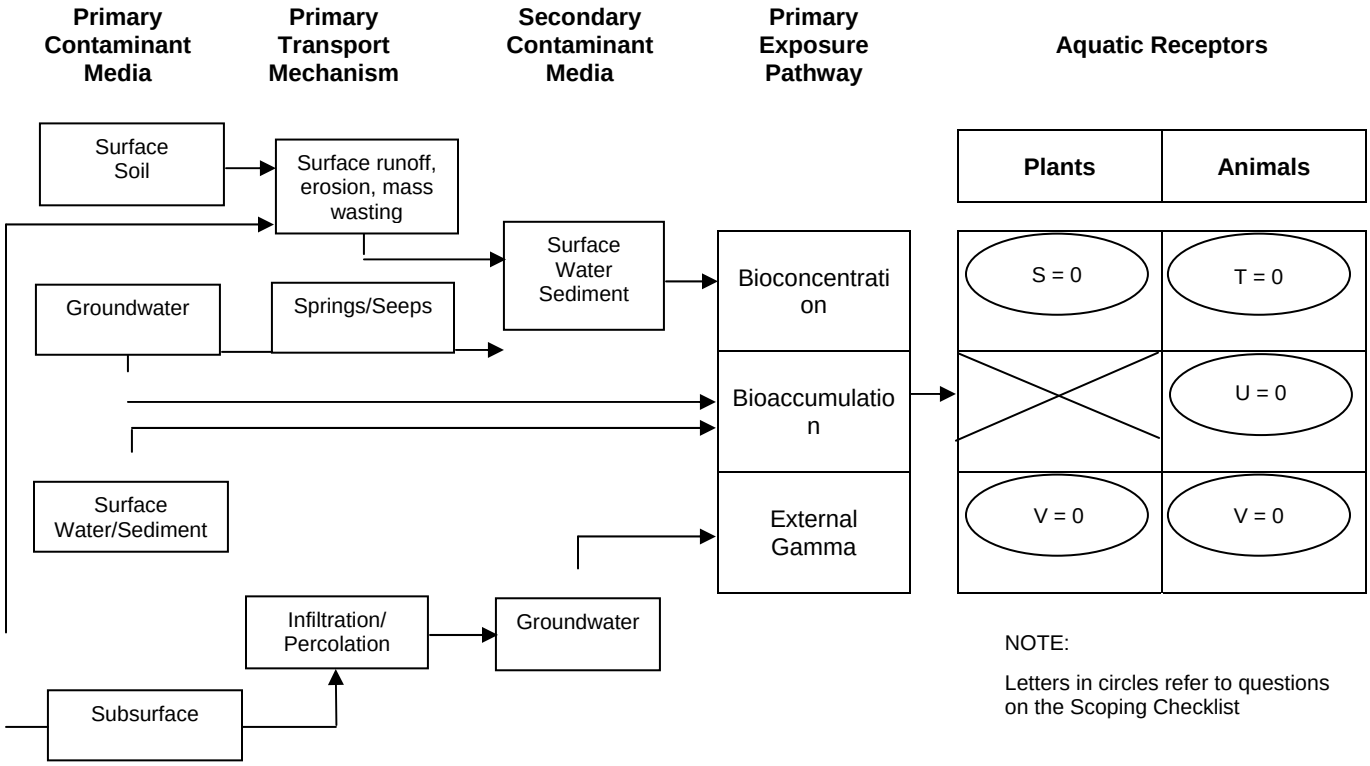
Ecological Scoping Checklist
Terrestrial Receptors
Ecological Pathways Conceptual Exposure Model

NOTE:

Letters in circles refer to questions on the Scoping Checklist



Ecological Scoping Checklist
Aquatic Receptors
Ecological Pathways Conceptual Exposure Model



Signatures and certifications:

Checklist completed by (provide name, organization and phone number):

Name (printed): PattieBaucom
Name (signature):
Organization: TerranearPMC
Phone number: 505-412-3998
Date Completed: December 12, 2008

Verification by a member of Environmental Programs Directorate (provide name, organization and phone number):

Name (printed): Rich Mirenda
Name (signature):
Organization: WES-EDA
Phone number: 505-665-6953

H1-2.0 AOCs 51-001 AND 54-007(d)

Part A—Scoping Meeting Documentation

Site ID	Cañada del Buey Aggregate Area
Form of site releases (solid, liquid, vapor). Describe all relevant known or suspected mechanisms of release (spills, dumping, material disposal, outfall, explosive testing, etc.) and describe potential areas of release. Reference locations on a map as appropriate.	The Middle Cañada del Buey Aggregate Area is located in the central portion of Cañada del Buey and Mesita del Buey and incorporates parts of TA- 51 and TA-54 West at LANL. The Middle Cañada del Buey Aggregate Area includes 23 solid waste management units (SWMU) and areas of concern (AOC) Of the 23 sites, 11 have been approved for no further action, four are Resource Conservation and Recovery Act-permitted storage units, one is a Toxic Substances Control Act-permitted storage unit, one (Material Disposal Area [MDA] J) was closed under New Mexico Environment Department solid waste regulations, and two (MDAs H and L) were investigated under separate work plans. Of the four AOCs in the Middle Cañada del Buey Aggregate Area requiring additional characterization, one is located within TA-51 (AOC 51-001) and three are located within TA-54 [AOCs 18-005(b), 18-005(c), and 54-007(d)]. These sites include two former septic systems and two former high explosives storage magazines Only the two former septic systems (AOCs 51-001 and 54-007(d)) mentioned above are the focus of this ecological scoping checklist and they are both located on the mesa tops. The first operations in the current TA-51 area began in 1980 with construction of the Experimental Engineering Test Facility (EETF). This facility was constructed to support research to develop effective isolation techniques for burial of waste in semiarid climates. Support offices were constructed on site in 1986. TA-51 is currently used for research and experimental studies on the long-term impacts of radioactive materials on the environment, including the effectiveness of waste isolation barriers AOC 51-001 at TA-51 was an inactive/abandoned septic system that served the EETF and the transportable offices for buildings 51-25, 51-26, and 51-27. The septic system consisted of a 1000-gallon concrete septic tank, drainlines, and a 4-ft-wide by 50-ft-deep seepage pit. In 2001, a Voluntary Corrective Action (VCA) to remove the septic system was conducted at AOC 51-001 and involved removing the septic tank contents and the septic tank and plugging the drainlines. Confirmation samples were collected in 2001 from six locations within the septic tank excavation, beneath the inlet drainline connection, and adjacent to the seepage pit. Two volatile organic compounds (VOCs)(2-butanone and trichlorofluoromethane) were detected at concentrations less than the estimated quantitation (EQL) at two locations. Bromomethane was detected at a concentration below the EQL in the deepest sample collected at location 51-10001. No semi-volatile organic compounds (SVOCs), pesticides or PCBs were detected. Cesium-137 was detected in one sample of fill material at 0.0761 pCi/g at location 51-0002 at a depth of 5.5 to 6.5 ft bgs. The western part of TA-54 on Mesita del Buey associated with Middle Cañada del Buey Aggregate Area houses the former radiation exposure facility that was used to conduct biomedical research on animal exposure to radiation. This facility was operated from 1962 to the mid-1970s. TA-54 West is now used to conduct waste characterization and packaging operations associated with shipment of transuranic wastes.

	AOC 54-007(d) was an inactive/abandoned septic system that served the Radiation Exposure Facility at TA-54 West. The septic system consisted of a 1500-gallon concrete septic tank, drainlines, a distribution box, and a split drain field. A 4-in. drainline from the septic tank connected to a reinforced concrete distribution box, which diverted the effluent east and west into the drain field. The drain field consists of two 60-ft-long, 4-in.-diameter tile drainlines running east and west from the distribution box. A VCA was conducted at AOC 54-007(d) in 2001 to remove the septic tank contents and the septic tank and to plug the drainlines. Confirmation samples were collected in 2001 from six locations within the septic tank excavation, beneath the inlet drainline connection, and from the drain field. Detected organic chemicals included benzene, bis(2-ethylhexyl) phthalate; bromomethane; 2-butanone; isopropylbenzene; 4-isopropyltoluene; 4-methyl-2-pentanone; toluene; trichlorofluoromethane; and trimethylbenzene[1,2,4-]. These organic chemicals were detected at concentrations less than or slightly above their respective EQLs in one or more samples. None of these organic chemicals were detected in the contents of the septic tank. At most locations, the concentrations of organic chemicals decreased slightly with depth or remained unchanged.
List of Primary Impacted Media **(Indicate all that apply.)**	**Surface soil** –There are no known chemicals or radiological isotopes in surface soils at AOC 51-001 at TA-51 or AOC 54-007(d) at TA-54. **Subsurface** – There are some known organic chemicals detected in residual amounts in subsurface soils at AOC 51-001 at TA-51 and AOC 54-007(d) at TA-54. One radionuclide, Cesium-137, was detected in an isolated fill sample at AOC 51-001. **Groundwater** – Alluvial or perched groundwater is not present within in the central portion of Cañada del Buey and Mesita del Buey in the vicinity of the two AOCs and the regional groundwater table is approximately 1,200 ft bgs. **Surface water** – Permanent (year round) surface water is not present in the central portion of Cañada del Buey and Mesita del Buey in the vicinity of the two AOCs. Only water ever present is sheet flow from storm water following thunderstorms and gradual melt flow from snow pack in the spring.
FIMAD vegetation class based on Arcview vegetation coverage **(Indicate all that apply.)**	Dominant trees within the central portion of Cañada del Buey and Mesita del Buey in the vicinity of the two AOCs include: juniper and piñon and gamble oak and scattered ponderosa pine. Trees are sparse and separated by open space Dominant Shrubs include: chamisa, big sagebrush, salt bush and chokeberry. Dominant forbs and grasses include: bluegrass, mountain muhly, blue grama, pine dropseed, wormwood, false tarragon, tall lupine, and cinquefoil.
Is T&E Habitat Present? **If applicable, list species known or suspected to use the site for breeding or foraging.**	The only threatened or endangered (T&E) species known to frequent the LANL area is the Mexican spotted owl. The owl's primary habitat is densely forested canyons and it has not been observed to roost in the central portion of Cañada del Buey and Mesita del Buey in the vicinity of the two AOCs, which occupy mesa tops.

Provide list of Neighboring/ Contiguous/ Up-gradient sites, include a brief summary of COPCs and form of releases for relevant sites and reference map as appropriate. **(Use information to evaluate need to aggregate sites for screening.)**	The two AOCs occupy small isolated areas (less than one acre) on a mesa top and have no neighboring relevant sites up gradient or contiguous sites.
Surface Water Erosion Potential Information **Summarize information from SOP 2.01, including the run-off subscore (maximum of 46); terminal point of surface water transport; slope; and surface water run-on sources.**	The two AOCs occupy small isolated areas (less than ¼ acre each) on flat, well vegetated mesa top sites. The run-off evidence scores for these sites range from 0 to 5 and the total erosion scores range from 8.8 to 23.3. The run-on score for the sites are 0 and the erosion type score is also 0. The % slope is approximately 1.3.

Part B—Site Visit Documentation

Site ID	Cañada del Buey Aggregate Area
Date of Site Visit	12/12/08
Site Visit Conducted by	Gary Stoopes and Pattie Baucom

Receptor Information:

Estimate cover	Relative vegetative cover (high, medium, low, none) = medium Relative wetland cover (high, medium, low, none) = none Relative structures, asphalt, etc., cover (high, medium, low, none) = none.
Field notes on the FIMAD vegetation class to assist in ground-truthing the Arcview information	Vegetation is as noted above.
Field notes on T&E Habitat, if applicable. Consider the need for a site visit by a T&E subject matter expert to support the use of the site by T&E receptors.	The only threatened or endangered (T&E) species known to frequent the LANL area is the Mexican spotted owl. The owl's primary habitat is densely forested canyons and it has not been observed to roost in the central portion of Cañada del Buey and Mesita del Buey in the vicinity of the two AOCs, which occupy mesa tops.; however, the owl may use the surrounding area as a foraging site (LANL 2001, 071060)
Are ecological receptors present at the site? **(yes/no/uncertain)** **Describe the general types of receptors present at the site (terrestrial and aquatic), and make notes on the quality of habitat present at the site.**	Yes. The vegetation at the site is healthy and varied, no adverse affects on plants were noted during field activities, and the habitat is sufficient for supporting foraging of terrestrial receptors. Vegetative community is typical of mesa tops. The following wildlife has been observed or known to be present while conducting field work at the site: elk, mule deer, coyotes, rabbits, mice, birds, and although gophers have not been observed, their burrows are quite abundant in some areas.

Contaminant Transport Information:

Surface water transport **Field notes on the erosion potential, including a discussion of the terminal point of surface water transport (if applicable).**	Surface water transport and erosion potential is low overall and consists mainly of slow snow melt in the spring and sheet flow from thunderstorms during the summer months.
Are there any off-site transport pathways (surface water, air, or groundwater)? **(yes/no/uncertain)** **Provide explanation**	Surface Water: No Groundwater: No Air: No
Interim action needed to limit off-site transport? **(yes/no/uncertain)** **Provide explanation/ recommendation to project lead for IA SMDP.**	No. Releases are predominately subsurface and unlikely to move.

Ecological Effects Information:

Physical Disturbance **(Provide list of major types of disturbances, including erosion and construction activities, review historical aerial photos where appropriate.)**	No. The sites have not been physically disturbed since D&D operations. There is little evidence of disturbances or erosion on the mesa tops where the AOCs are located.
Are there obvious ecological effects? **(yes/no/uncertain)** **Provide explanation and apparent cause (e.g., contamination, physical disturbance, other).**	No. The habitat is healthy and wildlife is abundant**.**
Interim action needed to limit apparent ecological effects? **(yes/no/uncertain)** **Provide explanation and recommendations to mitigate apparent exposure pathways to project lead for IA SMDP.**	No. Releases are subsurface.

No Exposure/Transport Pathways:

If there are no complete exposure pathways to ecological receptors onsite and no transport pathways to offsite receptors, the remainder of the checklist should not be completed. Stop here and provide additional explanation/justification for proposing an ecological No Further Action recommendation (if needed). At a minimum, the potential for future transport should include likelihood that future construction activities could make contamination more available for exposure or transport. Not applicable.

Adequacy of Site Characterization:

Do existing or proposed data provide information on the nature, rate and extent of contamination? **(yes/no/uncertain)** **Provide explanation** **(Consider if the maximum value was captured by existing sample data.)**	Yes. Previous investigations were conducted to define nature and extent of contamination address potential contamination.
Do existing or proposed data for the site address potential transport pathways of site contamination? **(yes/no/uncertain)** **Provide explanation** **(Consider if other sites should aggregated to characterize potential ecological risk.)**	Yes. Previous investigations were designed to address potential transport pathways.

Part C—Ecological Pathways Conceptual Exposure Model

Question A:

Could soil contaminants reach receptors via vapors?

- **Volatility of the hazardous substance (volatile chemicals generally have Henry's Law constant >10^{-5} atm-me/mol and molecular weight <200 g/mol).**

Answer (likely/unlikely/uncertain): Unlikely

Provide explanation: There are no volatile chemicals detected at high concentrations.

Question B:

Could the soil contaminants reach receptors through fugitive dust carried in air?

- **Soil contamination would have to be on the actual surface of the soil to become available for dust.**
- **In the case of dust exposures to burrowing animals, the contamination would have to occur in the depth interval where these burrows occur.**

Answer (likely/unlikely/uncertain): Likely

Provide explanation: No high levels of surface contamination; however, contaminated near-surface soil could reach burrowing gophers.

Question C:

Can contaminated soil be transported to aquatic ecological communities (use SOP 2.01 run-off score and terminal point of surface water runoff to help answer this question)?

- **If the SOP 2.01 run-off score* for each PRS included in the site is equal to zero, this suggests that erosion at the site is not a transport pathway. (* Note that the runoff score is not the entire erosion potential score, rather it is a subtotal of this score with a maximum value of 46 points).**
- **If erosion is a transport pathway, evaluate the terminal point to see if aquatic receptors could be affected by contamination from this site.**

Answer (likely/unlikely/uncertain): Unlikely

Provide explanation: There are no nearby aquatic communities that could be impacted; runoff, if any is minimal.

Question D:

Is contaminated groundwater potentially available to biological receptors through seeps or springs or shallow groundwater?

- **Known or suspected presence of contaminants in groundwater.**
- **The potential for contaminants to migrate via groundwater and discharge into habitats and/or surface waters.**
- **Contaminants may be taken up by terrestrial and rooted aquatic plants whose roots are in contact with groundwater present within the root zone (~1 m depth).**
- **Terrestrial wildlife receptors generally will not contact groundwater unless it is discharged to the surface.**

Answer (likely/unlikely/uncertain): Unlikely

Provide explanation: There is no alluvial or perched water beneath site and there are no springs or seeps.

Question E:

Is infiltration/percolation from contaminated subsurface material a viable transport and exposure pathway?

- **Suspected ability of contaminants to migrate to groundwater.**
- **The potential for contaminants to migrate via groundwater and discharge into habitats and/or surface waters.**
- **Contaminants may be taken up by terrestrial and rooted aquatic plants whose roots are in contact with groundwater present within the root zone (~1 m depth).**
- **Terrestrial wildlife receptors generally will not contact groundwater unless it is discharged to the surface.**

Answer (likely/unlikely/uncertain): Unlikely

Provide explanation: There is no alluvial or perched water beneath site and there are no springs or seeps.

Question F:

Might erosion or mass wasting events be a potential release mechanism for contaminants from subsurface materials or perched aquifers to the surface?

- **This question is only applicable to release sites located on or near the mesa edge.**
- **Consider the erodability of surficial material and the geologic processes of canyon/mesa edges.**

Answer (likely/unlikely/uncertain): Unlikely

Provide explanation: Mass wasting is not a release mechanism because area is not near the mesa edge. Erosion is minimal at the site.

Question G:

Could airborne contaminants interact with receptors through respiration of vapors?

- **Contaminants must be present as volatiles in the air.**
- **Consider the importance of inhalation of vapors for burrowing animals.**
- **Foliar uptake of organic vapors is typically not a significant exposure pathway.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Plants: 1

Terrestrial Animals: 1

Provide explanation: Volatile organics compounds, if present, are detected at very low concentrations.

Question H:

Could airborne contaminants interact with plants through deposition of particulates or with animals through inhalation of fugitive dust?

- **Contaminants must be present as particulates in the air or as dust for this exposure pathway to be complete.**
- **Exposure via inhalation of fugitive dust is particularly applicable to ground-dwelling species that would be exposed to dust disturbed by their foraging or burrowing activities or by wind movement.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Plants: 2

Terrestrial Animals: 2

Provide explanation: Deposition of particulates on plants may be an exposure pathway. Inhalation of re-suspended dust is also a pathway for surface contaminants; however, most contamination occurs in the subsurface.

Question I:

Could contaminants interact with plants through root uptake or rain splash from surficial soils?

- **Contaminants in bulk soil may partition into soil solution, making them available to roots.**
- **Exposure of terrestrial plants to contaminants present in particulates deposited on leaf and stem surfaces by rain striking contaminated soils (i.e., rain splash).**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Plants: 2

Provide explanation: Site contamination mostly occurs in the subsurface, at depths that could be impacted by plant roots.

Question J:

Could contaminants interact with receptors through food web transport from surficial soils?

- **The chemicals may bioaccumulate in animals.**
- **Animals may ingest contaminated food items.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Animals: 2

Provide explanation: Some contaminants are known to be bioaccumulators; however, most contamination is present in the subsurface.

Question K:

Could contaminants interact with receptors via incidental ingestion of surficial soils?

- **Incidental ingestion of contaminated soil could occur while animals grub for food resident in the soil, feed on plant matter covered with contaminated soil or while grooming themselves clean of soil.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Animals: 2

Provide explanation: Foraging and grooming activities may result in exposure. However, most contamination is present in the subsurface.

Question L:

Could contaminants interact with receptors through dermal contact with surficial soils?

- **Significant exposure via dermal contact would generally be limited to organic contaminants that are lipophilic and can cross epidermal barriers.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Animals: 1

Provide explanation: Exposure via dermal contact is possible for terrestrial receptors; however, there is no organic chemical contamination at the surface and the organic COPCs are not lipophilic.

Question M:

Could contaminants interact with plants or animals through external irradiation?

- **External irradiation effects are most relevant for gamma emitting radionuclides.**
- **Burial of contamination attenuates radiological exposure.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Plants: 0

Terrestrial Animals: 0

Provide explanation: Only one gamma-emitting radionuclide detected in one sample at depth (< 5 ft) at one AOC at less than background value.

Question N:

Could contaminants interact with plants through direct uptake from water and sediment or sediment rain splash?

- **Contaminants may be taken-up by terrestrial plants whose roots are in contact with surface waters.**
- **Terrestrial plants may be exposed to particulates deposited on leaf and stem surfaces by rain striking contaminated sediments (i.e., rain splash) in an area that is only periodically inundated with water.**
- **Contaminants in sediment may partition into soil solution, making them available to roots.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Plants: 2

Provide explanation: There is subsurface contamination at the sites.

Question O:

Could contaminants interact with receptors through food web transport from water and sediment?

- **The chemicals may bioconcentrate in food items.**
- **Animals may ingest contaminated food items.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Animals: 0

Provide explanation: There is no persistent water on the sites and no sediment.

Question P:

Could contaminants interact with receptors via ingestion of water and suspended sediments?

- **If sediments are present in an area that is only periodically inundated with water, terrestrial receptors may incidentally ingest sediments.**
- **Terrestrial receptors may ingest water-borne contaminants if contaminated surface waters are used as a drinking water source.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Animals: 0

Provide explanation: There is no persistent water on the sites.

Question Q:

Could contaminants interact with receptors through dermal contact with water and sediment?

- **If sediments are present in an area that is only periodically inundated with water, terrestrial species may be dermally exposed during dry periods.**
- **Terrestrial organisms may be dermally exposed to water-borne contaminants as a result of wading or swimming in contaminated waters.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Animals: 0

Provide explanation: There is no persistent water on the sites.

Question R:

Could contaminants interact with plants or animals through external irradiation?

- **External irradiation effects are most relevant for gamma emitting radionuclides.**
- **Burial of contamination attenuates radiological exposure.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Plants: 0

Terrestrial Animals: 0

Provide explanation: Cesium-137 a gamma-emitting radionuclide is present at less than background value at one location but at depth (greater than 5 ft) which attenuates radiological exposure.

Question S:

Could contaminants bioconcentrate in free floating aquatic, attached aquatic plants, or emergent vegetation?

- **Aquatic plants are in direct contact with water.**
- **Contaminants in sediment may partition into pore water, making them available to submerged roots.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Aquatic Plants/Emergent Vegetation: 0

Provide explanation: There is no persistent water on the sites.

Question T:

Could contaminants bioconcentrate in sedimentary or water column organisms?

- **Aquatic receptors may actively or incidentally ingest sediment while foraging.**
- **Aquatic receptors may be directly exposed to contaminated sediments or may be exposed to contaminants through osmotic exchange, respiration, or ventilation of sediment pore waters.**
- **Aquatic receptors may be exposed through osmotic exchange, respiration, or ventilation of surface waters.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Aquatic Animals: 0

Provide explanation: There is no persistent water on the sites.

Question U:

Could contaminants bioaccumulate in sedimentary or water column organisms?

- **Lipophilic organic contaminants and some metals may concentrate in an organism's tissues**
- **Ingestion of contaminated food items may result in contaminant bioaccumulation through the food web.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Aquatic Animals: 0

Provide explanation: There is no persistent water on the sites.

Question V:

Could contaminants interact with aquatic plants or animals through external irradiation?

- **External irradiation effects are most relevant for gamma emitting radionuclides.**
- **The water column acts to absorb radiation, thus external irradiation is typically more important for sediment dwelling organisms.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Aquatic Plants: 0

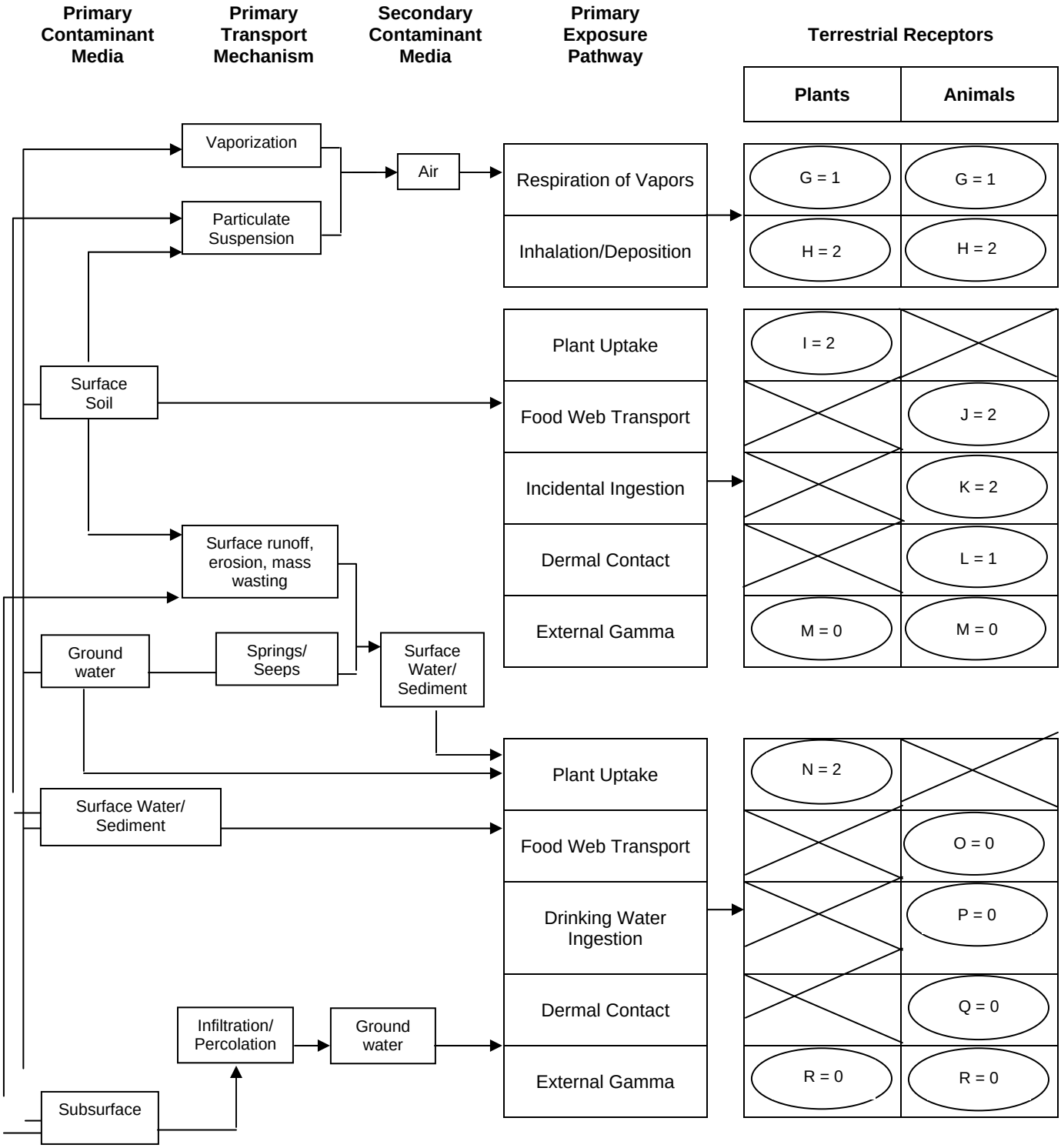
Aquatic Animals: 0

Provide explanation: There is no persistent water on the sites.

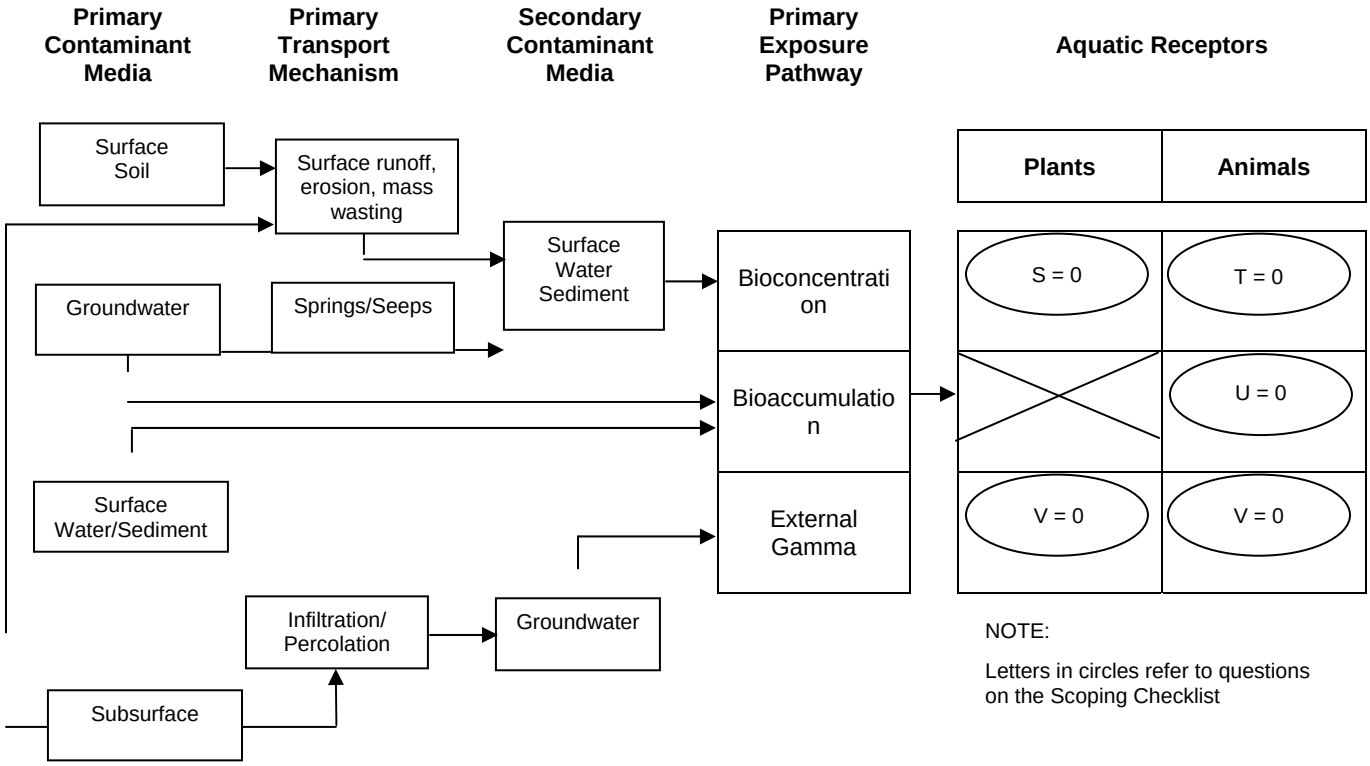
Ecological Scoping Checklist
Terrestrial Receptors
Ecological Pathways Conceptual Exposure Model

NOTE:

Letters in circles refer to questions on the Scoping Checklist



Ecological Scoping Checklist
Aquatic Receptors
Ecological Pathways Conceptual Exposure Model



Signatures and certifications:

Checklist completed by (provide name, organization and phone number):

Name (printed): Gary Stoopes
Name (signature): Gary Stoopes
Organization: TerraneaPMC
Phone number: 505-412-0028
Date Completed: December 12, 2008

Verification by a member of Environmental Programs Directorate (provide name, organization and phone number):

Name (printed): Rich Mirenda
Name (signature): Richard Miranda
Organization: WES-EDA
Phone number: 505-665-6953

Attachment H-2

ProUCL Files
(on CD included with this document)