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Date: June 20, 2002
Refer to: ER2002-0427

Mr. John Young, Corrective Action Project Leader
Permits Management Program
NMED – Hazardous Waste Bureau
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Santa Fe, NM 87505-6303

SUBJECT: SUBMITTAL OF VOLUNTARY CORRECTIVE ACTION (VCA) PLAN FOR POTENTIAL RELEASE SITES (PRSs) 0-030(b)-00, 0-027, 0-030(a), 0-029(a,b,c), 0-010(a,b), and 0-033(a)

Dear Mr. Young:

Enclosed are two copies of the Los Alamos National Laboratory (LANL) Environmental Restoration (ER) Project's VCA Plan for PRSs 0-030(b)-00, 0-027, 0-030(a), 0-029(a,b,c), 0-010(a,b), and 0-033(a).

If you have any questions, please contact Terry Rust at (505) 665-8843 or David Gregory at (505) 667-5808.

Sincerely,

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Los Alamos National Laboratory

Sincerely,

Everett Trollinger, Project Manager
Department of Energy
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DM/ET/NR/vn

Enclosure: VCA Plan (ER2002-0094)

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ENVIRONMENTAL RESTORATION PROJECT

A Department of Energy
Environmental Cleanup Program

LA-UR-02-1081
June 2002
ER2002-0094

Voluntary Corrective Action Plan for Potential Release Sites 0-030(b)-00, 0-027, 0-030(a), 0-029(a,b,c), 0-010(a,b), and 0-033(a)

Los Alamos
NATIONAL LABORATORY

Los Alamos NM 87545

Produced by the Remedial Actions Focus Area

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EXECUTIVE SUMMARY

This document is the voluntary corrective action (VCA) plan for potential release sites (PRSs) in the DP Road South and DP Road 4 land transfer parcels as well as several other PRSs. The PRSs included in this plan are 0-027, 0-030(a), 0-030(b)-00, 0-029(a,b,c), 0-010(a,b), and the 6th Street Warehouse PRSs [0-004, 0-030(l,m), and 0-033(a,b)]; all are in Technical Area 0 (TA-0) at Los Alamos National Laboratory (the Laboratory or LANL). PRSs 0-027 and 0-030(a) are not part of the land transfer, but have been included in this PRS aggregate because of their close proximity to the land transfer parcel. The PRSs that are listed in Table A of the Hazardous and Solid Waste Amendments (HSWA) of LANL's Hazardous Waste Facility Permit are PRS 0-030(a) and consolidated PRS 0-030(b)-00, which includes PRSs 0-030(b,l,m), 0-004, and 0-033(b).

This plan describes the sites and their histories; previous site activities, such as Resource Conservation and Recovery Act (RCRA) facility investigations (RFIs) and VCAs; proposed sampling activities to address data gaps; proposed cleanup activities; and planned site restoration. Also included in this plan is information about TA-21 and Material Disposal Area (MDA) B (PRS 21-015). This is because air emissions from TA-21 had the potential to affect surface soil within the DP Road land transfer parcel. PRS 21-015 is located directly north of the eastern boundary of the DP Road land transfer parcel.

PRS 0-027 was a fuel and lubricant drum storage area which is now on private property. A VCA is planned for PRS 0-027 because the site contains benzene, ethylbenzene, toluene, trimethylbenzene, and xylene (BTEX) at levels that pose a potentially unacceptable human health risk based on a residential scenario. These elevated levels of contaminants are mainly confined to the subsurface soil at depths greater than 10 ft). It is expected that the site potentially would meet the requirements for a risk-based closure even with no active remediation phase. However, an active remediation is being proposed to further reduce and/or accelerate reduction of potential risk from the subsurface contamination at the site. To accomplish this task, a soil vapor extraction (SVE) system is proposed. The SVE system will volatilize the BTEX and accelerate the reduction of potential risk at the site. SVE is viewed to be a cost-effective proactive remedial alternative.

PRSs 0-030(a,b,l,m) are septic systems. PRSs 0-030 (b,l,m) will be sampled to fill data gaps that were identified during the evaluation of existing PRS data. If, during the sampling, any unexpected areas of contamination are found, the contaminated material will be removed. The sampling proposed for each PRS is described in Appendix E to this plan. In addition, removal of the piping at PRSs 0-030(b) and 0-030(m) is proposed. Removal of this piping will ensure that future development in these areas will not result in contact with historically disposed waste that may have residual contamination associated with it. PRS 0-030(a) does not require any additional sampling and is proposed for no further action (NFA) under Criterion 5 on the basis of human health and ecological screening assessments using existing data. Criterion 5 states that the site was characterized or remediated in accordance with current applicable state and/or federal regulations, and the available data indicate that contaminants do not pose an unacceptable level of risk, assuming current and projected future land use.

PRS 0-004 was an indoor container storage area where at least two spills occurred. PRS 0-033(b) is contaminated soil, drain lines, and an outfall located near the 6th Street Warehouses. PRSs 0-029(a,b,c) are former polychlorinated biphenyl (PCB) transformer sites, two of which are located on San Ildefonso Pueblo property and one of which is located on Santa Fe National Forest property.

At PRSs 0-004 and 0-033(b), data gaps were found from the previous RFI and VCA activities in 1995 and 1996, respectively. These data gaps will be addressed by collecting additional samples. The sampling for each PRS is described in Appendix E to this plan.

The former PCB transformers [PRSs 0-029(a,b,c)] were sampled in 1992 as part of Phase I of the RFI. The quality assurance/quality control (QA/QC) information on the sample data was not available; therefore, the use of the sample data is questionable. Because the PRSs have been included in this VCA for convenience, economy of scale, and relative proximity to this project, the three sites will be resampled for PCBs using a grid system similar to the one used in 1992 (LANL 1993, 26972). This sampling is described in Appendix E to this plan.

PRSs 0-010(a,b) were described as surface disposal areas in the "Solid Waste Management Units [SWMU] Report" (LANL 1990, 0145) but have been proposed and approved for no further action (NFA) by the Department of Energy (DOE) under Criterion 2. Criterion 2 states that the site was never used for the management (i.e., generation, treatment, storage, or disposal) of RCRA solid or hazardous wastes and/or constituents. The PRSs are included in this plan because they are located within the land transfer boundary. Neither of the PRSs requires additional sampling.

PRS 0-033(a), a former underground storage tank (UST) which has been removed, has been proposed for NFA under Criterion 4. Criterion 4 states that the site is regulated under another state and/or federal authority. If the site is known to have released, or is suspected of releasing or having released RCRA solid or hazardous wastes and/or constituents to the environment, it has been or will be investigated and/or remediated in accordance with applicable state and/or federal regulations.

Additional surface soil samples will be collected within the land transfer boundary because of the potential for surface deposition of radionuclides from historical stack emissions at TA-21, and to verify that contaminants from MDA B (PRS 21-015) have not migrated to surface soils within the land transfer boundary. MDA B is located on the east side of the field associated with PRS 0-030(b) and the eastern portion of the land transfer area.

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1.0 INTRODUCTION

The Laboratory is a multidisciplinary research facility owned by the DOE and managed by the University of California. The Laboratory is located in north-central New Mexico approximately 60 mi northeast of Albuquerque and 20 mi northwest of Santa Fe (Figure 1.0-1). The Laboratory site covers 43 mi^2 of the Pajarito Plateau, which consists of a series of finger-like mesas that are separated by deep canyons containing perennial and intermittent streams running from west to east. Mesa tops range in elevation from approximately 6200 ft to 7800 ft. The eastern portion of the plateau stands 300 ft to 1000 ft above the Rio Grande.

The DOE is responsible for identifying and remediating, where necessary, environmental hazards attributable to past activities at LANL. As contractor to DOE, the Laboratory's Environmental Restoration (ER) Project is tasked with investigating all PRSs at LANL and executing a remedy at those PRSs where environmental hazards related to past operations pose an unacceptable risk to human health or the environment.

This VCA plan covers PRSs in the DP Road South (A8) and DP Road 4 (A11) land transfer parcels as well as several other PRSs. These PRSs are located in TA-0 at the Laboratory and include 0-027, 0-030(a), 0-030(b), 0-029(a,b,c), 0-010(a,b), and the 6th Street Warehouse PRSs [0-004, 0-030(l,m), and 0-033(a,b)] (Figures 1.0-1, 1.0-2, and 1.0-3). Figure 1.0-1 shows the DP Road land transfer parcel before subdivision. The subdivided parcels are not yet final; therefore, the division cannot be shown on Figure 1.0-1. PRSs 0-027 and 0-030(a) are not part of the land transfer, but are included in this PRS aggregate due to their close proximity to the land transfer parcel. PRSs 0-029(a,b,c) are also included in this PRS aggregate. The PRSs that are listed in Module VIII of LANL's Resource Conservation and Recovery Act (RCRA) Hazardous Waste Facility operating permit are PRS 0-030(a) and consolidated PRS 0-030(b)-00, which includes 0-030(b,l,m), 0-004, and 0-033(b). Additional information about TA-21 and Material Disposal Area (MDA) B (PRS 21-015) is included in this document because air emissions from TA-21 potentially affected surface soil within the DP Road land transfer parcel. PRS 21-015 is directly north of the eastern boundary of the DP Road South land transfer parcel. Sampling to determine nature and extent of contamination at PRS 21-015 has concluded that some contaminants have migrated to the eastern edge of the DP Road South land transfer parcel.

This plan proposes the work required to reduce the residual risk from past Laboratory and Laboratory support operations to human health and the environment. The document includes background information for the sites, existing site characterization data, descriptions of previous site activities, descriptions of previous corrective action plans, sampling plans to address data gaps, proposed cleanup activities, and planned site restoration. Table 1.0-1 lists the PRSs covered in this plan, the proposed action for each PRS, and the current owner of the land. Appendix E of this plan is an abbreviated sampling plan for sites that need additional sampling, including a part of the land transfer parcel that needs to be assessed for historical airborne releases from TA-21 (PRS 21-021).

1.1 Purpose and Scope

The purpose of the work proposed in this plan is to reduce the residual human health and ecological risk associated with past Laboratory and Laboratory support activities. The plan describes the PRSs included in this corrective action, the previous investigations conducted at each of the sites, the results of the investigations, the basis for additional cleanup or sampling, any proposed corrective action, the confirmatory sampling rationale, and waste management. Each PRS has been investigated and/or remediated previously, and most PRSs have been written about in RFI or VCA plans and reports that describe those activities. Previous investigations and activities related to each PRS are summarized in

section 2.0. Except for PRS 0-027, potential impacts on human health could not be evaluated at the remaining PRSs because of insufficient data for identifying the nature and extent of contamination. The data gaps that precluded defining the nature and extent of contamination will be addressed in the abbreviated sampling and analysis plan (Appendix E). Ecological screening assessments were not performed for any of the PRSs either because complete exposure pathways do not exist for ecological receptors (e.g., a parking lot precludes access or the contaminants are buried at depth[1]; Appendix D) or because data were insufficient to define the nature and extent of contamination.

Table 1.0-1
PRSs Included in VCA Plan

PRS	Description	Proposed Action	Current Land Owner	Relevant Sections of This Plan
0-027	Drum storage area	Soil vapor extraction	Private	2.1, 3, 4, 5, 6, 7
0-004	Indoor container storage area	Additional sampling	DOE[b]	2.2, Appendix E
0-010(a, b)	Disposal areas	Administratively complete	DOE[b]	2.5
0-030(a)	Septic system	Propose for NFA, Criterion 5	Private	2.1
0-030(b)	Septic system	Additional sampling, piping removal	DOE[b]/Private	2.3, Appendix E
0-030(l)	Septic system	Additional sampling, piping removal	DOE[b]	2.2, Appendix E
0-030(m)	Septic system	Additional sampling, piping removal	DOE[b]	2.3, Appendix E
0-033(a)	UST[a]	Administratively complete	DOE	2.5
0-033(b)	Contaminated soil, drainlines, and an outfall	Additional sampling	DOE[b]	2.2, Appendix E
0-029(a)	PCB transformer site	Additional sampling	San Ildefonso	2.4, Appendix E
0-029(b)	PCB transformer site	Additional sampling	San Ildefonso	2.4, Appendix E
0-029(c)	PCB transformer site	Additional sampling	Santa Fe National Forest	2.4, Appendix E
21-021	Aerial deposition from TA-21 stacks	Additional sampling	DOE[b]	2.6, Appendix E

[a] UST = underground storage tank.

[b] Part of proposed DP Road South and DP Road 4 land transfer parcels.

The previous reports did not address ecological concerns and some did not address nature and extent of contamination. Because the guidelines for evaluating sites have become more stringent over the years, this plan will address data gaps for situations in which nature and extent are either undefined or incompletely defined.

---

[1]It is important to note that ecological receptors are not expected to experience significant chemical exposure at more than 5 ft below the ground surface (bgs) because burrowing activity and most plant root development are unlikely this far below the surface; therefore, depths greater than 5 ft bgs were not screened for ecological receptors (LANL 1999, 64783).

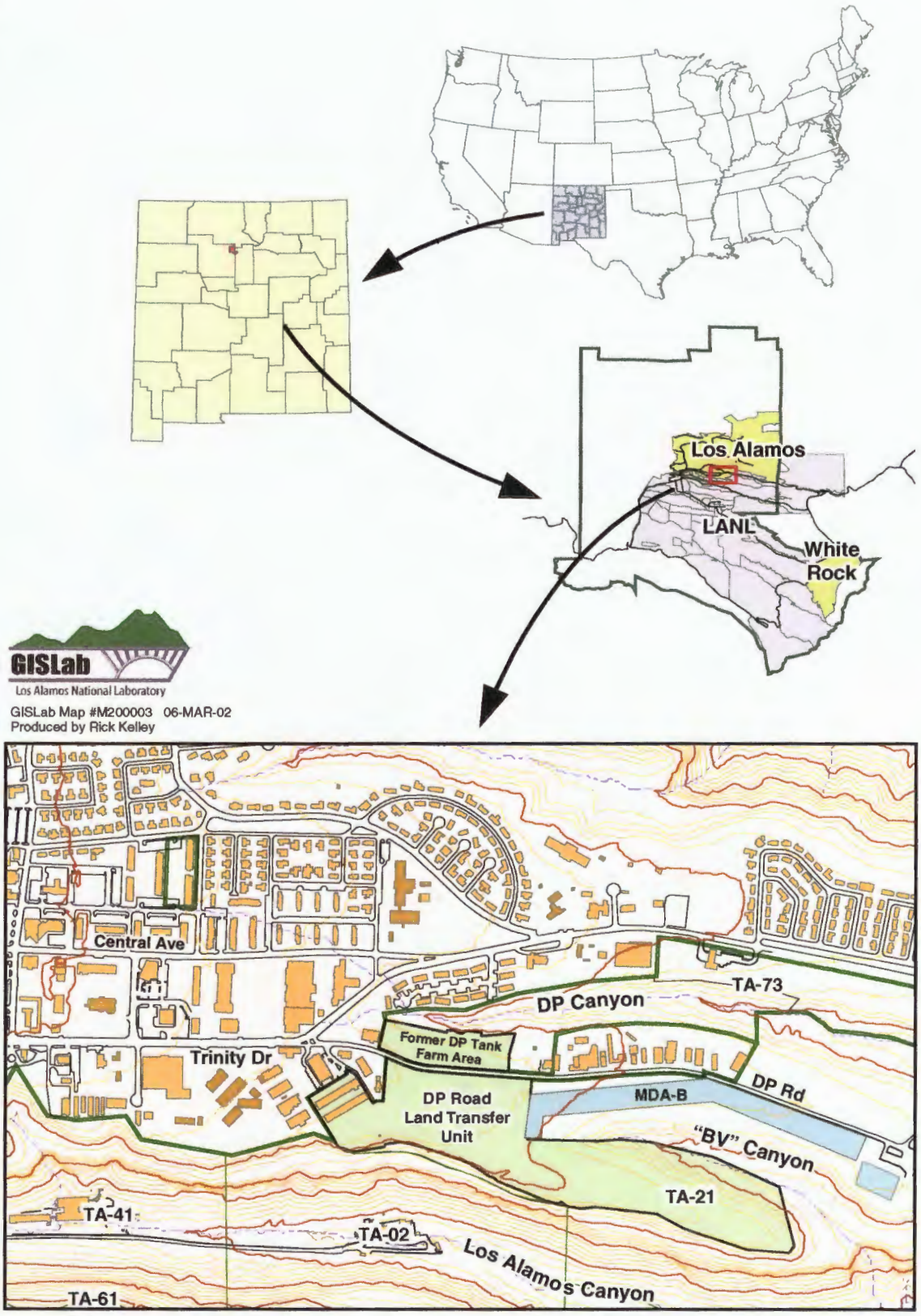
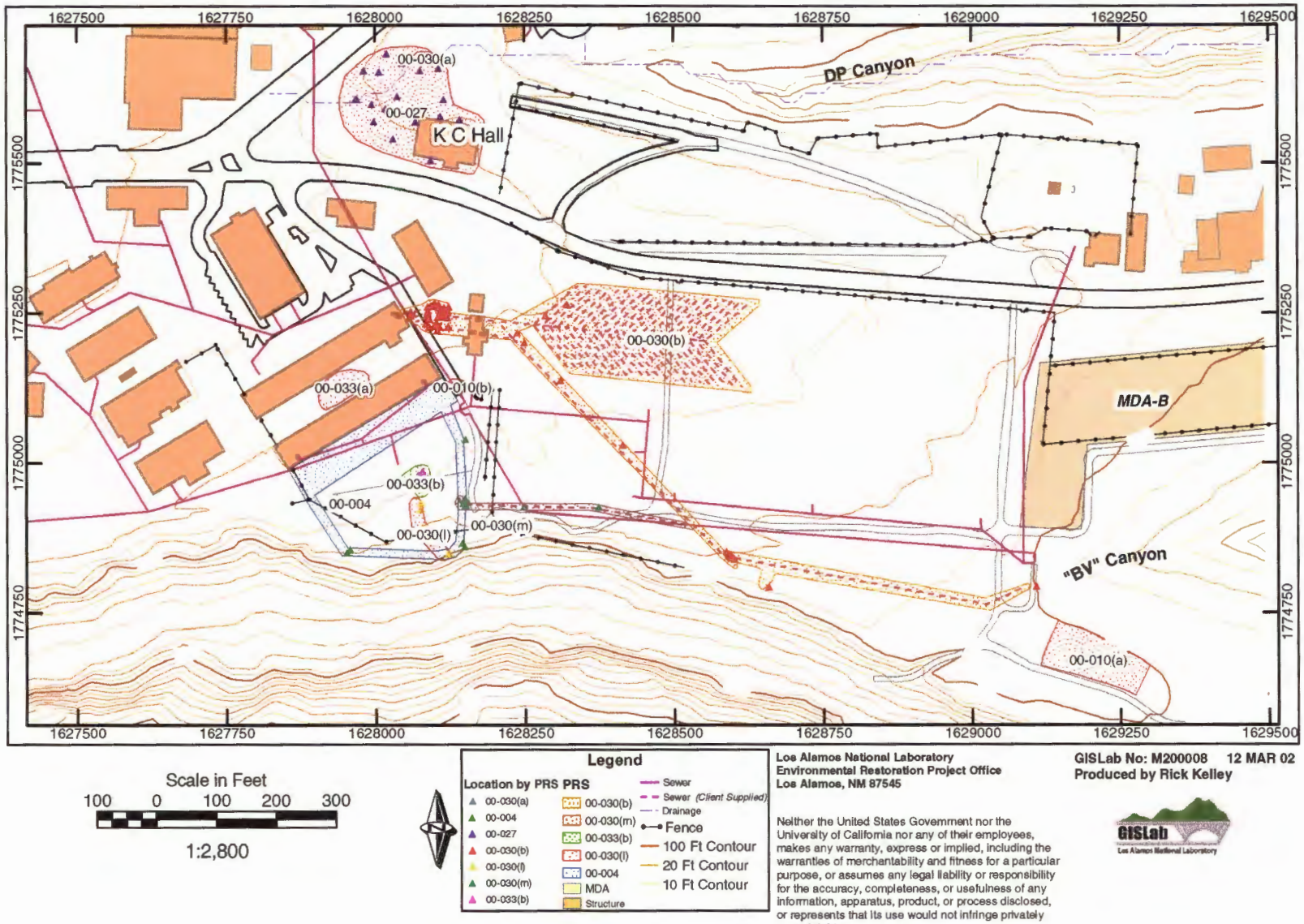


Figure 1.0-1. Location map of New Mexico, LANL, and DP Road land transfer parcel



Scale in Feet

100 0 100 200 300

1:2,800

Legend

Location by PRS PRS

- 00-030(a)
- 00-004
- 00-027
- 00-030(b)
- 00-030(l)
- 00-030(m)
- 00-033(b)
- 00-030(b)
- 00-030(m)
- 00-033(b)
- 00-030(l)
- 00-004
- MDA
- Structure
- Sewer
- Sewer *(Client Supplied)*
- Drainage
- Fence
- 100 Ft Contour
- 20 Ft Contour
- 10 Ft Contour

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Produced by Rick Kelley

Figure 1.0-2. DP land transfer potential release sites

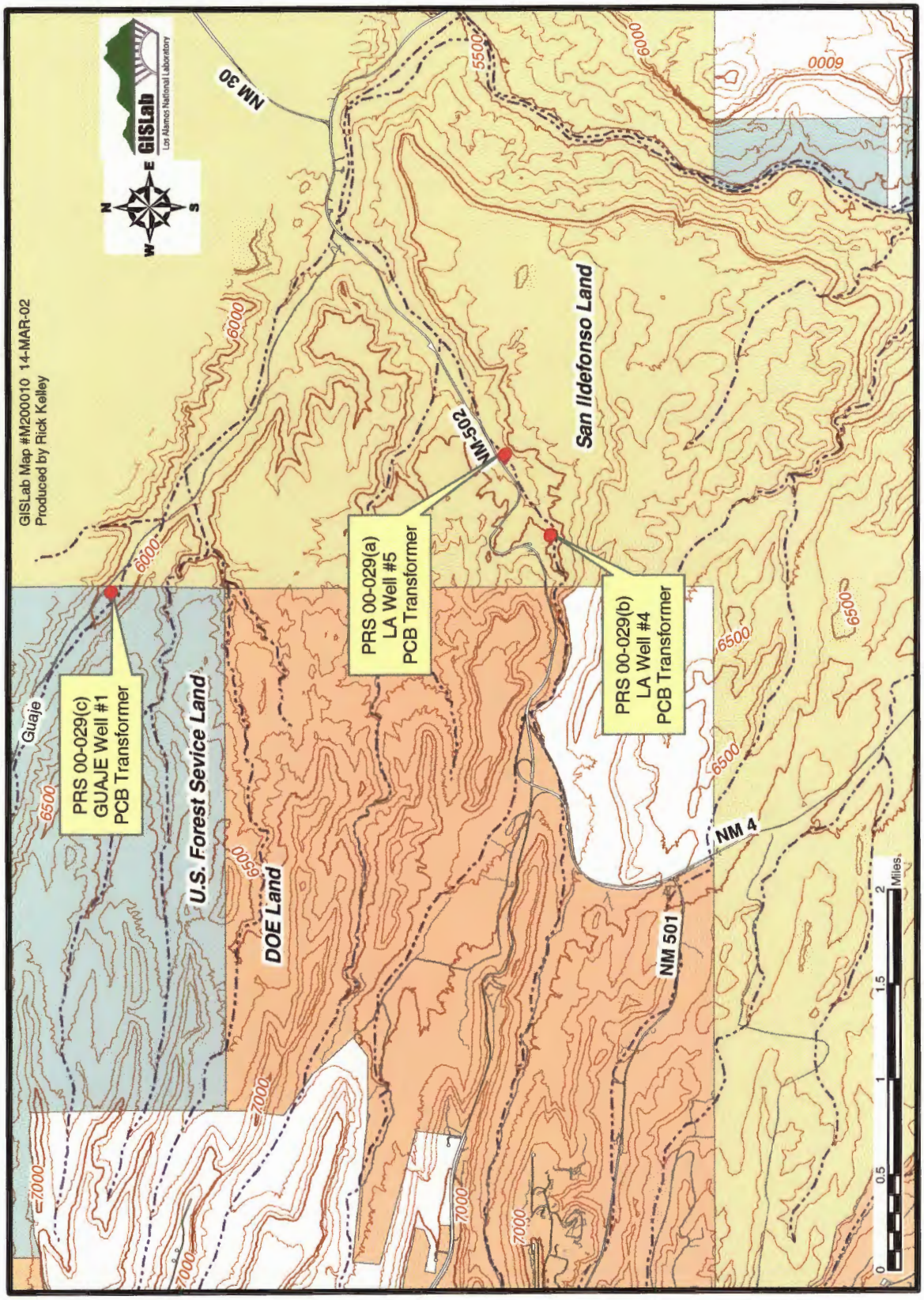


Figure 1.0-3. Locations of PRSs 0-029(a,b,c)

1.2 Regulatory History

Depending upon the type of contaminant(s) and the history of a PRS, either the New Mexico Environment Department (NMED) or the DOE has administrative authority over work performed by the ER Project. NMED, under the auspices of the State of New Mexico, has authority over sites with hazardous waste or hazardous constituents, including the hazardous waste portion of mixed waste (i.e., waste contaminated with both radioactive and hazardous constituents). Hazardous constituents are regulated under RCRA. The DOE has authority over sites with radioactive contamination; radionuclides are regulated under DOE Order 5400.5, "Radiation Protection of the Public and the Environment," and DOE Order 435.1, "Radioactive Waste Management."

Module VIII of the Laboratory's Hazardous Waste Facility Permit, hereinafter referred to as the HSWA module (EPA 1990, 1585), is regulated by NMED. The HSWA module specifies conditions and requirements for performing ER activities. The Environmental Protection Agency (EPA) issued the HSWA module on May 23, 1990, and revised it on May 19, 1994; the permit renewal application is currently undergoing review by NMED.

Although only PRSs 0-030(a,b,l,m) and 0-033(a) are listed in the HSWA module, all of the PRSs within the area to be transferred are included in this plan. DOE is the administrative authority for PRSs 0-027, 0-010(a,b), and 0-029(a,b,c). NMED is the administrative authority for PRSs 0-004, 0-030(a,b,l,m) and 0-033(b). DOE has approved NFA for PRSs 0-010(a,b) under Criterion 2. Criterion 2 states that the site was never used for the management (i.e., generation, treatment, storage, or disposal) of RCRA solid or hazardous wastes and/or constituents. The NFA for PRS 0-033(a) under Criterion 4 is pending NMED approval. Criterion 4 states that the site is regulated under another state and/or federal authority. If the site is known to have released, or is suspected of releasing or having released, RCRA solid or hazardous wastes and/or constituents to the environment, it has been or will be investigated and/or remediated in accordance with applicable state and/or federal regulations.

1.3 Rationale for Proposed Voluntary Corrective Action

Some of the PRSs are located on property that is slated for land transfer to Los Alamos County (Figures 1.0-1 and 1.0-2). Two of the PRSs that are not part of the land transfer parcel belong to the Archdiocese of Santa Fe [PRS 0-027 and PRS 0-030(a)] (Figure 1.0-2). The San Ildefonso Pueblo owns the land where PRSs 0-029(a) and 0-029(b) are located (Figure 1.0-3); and Santa Fe National Forest manages the land where PRS 0-029(c) is located (Figure 1.0-3). A portion of PRS 0-030(b) is private property; the remainder is located on DOE land.

The proposed VCA activities will remove residual contamination that could pose an unacceptable risk to human health or the environment from the Los Alamos town site, will allow the PRSs to be closed and subsequently removed from the Laboratory's operating permit, and will allow permanent transfer of the property to the county for commercial or private use. Previous RFI and VCA activities did not remove existing pipelines; therefore, these pipelines will be removed to prevent future exposure to any residual concentrations of chemicals of potential concern (COPCs). Because data gaps and COPCs were identified at some of the PRSs, additional sampling will be conducted to ensure that the extent of potential contamination has been defined and will provide sufficient information for human health and ecological assessments. Soil vapor extraction (SVE) is proposed for PRS 0-027 to remove elevated concentrations of volatile organic chemicals (VOCs) in the subsurface. SVE is viewed as a cost-effective, proactive remedial alternative and is preferred over additional characterization followed by a baseline risk assessment. It is anticipated that the VCA at PRS 0-027, as well as removal of any remaining piping and additional sampling at some of the other PRSs, will not generate a significant volume of waste. The

anticipated wastes and recyclable materials generated during VCA activities should be easily accommodated at local facilities. Completion of these VCA activities will constitute final remedies at each of the PRSs.

2.0 PREVIOUS SITE CHARACTERIZATION

The PRSs included in this plan were previously described in the Laboratory "Solid Waste Management Units Report" (LANL 1990, 0145) and in the "RFI Work Plan for Operable Unit [OU)] 1071" (LANL 1992, 0781). The PRSs have been characterized, and in some cases remediated; those activities and associated analytical data have been reported in the following reports.

- "RFI Report for Potential Release Sites 0-030(b), 0-004, 0-010(b), 0-033(b), 6th Street Warehouses" (LANL 1996, 54616)
- "Voluntary Corrective Action Completion Report for 6th Street Warehouses, PRSs 0-030(l), 0-030(m), and 0-033(a)" (LANL 1996, 55203)
- "Voluntary Corrective Action Completion Plan for Potential Release Site 0-030(a)" (LANL 1996, 54353.3)
- "Voluntary Corrective Action Report for Solid Waste Management Unit 0-030(a)" (LANL 1996, 59576.1)
- "Voluntary Corrective Action Plan for Potential Release Sites at TA-0, PRSs 0-033(b) and 0-030(b)" (LANL 1996, 54760)
- "Voluntary Corrective Action Completion Report for TA-0, PRSs 0-033(b) and 0-030(b)" (LANL 1996, 62536)
- "RFI Phase Report, Operable Unit 1071, SWMU Aggregate 0-G, Leakage from PCB Transformers" (LANL 1993, 26972)
- "Phase Report 1B: TA-21 Operable Unit RCRA Facility Investigation Operable Unit–Wide Surface Soil, Deposition Layer and Filter Building Investigation" (LANL 1994, 26073)

The information in this plan has been summarized from the documents listed above. In addition, the existing analytical data were re-examined to determine if they were sufficient for defining nature and extent for the PRSs. If data were adequate to define nature and extent, the data for the PRSs were assessed to determine if COPCs pose an acceptable risk to human health and the environment.

A sequence of aerial photographs recorded the changes that have occurred at the PRSs on the mesa top since the Laboratory was established. Figure 2.0-1 (LANL 1946, 15463) shows the land transfer mesa-top parcels in 1946, with the 6th Street Warehouses clearly visible as a point of reference. Also shown in this photo is the incinerator, which was served by the septic system of PRS 0-030(m). PRS 0-027 appears as a fuel tank farm. Coal piles are visible east of the leach field for PRS 0-030(b). PRS 0-010(a) is visible on the east side of the photograph as a storage area.

Figure 2.0-2 is an aerial photograph from 1951 (LANL 1951, 15503) which shows the trailer park located over the former PRS 0-030(b) leach field. Also shown on this photograph is the Material Testing Laboratory (MTL), which tested concrete and asphalt; the incinerator is no longer present. A berm that is now located along the canyon north of PRSs 0-030(l) and 0-030(m) is visible in this photograph. PRS

0-027 is clearly visible as a drum storage area; the fuel tank farm had been moved to the east to PRS 21-029 (DP Tank Farm).

Figure 2.0-3 (LANL 1958, 15730) is a 1958 aerial photograph that shows the cells of the drum storage area (PRS 0-027). The 1965 photo (Figure 2.0-4) shows the current building located over part of the drum storage area that can be seen in earlier photographs. The photo from 1974, Figure 2.0-5, shows that the former drum storage area had been either paved or covered by the existing building, and the trailer park had been recently removed, as indicated by bare soil. Figure 2.0-6 is an aerial photograph from 1986 in which it appears that the MTL is no longer present. Grass and shrubs cover the former trailer court.

2.1 DP Road Drum Storage Area and Septic Tank [PRSs 0-027 and 0-030(a)]

As shown on Figure 2.1-1, PRSs 0-027 and PRS 0-030(a) are both located on the Knights of Columbus property at 104 DP Road. These PRSs are aggregated due to their spatial proximity and because PRS 0-030(a) was the septic tank and associated lines that were connected to the dispatch office for the tank farm and drum storage area (PRS 0-027). An RFI report was never completed for PRS 0-027; a VCA plan and a VCA completion report were submitted for PRS 0-030(a) (LANL 1996, 54353.3 and LANL 1996, 59576.1, respectively).

2.1.1 PRS 0-027, DP Road Drum Storage Area

2.1.1.1 PRS 0-027 Site Description and Operational History

PRS 0-027 is located at the intersection of Trinity Drive and DP Road, the current site of the Knights of Columbus Hall, which is owned by the Archdiocese of Santa Fe. This PRS is described in detail in section 5.7 of the "RFI Work Plan for OU 1071" (LANL 1992, 0781). The site was used as a fuel tank farm from 1946 to mid-1948. An aerial photograph (Figure 2.0-1) and engineering drawings from 1946 and 1947 indicate that at least eight above-ground oil storage tanks and three fill stations were located in the DP Road storage area. In mid-1948, the fuel tank farm was relocated to the area that is now PRS 21-029, and the oil tanks were decommissioned and moved to PRS 21-029, DP Tank Farm (LANL 1990, 0145).

After the oil tanks were removed, the site was converted into a drum storage area where metal 55-gal. drums of lubricants were stored for distribution to various job sites and craft shops. The storage capacity of the site was approximately 600 to 700 drums (LANL 1990, 0145) and consisted of 6 cells, each approximately 38 ft wide (LANL 1990, 0145) with varying lengths (Figures 2.0-2 and 2.0-3). The cells were separated by 2-ft-high earthen dikes around the northern perimeter and a concrete berm at the southern perimeter. The floor of each cell was sloped to the north and covered by 2 in. of gravel. Aerial photos show that the drum storage area was used until the early 1960s (Figures 2.0-3 and 2.0-4).

By 1965, the current Knights of Columbus building existed on the property (Figure 2.0-4). As seen in an aerial photo (Figure 2.0-5), the parking lot was paved with concrete by 1974. Since that time the configuration of the property has changed very little.

Based on the site history and documented use, the COPCs for PRS 0-027 are primarily constituents of petroleum fuels, lubricants, etc., including VOCs, semivolatile organic compounds (SVOCs), total petroleum hydrocarbons (TPH), and target analyte list (TAL) metals.

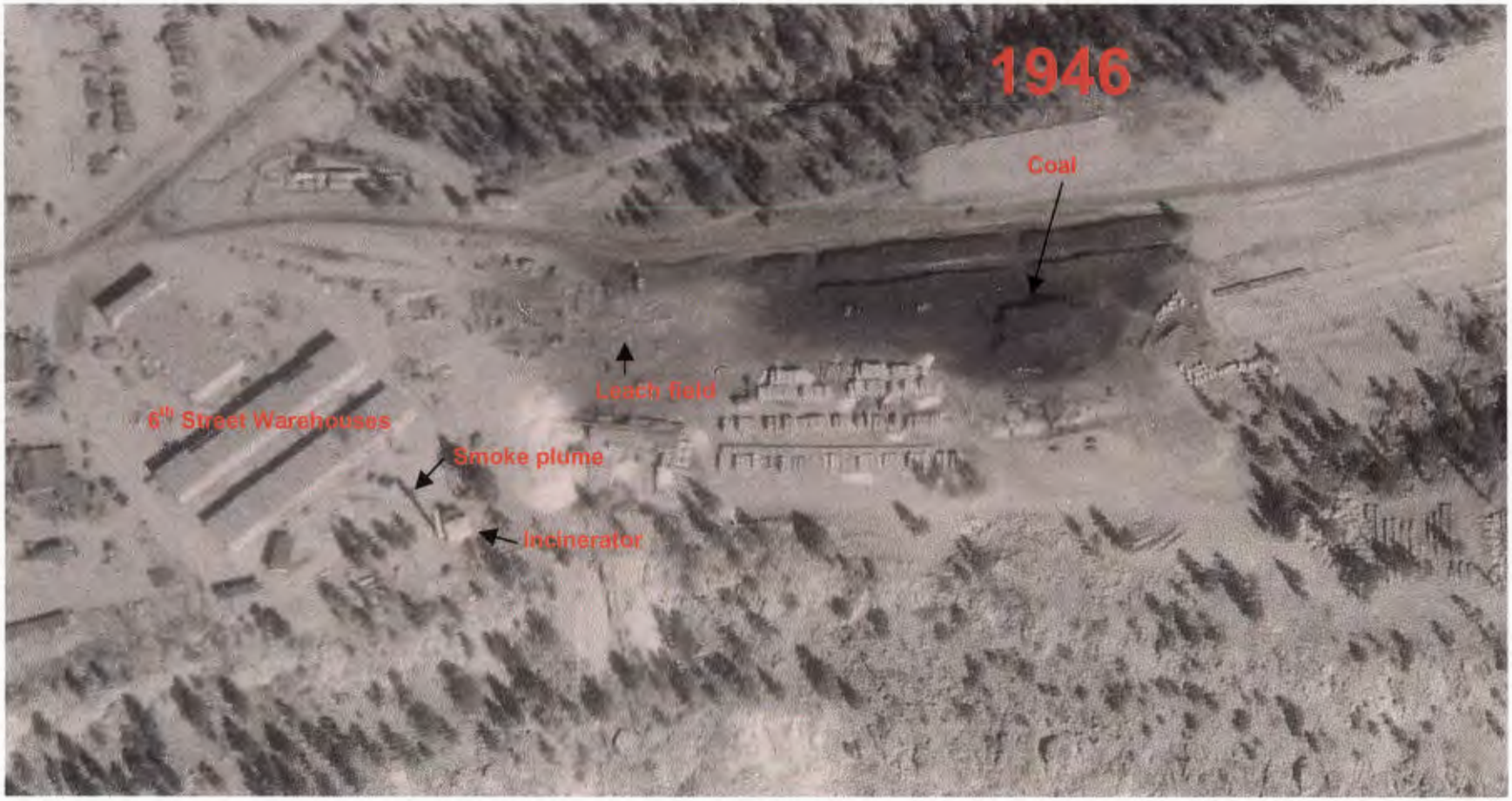


Figure 2.0-1. 1946 aerial photograph

Figure 2.0-2. 1951 aerial photograph (negative)

Figure 2.0-3. 1958 aerial photograph (negative)

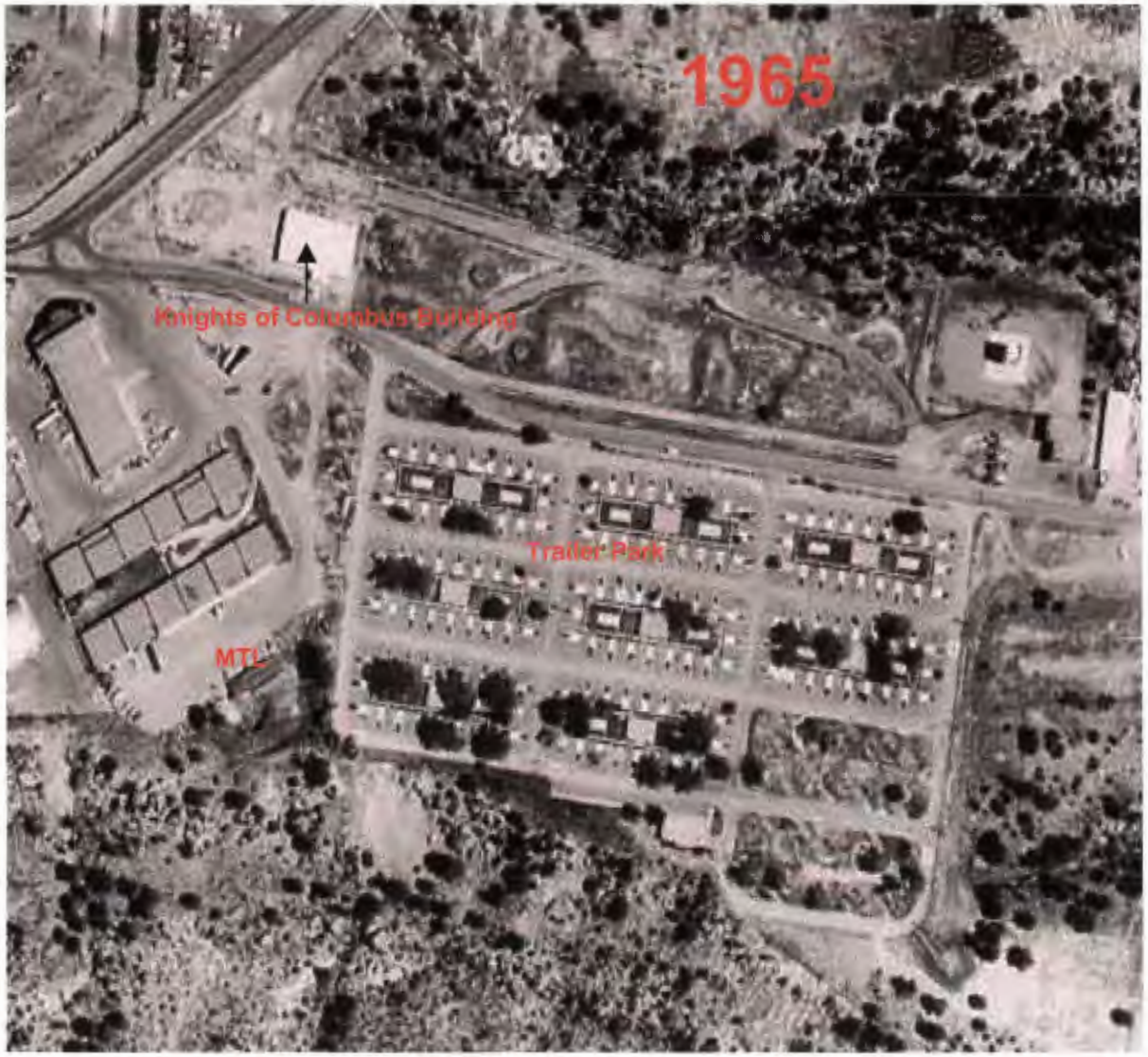


Figure 2.0-4. 1965 aerial photograph

Figure 2.0-5. 1974 aerial photograph

Figure 2.0-6. 1986 aerial photograph

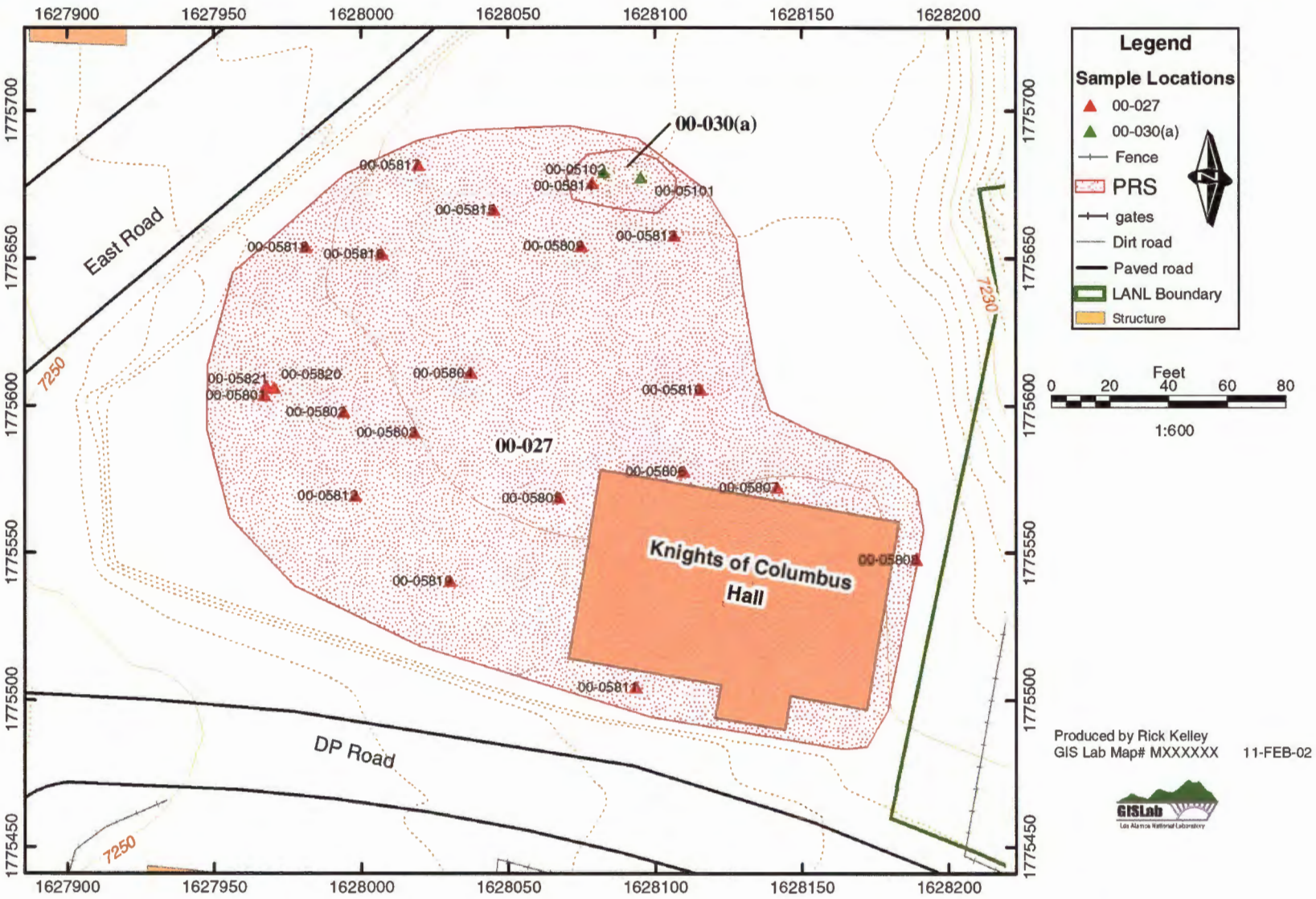


Figure 2.1-1. PRS 0-027 and PRS 0-030(a) sample location map

2.1.1.2 PRS 0-027 Previous Field Investigations

RFI field activities were conducted in the spring and fall of 1996 (Figure 2.1-1). The RFI report was never completed; therefore, all analytical data for PRS 0-027 will be presented in the VCA completion report to be prepared following completion of all proposed sampling and corrective measures as described in this plan. As stated in the RFI work plan (LANL 1992, 0781), the objectives of the RFI were to locate underground structures remaining after site decommissioning, to determine whether vapor phase contaminants existed in shallow soils or fill material at the drum storage areas, and to determine the nature and extent of contaminants, if any, in site media.

The following field activities were conducted at PRS 0-027:

- In early 1996, using site plans and archival maps as guides, a geodetic survey was conducted to determine the current locations of buried structures, drainlines, and outfall points, and the former locations of drum storage cells and above-ground fuel storage tanks. The survey was also used to identify soil vapor sample locations and borehole sample locations. The survey identified the locations of a former fuel dispatch office, the seven north-south trending earthen berms, and the eight former above-ground fuel storage tanks. Current structures were surveyed, including the Knights of Columbus Hall building, associated outbuildings, and a cement block wall along the south and west property lines.

- During the spring of 1996, a geophysical survey consisting of electromagnetic (EM) induction and magnetic methods was conducted to more precisely locate buried structures and drainlines.

- In June 1996, a soil vapor survey was conducted in the vicinity of the tank and drum storage areas to determine whether vapor phase contamination existed in the subsurface soils. Sampling was accomplished using probes that consisted of 5-ft lengths of 1 in. outside diameter stainless-steel pipe fitted with a 1-in. stainless-steel, retractable, disposable tip. In general, every attempt was made to drive the stainless-steel sampling probes to a target depth of approximately 6 ft bgs before collecting the soil vapor sample. At four locations, however, samples were collected at less than 6 ft bgs due to refusal. At two locations the probes were driven to a depth of 10 ft before sampling. Soil vapor samples were analyzed for benzene, toluene, ethylbenzene, and xylene (BTEX).

- In September and October of 1996, subsurface soil samples were collected at 21 borehole locations that were selected based on the locations of the former fuel storage cells and areas of contaminated soil that were identified by the soil vapor survey and the VCA investigation at PRS 0-030(a) (LANL 1996, 59576.1). Borehole depths ranged from 20 ft bgs to 60 ft bgs. Subsurface samples were analyzed for VOCs, SVOCs, TPH, TAL metals, and pesticides/polychlorinated biphenyls (PCBs).

- During December 1997, indoor air samples were collected within the Knights of Columbus Building in various locations to determine if VOCs were present in the building. A total of eight air samples were collected and analyzed for VOCs.

(a) Sample Analyses

All samples were collected in accordance with the sampling design specified in the "RFI Work Plan for OU 1071" (LANL 1992, 0781), with the exception of the indoor air samples, whose collection was a deviation from the work plan. The work plan did not require that indoor air samples be collected. Samples requiring chemical and radiological analyses and chain-of-custody documentation were submitted to the Mobile

Radiological Analysis Laboratory (MRAL) and the Mobile Chemical Analysis Laboratory (MCAL) for analyses before shipment from the Sample Management Office (SMO) to a fixed analytical laboratory. The indoor air samples were submitted to the SMO before shipment to a fixed analytical laboratory.

(b) Analytical Methods

All samples were analyzed by contract analytical laboratories using methods specified in the ER SMO analytical subcontracts (LANL 1995, 1278). The methods were current Environmental Protection Agency (EPA) SW-846 and Contract Laboratory Program (CLP) methods or equivalents for VOCs, SVOCs, TPH, TAL metals, and pesticides/PCBs. The indoor air samples were analyzed by method TO-14. Before analysis for inorganic chemicals, solid samples were digested according to EPA SW-846 method 3050 or equivalent (EPA 1992, 1207). The subcontracts specify LANL-approved methods for radiochemical analyses using the technologies identified in the subcontract (americium-241 by alpha spectroscopy). Analytical method selection is described in Appendix IV of the ER Project Quality Assurance Project Plan Requirements for Sampling and Analysis (QAPP), which is included as Chapter 4 of the "Installation Work Plan [IWP] for Environmental Restoration Program" (LANL 1996, 1379). For each analyte, quantitation or detection limits are specified as contract-required estimated quantitation limits (EQLs) for organic chemicals and radionuclides, and as estimated detection limits (EDLs) for inorganic chemicals. These limits are included in Appendix III of the ER Project QAPP, along with the target analytes for each analytical suite.

(c) Data Validation

Data verification and baseline validation procedures were used to determine if the data packages received for PRS 0-027 from the analytical laboratory were generated according to specifications and contained the information necessary for determining if the data are sufficient for decision-making. For analytical data used to support decisions discussed in this VCA plan, baseline data validation under the ER protocol was performed as described in the QAPP (LANL 1996, 1379). This process produced validation reports with data qualifiers indicating potential deficiencies for affected results. Each data qualifier is accompanied by a reason code that provides information about the deficiency that led to qualification of the data. A summary of the validation reports will be included in the VCA completion report.

Although data were qualified for a variety of reasons during the baseline data validation process, the quality of data obtained in the earlier investigation was good. The baseline validation procedure used for routine analytical services provides information about the reason the qualifier was applied and its potential impact on the affected data. The purpose is not to reject data but rather to ensure that the relative quality of the data is understood so that the data may be used appropriately.

(d) Field Investigation

The initial borehole locations at PRS 0-027 were selected using the criteria described in the "RFI Work Plan for OU 1071" (LANL 992, 0781). One borehole was placed inside the boundaries of each of the accessible drum storage cells (locations 00-05801, 00-05802, 00-05803, and 00-05805) (Figure 2.1-1). Because of problems with refusal, three boreholes were required to drill to the depth of 48 ft at borehole 00-05801. The first two attempts (location 00-5801 and 00-5802) met with refusal. A third attempt (location 00-05821) successfully reached 48 ft. Because the Knights of Columbus Hall currently covers the former two easternmost cells of the drum storage area, four boreholes (locations 00-05806, 00-05807, 00-05808, and 00-05811) were drilled around the perimeter of the building to detect contamination

associated with these cells. One borehole (location 00-05804) was placed near a location (also the location of a former fill station) corresponding to high soil vapor concentrations identified during the soil vapor survey. Two boreholes (locations 00-05809 and 00-05815) were placed near areas of contaminated soil that were identified during the VCA at PRS 0-030(a) (LANL 1996, 59576.1). Additional boreholes were added to bound contaminant plumes intercepted by the initial boreholes drilled during these field activities.

Samples were collected from 20 of the 21 boreholes at 19 distinct locations. In accordance with the work plan, samples were collected from soils or fill material overlying the tuff, at or near the soil/tuff interface, and from within the tuff. Where field-screening results indicated the presence of contaminants in the upper tuff, drilling and screening of samples continued in 5-ft intervals. Drilling ceased for each borehole when field-screening results indicated that the augers had penetrated at least 5 ft deeper than the deepest zone of contamination. A final sample was collected at, or near, the final depth of each borehole. If contamination was noted in a borehole, subsequent adjacent boreholes were advanced to at least the known depth of contamination in the original borehole. Depths of the boreholes at the DP Road storage area ranged from 20 ft bgs at the east end of the Knights of Columbus Hall (location 00-05808) to 60 ft bgs near the northwest portion of the storage area (location 00-05816).

Based on field screening, MCAL data, and fixed laboratory data, the areal and vertical extent of potential subsurface contamination was defined. The contamination extends vertically from the surface soils underlying the concrete parking lot to a depth of approximately 43 ft at location 00-05802. The approximate areal extent of the risk-driver contaminants is shown in Figure 2.1-2. To keep the figure as clear as possible, other contaminants, which were detected at lower levels, are not presented on this figure.

After sampling was completed, cuttings were returned to the borehole from which they were retrieved. Cuttings were placed in the boreholes in their original vertical sequence. The upper 2 ft of each borehole was filled with concrete.

Solid wastes generated during this investigation, including drill cuttings and core, disposable sampling equipment, plastic sheeting, empty plastic cuttings bags, and personal protective equipment, were placed in 55-gal. drums. Liquid wastes produced during the decontamination of drilling and downhole sampling equipment and personal hand-wash rinse water were also stored in 55-gal. drums. Waste drums were staged in a temporary waste staging area and then transferred to the Laboratory's CST-5. All waste was then profiled, manifested, and transported off-site for disposal.

The following deviations from the work plan occurred during fieldwork:

- Geomorphic mapping was not conducted. The intent of the mapping was to locate first-order stream channels and sediment catchment areas below outfalls from the site. It is believed that the work plan was written without a site visit because the upper end of the canyon was filled in the 1960s and 1970s, burying the channel and any sediment catchment areas. The presence of fill material in the upper portion of DP Canyon made this task irrelevant and impossible.
- Subsurface sampling associated with outfall piping from the drum storage area was not conducted because no evidence was found to indicate that the piping or outfall existed.
- Because the Knights of Columbus Hall covers the two easternmost drum storage cells, no drilling was attempted in those cells. Instead, four boreholes were drilled around the perimeter of the building in an attempt to bound any contamination that may exist beneath the building.

- In an attempt to bound the extent of contamination at the site, borehole drilling and sampling operations were expanded to 19 distinct locations at the site.
- Indoor air samples were collected in 1997 to determine whether contaminants from PRS 0-027 were entering the building. Indoor air samples were not included in the work plan.

2.1.1.3 PRS 0-027, Results of Previous Investigations

Data collected for the PRS 0-027 RFI were adequate to define the nature and extent of contamination associated with the former fuel and lubricant storage operations. Figure 2.1-2 shows the sample locations and contour lines of analytical data and photo-ionization detector (PID) readings.

(a) Data Review

Inorganic Chemical Comparison to Background Values

Table 2.1-1 summarizes the inorganic chemical data. It lists each analyte with its number of detects, the range of concentrations, the frequency of detects above the background values (BVs), and the frequency of nondetects above the BVs. Table 2.1-2 shows the samples with concentrations above the corresponding BVs.

Three subsurface soil samples were collected. Antimony, calcium, and zinc were detected above their BVs in at least 1 of those samples. Antimony, cadmium, calcium, and lead were detected above their BVs in one or more of the 7 fill samples. Aluminum, barium, calcium, cobalt, copper, lead, magnesium, nickel, vanadium, and zinc were above their respective BVs in one or more of 23 tuff samples.

Organic Chemicals

Table 2.1-3 summarizes the organic chemical data by analyte, with number of detects, range of concentrations, and frequency of detects. Table 2.1-4 presents the detected concentrations for all of the organic chemicals that were detected in at least one sample.

Indoor Air Data

Eight indoor air samples were collected inside the Knights of Columbus Building and analyzed for VOCs. The results of the COPCs are included on Table 2.1-5. The values are given in parts per billion by volume (ppbv). This means that the analytical techniques determine the total weight of contaminant in the collection medium.

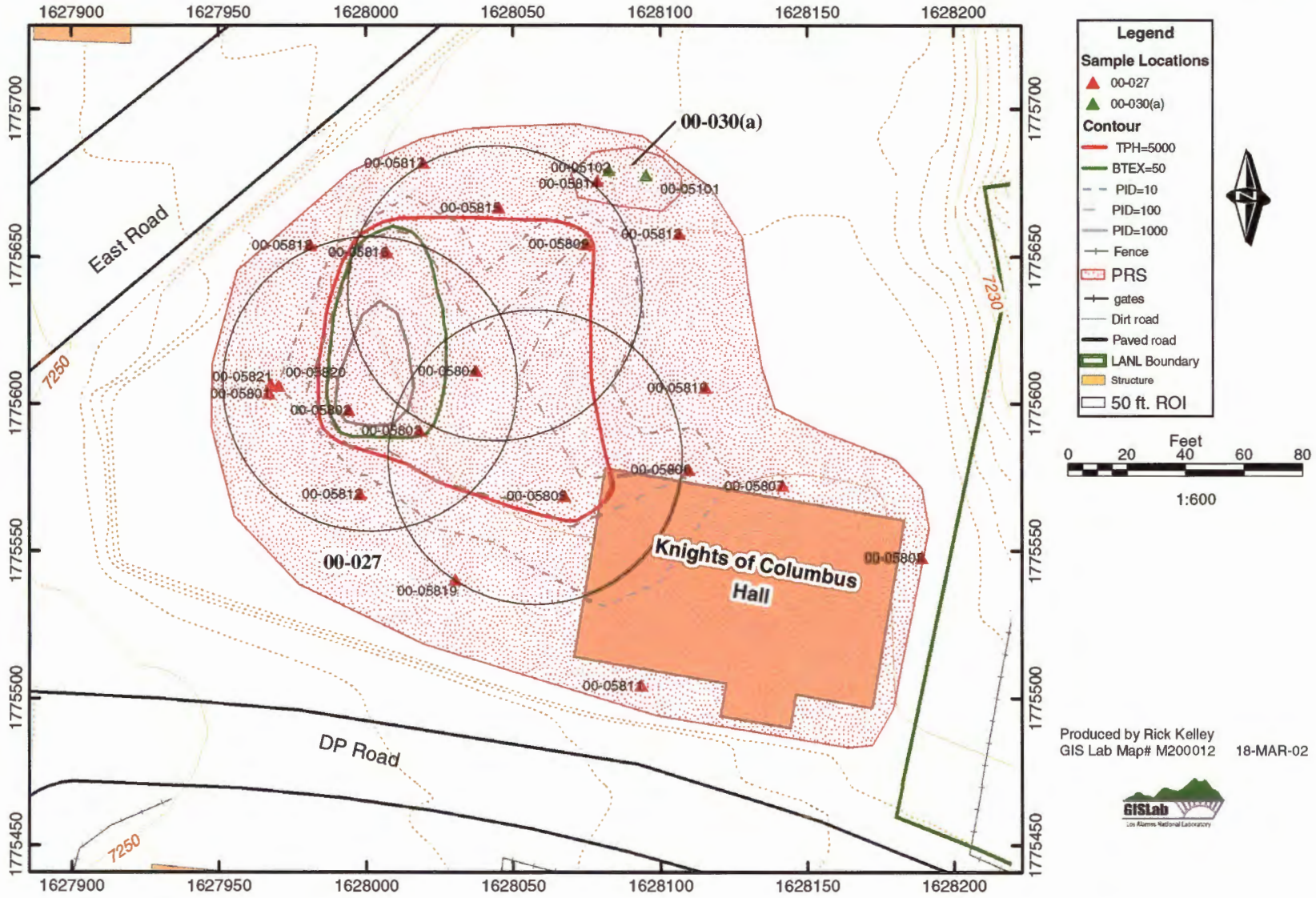


Figure 2.1-2. PRS 0-027, contaminant plume and maximum values of BTEX and TPH

(b) Results of Quality Assurance/Quality Control Activities

Most of the data were determined to be useable. A few organics had problems related to high or low surrogates. A complete data quality section will be included in the VCA completion report.

Table 2.1-1
Frequency of Detects for Inorganic Chemicals at PRS 0-027

Analyte	Media	Number of Analyses	Number of Detects	Concentration Range (mg/kg)	BV (mg/kg)	Frequency of Detects Above BV[a]	Frequency of Nondetects Above BV[b]
Aluminum	Soil	3	3	4980 to 9890	29200	0/3	0/0
	Fill	7	7	1300 to 10400	29200	0/7	0/0
	Qbt 3	23	23	268 to 8490	7340	1/23	0/0
Antimony	Soil	3	1	[0.39] to 10.2	0.83	1/3	0/2
	Fill	7	1	[0.4] to 6.4	0.83	1/7	1/6
	Qbt 3	23	0	[0.38 to 6.2]	0.5	0/23	20/23
Arsenic	Soil	3	3	2.4 to 4.1	8.17	0/3	0/0
	Fill	7	7	1.3 to 3.3	8.17	0/7	0/0
	Qbt 3	23	21	0.23 to [11.2]	2.79	0/23	2/2
Barium	Soil	3	3	53.8 to 155	295	0/3	0/0
	Fill	7	7	17.4 to 170	295	0/7	0/0
	Qbt 3	23	23	6.2 to 317	46	2/23	0/0
Beryllium	Soil	3	3	0.51 to 0.79	1.83	0/3	0/0
	Fill	7	7	0.35 to 0.8	1.83	0/7	0/0
	Qbt 3	23	23	0.09 to 0.96	1.21	0/23	0/0
Cadmium	Soil	3	1	0.05 to [0.73]	0.4	0/3	1/2
	Fill	7	1	[0.04] to 0.77	0.4	1/7	0/6
	Qbt 3	23	0	[0.04 to 0.78]	1.63	0/23	0/23
Calcium	Soil	3	3	1150 to 14500	6120	1/3	0/0
	Fill	7	7	495 to 7050	6120	1/7	0/0
	Qbt 3	23	23	96.3 to 3530	2200	1/23	0/0
Chromium, total	Soil	3	3	4.1 to 10	19.3	0/3	0/0
	Fill	7	7	0.97 to 9.7	19.3	0/7	0/0
	Qbt 3	23	22	0.28 to 9.3	7.14	1/23	0/1
Cobalt	Soil	3	3	1.8 to 6.7	8.64	0/3	0/0
	Fill	7	7	0.81 to 6.7	8.64	0/7	0/0
	Qbt 3	23	17	0.22 to 8.3	3.14	1/23	0/6
Copper	Soil	3	3	2.4 to 7.7	14.7	0/3	0/0
	Fill	7	7	2.2 to 6.5	14.7	0/7	0/0
	Qbt 3	23	21	0.68 to 11.7	4.66	1/23	0/2
Iron	Soil	3	3	6640 to 12600	21500	0/3	0/0
	Fill	7	7	2610 to 11800	21500	0/7	0/0
	Qbt 3	23	23	1690 to 13200	14500	0/23	0/0

Table 2.1-1 (continued)

Analyte	Media	Number of Analyses	Number of Detects	Concentration Range (mg/kg)	BV (mg/kg)	Frequency of Detects Above BV[a]	Frequency of Nondetects Above BV[b]
Lead	Soil	3	3	9.4 to 15.3	22.3	0/3	0/0
	Fill	7	7	6.3 to 27	22.3	2/7	0/0
	Qbt 3	23	23	2.6 to 38.7	11.2	7/23	0/0
Magnesium	Soil	3	3	787 to 2620	4610	0/3	0/0
	Fill	7	7	360 to 2000	4610	0/7	0/0
	Qbt 3	23	23	81.5 to 2010	1690	1/23	0/0
Manganese	Soil	3	3	128 to 335	671	0/3	0/0
	Fill	7	7	145 to 377	671	0/7	0/0
	Qbt 3	23	23	129 to 405	482	0/23	0/0
Mercury	Soil	3	0	[0.05 to 0.06]	0.1	0/3	0/3
	Fill	7	4	0.01 to [0.06]	0.1	0/7	0/3
	Qbt 3	23	11	0.01 to [0.06]	0.1	0/23	0/12
Nickel	Soil	3	2	[3.2] to 7.8	15.4	0/3	0/1
	Fill	7	7	2.4 to 6	15.4	0/7	0/0
	Qbt 3	23	18	0.66 to 7.9	6.58	1/23	0/5
Potassium	Soil	3	2	[473] to 1590	3460	0/3	0/1
	Fill	7	7	148 to 1420	3460	0/7	0/0
	Qbt 3	23	20	81.9 to 1190	3500	0/23	0/3
Selenium	Soil	3	0	[0.42 to 0.68]	1.52	0/3	0/3
	Fill	7	0	[0.42 to 0.65]	1.52	0/7	0/7
	Qbt 3	23	0	[0.33 to 11.3]	0.3	0/23	23/23
Silver	Soil	3	0	[0.2 to 1.6]	1	0/3	1/3
	Fill	7	0	[0.17 to 1.5]	1	0/7	1/7
	Qbt 3	23	0	[0.15 to 1.5]	1	0/23	4/23
Sodium	Soil	3	3	67.2 to 606	915	0/3	0/0
	Fill	7	7	51.8 to 224	915	0/7	0/0
	Qbt 3	23	23	66.3 to 284	2770	0/23	0/0
Thallium	Soil	3	0	[0.61 to 0.85]	0.73	0/3	1/3
	Fill	7	0	[0.63 to 0.81]	0.73	0/7	5/7
	Qbt 3	23	2	[0.16] to 1.1	1.1	0/23	0/21
Vanadium	Soil	3	3	6 to 26.3	39.6	0/3	0/0
	Fill	7	7	2.5 to 22.8	39.6	0/7	0/0
	Qbt 3	23	22	0.65 to 25.6	17	1/23	0/1
Zinc	Soil	3	3	30.9 to 121	48.8	1/3	0/0
	Fill	7	7	22.5 to 39	48.8	0/7	0/0
	Qbt 3	23	23	14.2 to 75.6	63.5	2/23	0/0

[a] Number of detects above BV out of the total number of analyses.

[b] Number of nondetects above BV out of the number of nondetects to express usability of nondetected data above BV for background comparisons.

Table 2.1-2
Samples Above BVs for Inorganic Chemicals at PRS 0-027

Sample ID	Location ID	Depth (ft)	Media	Aluminum	Antimony	Arsenic	Barium	Cadmium	Calcium	Chromium, Total	Cobalt	Copper	Lead	Mag`nesium	Nickel	Selenium	Silver	Thallium	Vanadium	Zinc
Soil BV				**29200**	**0.83**	**8.17**	**—**	**0.4**	**6120**	**19.3**	**8.64**	**14.7**	**22.3**	**4610**	**15.4**	**1.52**	**1**	**0.73**	**39.6**	**48.8**
Qbt 2,3,4 BV				**7340**	**0.5**	**2.79**	**46**	**1.63**	**2200**	**7.14**	**3.14**	**4.66**	**11.2**	**1690**	**6.58**	**0.3**	**1**	**1.1**	**17**	**63.5**
Fill BV				**29200**	**0.83**	**8.17**	**—**	**0.4**	**6120**	**19.3**	**8.64**	**14.7**	**22.3**	**4610**	**15.4**	**1.52**	**1**	**0.73**	**39.6**	**48.8**
0100-96-1871	00-05802	1.2–2.0	Fill	—	6.4(J)	—	—	0.77(J)	7050	—	—	—	25.4	—	—	—	1.5(U)	0.81(U)	—	—
0100-96-1872	00-05802	2.6–3.7	Soil	—	10.2(J)	—	—	0.73(U)	—	—	—	—	—	—	—	—	1.6(U)	0.85(U)	—	121
0100-96-1873	00-05802	20.0–21.0	Qbt 3	—	6.1(U)	—	—	—	—	—	—	—	—	—	—	0.63(U)	1.5(U)	—	—	—
0100-96-1874	00-05802	30.0–31.0	Qbt 3	—	6(U)	—	—	—	—	—	—	—	25	—	—	0.62(U)	1.5(U)	—	—	—
0100-96-1876	00-05802	39.8–41.0	Qbt 3	—	6.1(U)	11.2(U)	—	—	—	—	—	—	21.1	—	—	11.3(U)	1.5(U)	—	—	—
0100-96-1875	00-05802	47.0–48.5	Qbt 3	—	5.7(U)	10.5(U)	—	—	—	—	—	—	25.7	—	—	10.5(U)	1.4(U)	—	—	—
0100-96-1894	00-05803	3.4–4.0	Fill	—	1(U)	—	—	—	—	—	—	—	—	—	—	—	—	0.76(U)	—	—
0100-96-[illegible]5	00-05803	5.0–5.8	Qbt 3	—	0.9(U)	—	—	—	—	—	—	—	—	—	—	0.56(U)	—	—	—	—
0100-96-1896	00-05803	14.2–15.0	Qbt 3	—	0.92(U)	—	—	—	—	—	—	—	—	—	—	0.57(U)	—	—	—	—
0100-96-1897	00-05803	29.2–30.0	Qbt 3	—	0.9 (U)	—	61.9	—	—	—	—	—	—	—	—	0.56(U)	—	—	—	—
0100-96-1898	00-05803	38.2–40.0	Qbt 3	—	0.9(U)	—	—	—	—	—	—	—	12.9	—	—	0.55(U)	—	—	—	—
0100-96-1899	00-05803	49.2–50.0	Qbt 3	—	0.89(U)	—	—	—	—	—	—	—	—	—	—	0.55(U)	—	—	—	—
0100-96-1901	00-05804	8.4–8.9	Fill	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.81(U)	—	—
0100-96-1902	00-05804	12.0–12.5	Qbt 3	—	0.7(U)	—	—	—	—	—	—	—	—	—	—	0.42(U)	—	—	—	—
0100-96-1903	00-05804	19.2–20.0	Qbt 3	—	0.66(U)	—	—	—	—	—	—	—	—	—	—	0.4(U)	—	—	—	—
0100-96-1904	00-05804	29.4–30.0	Qbt 3	—	0.67(U)	—	—	—	—	—	—	—	—	—	—	0.4(U)	—	—	—	—
0100-96-1905	00-05805	2.5–4.0	Fill	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.8(U)	—	—
0100-96-1906	00-05805	2.5–4.0	Fill	—	—	—	—	—	—	—	—	—	27	—	—	—	—	0.8(U)	—	—
0100-96-[illegible]07	00-05805	4.0–5.0	Qbt 3	—	0.67(U)	—	—	—	—	—	—	—	—	—	—	0.4(U)	—	—	—	—

Table 2.1-2 (continued)

Sample ID	Location ID	Depth (ft)	Media	Aluminum	Antimony	Arsenic	Barium	Cadmium	Calcium	Chromium, Total	Cobalt	Copper	Lead	Magnesium	Nickel	Selenium	Silver	Thallium	Vanadium	Zinc
Soil BV				**29200**	**0.83**	**8.17**	**—**	**0.4**	**6120**	**19.3**	**8.64**	**14.7**	**22.3**	**4610**	**15.4**	**1.52**	**1**	**0.73**	**39.6**	**48.8**
Qbt 2,3,4 BV				**7340**	**0.5**	**2.79**	**46**	**1.63**	**2200**	**7.14**	**3.14**	**4.66**	**11.2**	**1690**	**6.58**	**0.3**	**1**	**1.1**	**17**	**63.5**
Fill BV				**29200**	**0.83**	**8.17**	**—**	**0.4**	**6120**	**19.3**	**8.64**	**14.7**	**22.3**	**4610**	**15.4**	**1.52**	**1**	**0.73**	**39.6**	**48.8**
0100-96-1908	00-05805	19.2–20.0	Qbt 3	—	0.68(U)	—	—	—	—	—	—	—	—	—	—	0.41(U)	—	—	—	—
0100-96-1909	00-05805	34.5–35.0	Qbt 3	—	0.65(U)	—	—	—	—	—	—	—	—	—	—	0.39(U)	—	—	—	—
0100-96-1886	00-05806	26.0–27.0	Qbt 3	—	—	—	—	—	—	—	—	—	—	—	—	0.41(U)	—	—	—	—
0100-96-1887	00-05807	10.5–11.5	Qbt 3	—	—	—	—	—	—	—	—	—	—	—	—	0.4(U)	—	—	—	—
0100-96-1891	00-05808	3.8–4.5	Soil	—	—	—	—	—	14500	—	—	—	—	—	—	—	—	—	—	—
0100-96-1893	00-05808	7.5–8.5	Qbt 3	—	—	—	—	—	—	—	—	—	13.9	—	—	0.41(U)	—	—	—	—
0100-96-1878	00-05820	4.8–6.0	Qbt 3	8490	5.9(U)	—	317	—	3530	9.3	8.3 (J)	11.7	38.7	2010	7.9(J)	0.33(U)	—	—	25.6	75.6
0100-96-1879	00-05821	5.1–6.1	Qbt 3	—	6(U)	—	—	—	—	—	—	—	11.9	—	—	0.4(U)	—	—	—	67
0100-96-1880	00-05821	10.5–12.0	Qbt 3	—	6.2(U)	—	—	—	—	—	—	—	—	—	—	0.39(U)	—	—	—	—
0100-96-1881	00-05821	30.0–31.2	Qbt 3	—	6.1(U)	—	—	—	—	—	—	—	—	—	—	0.39(U)	—	—	—	—
0100-96-1882	00-05821	47.5–48.7	Qbt 3	—	5.9(U)	—	—	—	—	—	—	—	—	—	—	0.37(U)	—	—	—	—

Notes: A dash indicates that the sample was not analyzed for the analyte or the reported concentration or detection limit was below the BV.
All units are mg/kg.

Table 2.1-3
Frequency of Detects for Organic Chemicals at PRS 0-027

Analyte	Media	Number of Analyses	Number of Detects	Concentration Range (mg/kg)	EQL (µg/kg)	Frequency of Detects
Acetone	Fill	14	5	[0.009 to 1.3]	20	5/14
	Qbt 3	60	7	[0.005 to 56]	20	7/60
Aldrin	Qbt 3	23	1	[0.0018] to 0.0036	0.05 µg/L	1/23
Aroclor-1260	Qbt 3	23	1	[0.035] to 0.076	1.0 µg/L	1/23
Benzene	Fill	14	3	0.004 to 2.9	5	3/14
	Qbt 3	60	7	[0.005] to 40	5	7/60
Benzoic acid	Qbt 3	23	3	0.059 to [360]	3300	3/23
BHC[beta-]	Soil	3	1	[0.002] to 0.00252	0.05 µg/L	1/3
BHC[gamma-]	Qbt 3	23	2	[0.0018] to 0.0024	0.05 µg/L	2/23
Bis(2-ethylhexyl)phthalate	Qbt 3	23	1	0.05 to [36]	330	1/23
Butanone[2-]	Fill	14	2	0.005 to [2.4]	20	2/14
	Qbt 3	60	1	0.003 to [56]	20	1/60
Butylbenzene[n-]	Qbt 3	60	6	[0.005] to 42	5	6/60
Butylbenzene[sec-]	Qbt 3	60	5	[0.005] to 28	5	5/60
Butylbenzene[tert-]	Fill	14	1	[0.006 to 0.59]	5	1/14
Chlordane[gamma-]	Qbt 3	23	1	[0.0018] to 0.0022	17	1/23
Chloroaniline[4-]	Qbt 3	23	1	[0.35 to 150]	1300	1/23
Chlorotoluene[4-]	Fill	14	1	[0.006 to 0.59]	5	1/14
DDD[4,4'-]	Fill	7	1	[0.0038] to 0.0055	0.10 µg/L	1/7
	Qbt 3	23	1	[0.0035] to 0.006	0.10 µg/L	1/23
DDE[4,4'-]	Fill	7	1	0.0014 to [0.00391]	0.10 µg/L	1/7
	Qbt 3	23	1	0.0031 to [0.0039]	0.10 µg/L	1/23
DDT[4,4'-]	Soil	3	1	[0.0039] to 9.81E-03	0.10 µg/L	1/3
	Fill	7	1	0.0017 to [0.0058]	0.10 µg/L	1/7
	Qbt 3	23	1	[0.0035] to 0.025	0.10 µg/L	1/23
Dichlorobenzene[1,4-]	Fill	21	1	[0.006 to 40]	330	1/21
Dimethylphenol[2,4-]	Qbt 3	23	1	[0.35 to 36]	330	1/23
Ethylbenzene	Fill	14	3	[0.006] to 1.1	5	3/14
	Qbt 3	60	12	0.002 to 300	5	12/60
Fluoranthene	Qbt 3	23	1	0.049 to [36]	330	1/23
Heptachlor	Qbt 3	23	1	[0.0018] to 0.0024	0.05 µg/L	1/23
Hydrocarbons, total extractable petroleum	Fill	4	4	8900 to 17000		4/4
	Qbt 3	11	7	[5.3] to 9500		7/11
Isophorone	Qbt 3	23	1	[0.35 to 36]	330	1/23
Isopropyl benzene	Soil	4	1	[0.006] to 1.1	5	1/4
	Fill	14	2	[0.006 to 0.59]	5	2/14
	Qbt 3	60	8	[0.005] to 54	5	8/60

Table 2.1-3 (continued)

Analyte	Media	Number of Analyses	Number of Detects	Concentration Range (mg/kg)	EQL (µg/kg)	Frequency of Detects
Isopropyl toluene[4-]	Soil	4	1	[0.006] to 3.7	5	1/4
	Fill	14	5	[0.006] to 3.6	5	5/14
	Qbt 3	60	10	[0.005] to 43	5	10/60
Methyl-2-pentanone[4-]	Qbt 3	60	1	0.004 to [56]	20	1/60
Methylene Chloride	Fill	14	3	[0.006] to 0.58	5	3/14
	Qbt 3	60	10	0.003 to [14]	5	10/60
Methylnaphthalene[2-]	Fill	7	2	[0.38 to 40]	330	2/7
	Qbt 3	23	7	[0.35] to 58	330	7/23
Naphthalene	Fill	11	3	[0.029 to 40]	330	3/11
	Qbt 3	34	9	[0.005] to 27	330	9/34
Nitrophenol[4-]	Qbt 3	23	1	[0.86 to 180]	1600	1/23
Organics, diesel range	Fill	4	1	[4.8] to 460		1/4
	Qbt 3	31	1	[4.3 to 1400]		1/31
Pentachlorophenol	Qbt 3	23	1	0.038 to [180]	1600	1/23
Propylbenzene[1-]	Fill	14	1	[0.006 to 0.59]	5	1/14
	Qbt 3	60	10	[0.005] to 82	5	10/60
Pyrene	Qbt 3	23	1	0.053 to [36]	330	1/23
Tetrachloroethene	Soil	4	1	0.001 to [0.75]	5	1/4
Toluene	Soil	4	1	[0.006 to 0.75]	5	1/4
	Fill	14	9	0.001 to 2.8	5	9/14
	Qbt 3	60	16	0.002 to 440	5	16/60
Total extractable hydrocarbons	Fill	3	1	[6] to 6.2	10,000	1/3
	Qbt 3	14	4	[5.3] to 17000	10,000	4/14
TPH-diesel	Soil	2	1	[6.1] to 45	10,000	1/2
	Fill	4	3	[28] to 5300	10,000	3/4
	Qbt 3	19	2	[5.4 to 1400]	10,000	2/19
Trichlorobenzene[1,2,3-]	Qbt 3	11	1	0.003 to [0.58]		1/11
Trichlorobenzene[1,2,4-]	Qbt 3	34	1	0.002 to [36]	330	1/34
Trimethylbenzene[1,2,4-]	Soil	4	1	[0.006] to 4.9	5	1/4
	Fill	14	4	[0.006] to 4.9	5	4/14
	Qbt 3	60	11	0.002 to 160	5	11/60
Trimethylbenzene[1,3,5-]	Fill	14	5	[0.006] to 2.5	5	5/14
	Qbt 3	60	6	[0.005] to 38	5	6/60
Xylene (Total)	Soil	4	1	[0.006] to 13	5	1/4
	Fill	14	5	[0.006] to 1.3	5	5/14
	Qbt 3	60	12	[0.005] to 510	5	12/60
Xylene[1,2-]	Fill	4	4	0.092 to 0.8	5	4/4
	Qbt 3	11	6	[0.005] to 9.7	5	6/11

Table 2.1-4
Detected Concentrations for Organic Chemicals at PRS 0-027

Part 1

Sample ID	Location ID	Depth (ft)	Media	Acetone	Aldrin	Aroclor-1260	Benzene	Benzoic Acid	BHC[beta-]	BHC[gamma-]	Bis(2-ethylhexyl)-phthalate	Butanone[2-]	Butylbenzene[n-]	Butylbenzene[sec-]	Butylbenzene[tert-]
0100-96-1872	00-05802	2.60–3.70	Soil	—	—	—	—	—	—	—	—	—	—	—	—
0100-96-1873	00-05802	20.00–21.00	Qbt 3	—	0.0036	—	—	—	—	—	—	—	27 (J+)	—	—
0100-96-1874	00-05802	30.00–31.00	Qbt 3	—	—	—	8(J+)	7.2 (J+)	—	0.0024	—	—	32	—	—
0100-96-1876	00-05802	39.80–41.00	Qbt 3	—	—	—	6.4 (J+)	—	—	0.0023	—	—	35 (J+)	—	—
0100-96-1875	00-05802	47.00–48.50	Qbt 3	0.024	—	—	—	0.76 (J)	—	—	0.05 (J)	0.003 (J)	—	—	—
0100-96-1894	00-05803	3.40–4.00	Fill	—	—	—	2.9	—	—	—	—	—	—	—	—
0100-96-1895	00-05803	5.00–5.80	Qbt 3	—	—	—	0.32 (J)	—	—	—	—	—	—	—	—
0100-96-1896	00-05803	14.20–15.00	Qbt 3	2.2	—	—	1.9	—	—	—	—	—	—	—	—
0100-96-1897	00-05803	29.20–30.00	Qbt 3	—	—	—	—	—	—	—	—	—	—	—	—
0100-96-1898	00-05803	38.20–40.00	Qbt 3	—	—	—	—	—	—	—	—	—	—	—	—
0100-96-1899	00-05803	49.20–50.00	Qbt 3	—	—	—	—	—	—	—	—	—	—	—	—
0100-96-1901	00-05804	8.40–8.90	Fill	—	—	—	0.18	—	—	—	—	—	—	—	0.012 (J)
0100-96-1902	00-05804	12.00–12.50	Qbt 3	—	—	—	0.13 (J)	—	—	—	—	—	—	2.5	—
0100-96-1903	00-05804	19.20–20.00	Qbt 3	—	—	—	0.47 (J)	—	—	—	—	—	8.1	2.6	—
0100-96-1904	00-05804	29.40–30.00	Qbt 3	0.02 (J)	—	—	—	—	—	—	—	—	—	—	—
0100-96-1905	00-05805	2.50–4.00	Fill	0.22	—	—	0.004 (J)	—	—	—	—	—	—	—	—
0100-96-1906	00-05805	2.50–4.00	Fill	0.11 (J)	—	—	—	—	—	—	—	—	—	—	—
0100-96-1907	00-05805	4.00–5.00	Qbt 3	0.048 (J-)	—	—	—	—	—	—	—	—	—	—	—
0100-96-1908	00-05805	19.20–20.00	Qbt 3	—	—	—	—	—	—	—	—	—	—	1.8	—
0100-96-1909	00-05805	34.50–35.00	Qbt 3	0.015 (J)	—	—	—	—	—	—	—	—	—	—	—
0100-96-1889	00-05806	9.00–10.00	Fill	0.016 (J)	—	—	—	—	—	—	—	0.005 (J)	—	—	—

Table 2.1-4 (continued)

Part 1 (continued)

Sample ID	Location ID	Depth (ft)	Media	Acetone	Aldrin	Aroclor-1260	Benzene	Benzoic Acid	BHC[beta-]	BHC[gamma-]	Bis(2-ethylhexyl)-phthalate	Butanone[2-]	Butylbenzene[n-]	Butylbenzene[sec-]	Butylbenzene[tert-]
0100-96-1886	00-05806	26.00–27.00	Qbt 3	—	—	—	—	—	—	—	—	—	—	—	—
0100-96-1888	00-05807	3.00–4.00	Fill	—	—	—	—	—	—	—	—	—	—	—	—
0100-96-1887	00-05807	10.50–11.50	Qbt 3	—	—	—	—	—	—	—	—	—	—	—	—
0100-96-1891	00-05808	3.80–4.50	Soil	—	—	—	—	—	0.00252	—	—	—	—	—	—
0100-96-1883	00-05809	13.30–14.00	Fill	0.022 (J)	—	—	—	—	—	—	—	—	—	—	—
0100-96-1910	00-05810	2.50–3.00	Fill	0.15	—	—	—	—	—	—	—	0.025	—	—	—
0100-96-1911	00-05810	9.50–10.00	Fill	—	—	—	—	—	—	—	—	—	—	—	—
0100-96-1914	00-05811	1.50–2.00	Soil	—	—	—	—	—	—	—	—	—	—	—	—
0100-96-1919	00-05812	9.50–10.00	Qbt 3	—	—	—	—	—	—	—	—	—	—	—	—
0100-96-1925	00-05813	17.00–17.50	Qbt 3	—	—	—	—	—	—	—	—	—	—	—	—
0100-96-1926	00-05813	24.50–25.00	Qbt 3	—	—	—	—	—	—	—	—	—	—	—	—
0100-96-1927	00-05813	27.50–28.00	Qbt 3	—	—	—	—	—	—	—	—	—	—	—	—
0100-96-1928	00-05814	8.50–9.10	Fill	—	—	—	—	—	—	—	—	—	—	—	—
0100-96-1930	00-05814	24.50–25.00	Qbt 3	0.011 (J)	—	—	—	—	—	—	—	—	—	—	—
0100-96-1931	00-05815	9.30–9.80	Fill	—	—	—	—	—	—	—	—	—	—	—	—
0100-96-1934	00-05815	29.50–30.00	Qbt 3	—	—	—	—	—	—	—	—	—	—	—	—
0100-96-1935	00-05816	3.40–3.90	Qbt 3	—	—	—	—	—	—	—	—	—	—	—	—
0100-96-1936	00-05816	12.00–12.50	Qbt 3	0.011 (J)	—	—	—	—	—	—	—	—	42	26	—
0100-96-1937	00-05816	19.50–20.00	Qbt 3	—	—	—	40	—	—	—	—	—	42	28	—
0100-96-1938	00-05816	29.00–29.50	Qbt 3	—	—	—	—	—	—	—	—	—	—	—	—
0100-96-1878	00-05820	4.80–6.00	Qbt 3	—	—	0.076	—	0.059 (J)	—	—	—	—	—	—	—

Table 2.1-4 (continued)

Part 2

Sample ID	Location ID	Depth (ft)	Media	Chlordane[gamma-]	Chloroaniline[4-]	Chlorotoluene[4-]	DDD[4,4'-]	DDE[4,4'-]	DDT[4,4'-]	Dichlorobenzene[1,4-]	Dimethylphenol[2,4-]	Ethylbenzene	Fluoranthene	Heptachlor	Hydrocarbons, Total Extractable Petroleum
0100-96-1872	00-05802	2.60–3.70	Soil	—	—	—	—	—	—	—	—	—	—	—	—
0100-96-1873	00-05802	20.00–21.00	Qbt 3	—	—	—	—	—	—	—	—	130 (J+)	—	0.0024	—
0100-96-1874	00-05802	30.00–31.00	Qbt 3	—	1.6 (J+)	—	—	—	—	—	0.49 (J+)	140	—	—	—
0100-96-1876	00-05802	39.80–41.00	Qbt 3	—	—	—	—	—	—	—	—	110 (J+)	—	—	—
0100-96-1875	00-05802	47.00–48.50	Qbt 3	—	—	—	—	—	—	—	—	—	—	—	—
0100-96-1894	00-05803	3.40–4.00	Fill	—	—	—	—	—	—	—	—	1.1	—	—	17000
0100-96-1895	00-05803	5.00–5.80	Qbt 3	—	—	—	—	—	—	—	—	5.2	—	—	6000
0100-96-1896	00-05803	14.20–15.00	Qbt 3	—	—	—	—	—	—	—	—	15	—	—	9500
0100-96-1897	00-05803	29.20–30.00	Qbt 3	—	—	—	—	—	—	—	—	—	—	—	270
0100-96-1898	00-05803	38.20–40.00	Qbt 3	—	—	—	—	—	—	—	—	—	—	—	—
0100-96-1899	00-05803	49.20–50.00	Qbt 3	—	—	—	—	—	—	—	—	—	—	—	—
0100-96-1901	00-05804	8.40–8.90	Fill	—	—	—	0.0055	0.0014 (J-)	0.0017 (J-)	—	—	0.27	—	—	16000
0100-96-1902	00-05804	12.00–12.50	Qbt 3	—	—	—	—	0.0031 (J)	0.025	—	—	1.8	—	—	7900
0100-96-1903	00-05804	19.20–20.00	Qbt 3	—	—	—	0.006	—	—	—	—	4	—	—	6200
0100-96-1904	00-05804	29.40–30.00	Qbt 3	—	—	—	—	—	—	—	—	—	—	—	—
0100-96-1905	00-05805	2.50–4.00	Fill	—	—	—	—	—	—	—	—	—	—	—	11000
0100-96-1906	00-05805	2.50–4.00	Fill	—	—	—	—	—	—	—	—	—	—	—	8900
0100-96-1907	00-05805	4.00–5.00	Qbt 3	—	—	—	—	—	—	—	—	—	—	—	6200
0100-96-1908	00-05805	19.20–20.00	Qbt 3	—	—	—	—	—	—	—	—	0.26 (J)	—	—	5300
0100-96-1909	00-05805	34.50–35.00	Qbt 3	—	—	—	—	—	—	—	—	—	—	—	—
0100-96-1889	00-05806	9.00–10.00	Fill	—	—	—	—	—	—	—	—	—	—	—	—

Table 2.1-4 (continued)

Part 2 (continued)

Sample ID	Location ID	Depth (ft)	Media	Chlordane[gamma-]	Chloroaniline[4-]	Chlorotoluene[4-]	DDD[4,4'-]	DDE[4,4'-]	DDT[4,4'-]	Dichlorobenzene[1,4-]	Dimethylphenol[2,4-]	Ethylbenzene	Fluoranthene	Heptachlor	Hydrocarbons, Total Extractable Petroleum
0100-96-1886	00-05806	26.00–27.00	Qbt 3	—	—	—	—	—	—	—	—	—	—	—	—
0100-96-1888	00-05807	3.00–4.00	Fill	—	—	—	—	—	—	—	—	—	—	—	—
0100-96-1887	00-05807	10.50–11.50	Qbt 3	—	—	—	—	—	—	—	—	—	—	—	—
0100-96-1891	00-05808	3.80–4.50	Soil	—	—	—	—	—	9.810001E-03	—	—	—	—	—	—
0100-96-1883	00-05809	13.30–14.00	Fill	—	—	0.041	—	—	—	—	—	0.093	—	—	—
0100-96-1910	00-05810	2.50–3.00	Fill	—	—	—	—	—	—	—	—	—	—	—	—
0100-96-1911	00-05810	9.50–10.00	Fill	—	—	—	—	—	—	—	—	—	—	—	—
0100-96-1914	00-05811	1.50–2.00	Soil	—	—	—	—	—	—	—	—	—	—	—	—
0100-96-1919	00-05812	9.50–10.00	Qbt 3	—	—	—	—	—	—	—	—	—	—	—	—
0100-96-1925	00-05813	17.00–17.50	Qbt 3	—	—	—	—	—	—	—	—	—	—	—	—
0100-96-1926	00-05813	24.50–25.00	Qbt 3	—	—	—	—	—	—	—	—	—	—	—	—
0100-96-1927	00-05813	27.50–28.00	Qbt 3	—	—	—	—	—	—	—	—	—	—	—	—
0100-96-1928	00-05814	8.50–9.10	Fill	—	—	—	—	—	—	0.006	—	—	—	—	—
0100-96-1930	00-05814	24.50–25.00	Qbt 3	—	—	—	—	—	—	—	—	—	—	—	—
0100-96-1931	00-05815	9.30–9.80	Fill	—	—	—	—	—	—	—	—	—	—	—	—
0100-96-1934	00-05815	29.50–30.00	Qbt 3	—	—	—	—	—	—	—	—	0.003 (J)	—	—	—
0100-96-1935	00-05816	3.40–3.90	Qbt 3	—	—	—	—	—	—	—	—	—	—	—	—
0100-96-1936	00-05816	12.00–12.50	Qbt 3	—	—	—	—	—	—	—	—	290	—	—	—
0100-96-1937	00-05816	19.50–20.00	Qbt 3	—	—	—	—	—	—	—	—	300	—	—	—
0100-96-1938	00-05816	29.00–29.50	Qbt 3	—	—	—	—	—	—	—	—	0.002 (J)	—	—	—
0100-96-1878	00-05820	4.80–6.00	Qbt 3	0.0022	—	—	—	—	—	—	—	—	0.049 (J)	—	—

Table 2.1-4 (continued)

Part 3

Sample ID	Location ID	Depth (ft)	Media	Isophorone	Isopropyl benzene	Isopropyl toluene[4-]	Methyl-2-pentanone[4-]	Methylene Chloride	Methylnaphthalene[2-]	Naphthalene	Nitrophenol[4-]	Organics, Diesel Range	Pentachlorophenol	Propylbenzene[1-]
0100-96-1872	00-05802	2.60–3.70	Soil	—	1.1 (J+)	3.7 (J+)	—	—	—	—	—	—	—	—
0100-96-1873	00-05802	20.00–21.00	Qbt 3	1.3 (J+)	28 (J+)	25 (J+)	—	—	6.8 (J+)	5.5 (J+)	—	—	—	40 (J+)
0100-96-1874	00-05802	30.00–31.00	Qbt 3	—	29	23	—	—	5.9 (J+)	6.9 (J+)	1.2 (J+)	—	—	47
0100-96-1876	00-05802	39.80–41.00	Qbt 3	—	29 (J+)	28 (J+)	—	—	4.2	2.2	—	—	—	45 (J+)
0100-96-1875	00-05802	47.00–48.50	Qbt 3	—	—	—	—	—	—	—	—	—	—	—
0100-96-1894	00-05803	3.40–4.00	Fill	—	—	1.8	—	0.58 (J)	—	—	—	—	—	—
0100-96-1895	00-05803	5.00–5.80	Qbt 3	—	—	1.4	—	0.56	7.4 (J)	2.7	—	—	—	0.56
0100-96-1896	00-05803	14.20–15.00	Qbt 3	—	2.2	3.1	—	0.59	58	27 (J)	—	—	—	3.3
0100-96-1897	00-05803	29.20–30.00	Qbt 3	—	—	—	—	0.005 (J+)	—	—	—	—	—	—
0100-96-1898	00-05803	38.20–40.00	Qbt 3	—	—	—	—	0.006	—	—	—	—	—	—
0100-96-1899	00-05803	49.20–50.00	Qbt 3	—	—	—	—	0.006	—	—	—	—	—	—
0100-96-1901	00-05804	8.40–8.90	Fill	—	0.086	0.16	—	—	—	0.99	—	—	—	0.15
0100-96-1902	00-05804	12.00–12.50	Qbt 3	—	—	2.6	—	0.33 (J)	26	9.4	—	—	—	2
0100-96-1903	00-05804	19.20–20.00	Qbt 3	—	1.5	2.3	—	0.31 (J)	21	17	—	—	—	2.8
0100-96-1904	00-05804	29.40–30.00	Qbt 3	—	—	—	—	0.003 (J)	—	0.008	—	—	—	—
0100-96-1905	00-05805	2.50–4.00	Fill	—	—	0.11	—	0.015 (J)	26	5.4 (J)	—	—	—	—
0100-96-1906	00-05805	2.50–4.00	Fill	—	—	0.074	—	0.012 (J)	15 (J)	4.9 (J)	—	—	—	—
0100-96-1907	00-05805	4.00–5.00	Qbt 3	—	—	—	—	0.007 (J-)	—	—	—	—	—	—
0100-96-1908	00-05805	19.20–20.00	Qbt 3	—	0.61	3.1	—	0.32 (J)	—	—	—	—	—	0.46 (J)
0100-96-1909	00-05805	34.50–35.00	Qbt 3	—	—	—	—	—	—	—	—	—	—	—
0100-96-1889	00-05806	9.00–10.00	Fill	—	—	—	—	—	—	—	—	—	—	—

Table 2.1-4 (continued)

Part 3 (continued)

Sample ID	Location ID	Depth (ft)	Media	Isophorone	Isopropyl benzene	Isopropyl toluene[4-]	Methyl-2-pentanone[4-]	Methylene Chloride	Methylnaphthalene[2-]	Naphthalene	Nitrophenol[4-]	Organics, Diesel Range	Pentachlorophenol	Propylbenzene[1-]
0100-96-1886	00-05806	26.00–27.00	Qbt 3	—	—	—	—	—	—	—	—	—	—	—
0100-96-1888	00-05807	3.00–4.00	Fill	—	—	—	—	—	—	—	—	—	—	—
0100-96-1887	00-05807	10.50–11.50	Qbt 3	—	—	—	—	—	—	—	—	—	—	—
0100-96-1891	00-05808	3.80–4.50	Soil	—	—	—	—	—	—	—	—	—	—	—
0100-96-1883	00-05809	13.30–14.00	Fill	—	0.026	3.6	—	—	—	—	—	—	—	—
0100-96-1910	00-05810	2.50–3.00	Fill	—	—	—	—	—	—	—	—	—	—	—
0100-96-1911	00-05810	9.50–10.00	Fill	—	—	—	—	—	—	—	—	460	—	—
0100-96-1914	00-05811	1.50–2.00	Soil	—	—	—	—	—	—	—	—	—	—	—
0100-96-1919	00-05812	9.50–10.00	Qbt 3	—	—	—	—	—	—	—	—	130	—	—
0100-96-1925	00-05813	17.00–17.50	Qbt 3	—	—	—	—	—	—	—	—	—	—	—
0100-96-1926	00-05813	24.50–25.00	Qbt 3	—	—	—	—	—	—	—	—	—	—	—
0100-96-1927	00-05813	27.50–28.00	Qbt 3	—	—	—	—	—	—	—	—	—	—	—
0100-96-1928	00-05814	8.50–9.10	Fill	—	—	—	—	—	—	—	—	—	—	—
0100-96-1930	00-05814	24.50–25.00	Qbt 3	—	—	—	—	—	—	—	—	—	—	—
0100-96-1931	00-05815	9.30–9.80	Fill	—	—	—	—	—	—	—	—	—	—	—
0100-96-1934	00-05815	29.50–30.00	Qbt 3	—	—	—	0.004 (J)	—	—	—	—	—	—	—
0100-96-1935	00-05816	3.40–3.90	Qbt 3	—	—	—	—	—	—	—	—	—	—	—
0100-96-1936	00-05816	12.00–12.50	Qbt 3	—	54	43	—	—	—	—	—	—	—	81
0100-96-1937	00-05816	19.50–20.00	Qbt 3	—	52	41	—	—	—	—	—	—	—	82
0100-96-1938	00-05816	29.00–29.50	Qbt 3	—	—	—	—	—	—	—	—	—	—	—
0100-96-1878	00-05820	4.80–6.00	Qbt 3	—	—	—	—	—	—	—	—	—	0.038 (J)	—

Table 2.1-4 (continued)

Part 4

Sample ID	Location ID	Depth (ft)	Media	Pyrene	Tetrachloroethene	Toluene	Total Extractable Hydrocarbons	TPH-Diesel	Trichlorobenzene[1,2,3-]	Trichlorobenzene[1,2,4-]	Trimethylbenzene[1,2,4-]	Trimethylbenzene[1,3,5-]	Xylene (Total)	Xylene[1,2-]
0100-96-1872	00-05802	2.60–3.70	Soil	—	—	—	—	—	—	—	4.9 (J+)	—	13 (J+)	—
0100-96-1873	00-05802	20.00–21.00	Qbt 3	—	—	85 (J+)	—	—	—	—	84 (J+)	—	230 (J+)	—
0100-96-1874	00-05802	30.00–31.00	Qbt 3	—	—	150	—	—	—	—	85	—	290	—
0100-96-1876	00-05802	39.80–41.00	Qbt 3	—	—	96 (J+)	—	—	—	—	91 (J+)	—	210 (J+)	—
0100-96-1875	00-05802	47.00–48.50	Qbt 3	—	—	—	—	—	—	—	—	—	—	—
0100-96-1894	00-05803	3.40–4.00	Fill	—	—	2.8	—	—	—	—	—	0.67	0.78	0.8
0100-96-1895	00-05803	5.00–5.80	Qbt 3	—	—	5.5	—	—	—	—	3.2	—	7.2	3.9
0100-96-1896	00-05803	14.20–15.00	Qbt 3	—	—	26	—	—	—	—	19	—	20	9.7
0100-96-1897	00-05803	29.20–30.00	Qbt 3	—	—	—	—	—	—	—	—	0.007 (J+)	—	—
0100-96-1898	00-05803	38.20–40.00	Qbt 3	—	—	—	—	—	—	—	—	—	—	—
0100-96-1899	00-05803	49.20–50.00	Qbt 3	—	—	—	—	—	—	—	—	—	—	—
0100-96-1901	00-05804	8.40–8.90	Fill	—	—	0.077	—	—	—	—	0.87	0.41	0.45	0.38
0100-96-1902	00-05804	12.00–12.50	Qbt 3	—	—	—	—	—	—	—	11	3.4	3.1	1.1
0100-96-1903	00-05804	19.20–20.00	Qbt 3	—	—	0.48 (J)	—	—	—	—	9.2	3	4.7	1.2
0100-96-1904	00-05804	29.40–30.00	Qbt 3	—	—	—	—	—	0.003 (J)	0.002 (J)	—	—	—	—
0100-96-1905	00-05805	2.50–4.00	Fill	—	—	0.017 (J)	—	—	—	—	0.97	0.51	0.14	0.12
0100-96-1906	00-05805	2.50–4.00	Fill	—	—	—	—	—	—	—	0.88	0.49	0.11	0.092
0100-96-1907	00-05805	4.00–5.00	Qbt 3	—	—	0.009 (J-)	—	—	—	—	—	—	—	0.013 (J-)
0100-96-1908	00-05805	19.20–20.00	Qbt 3	—	—	—	—	—	—	—	8.9	4.7	0.81	1.2
0100-96-1909	00-05805	34.50–35.00	Qbt 3	—	—	—	—	—	—	—	—	—	—	—
0100-96-1889	00-05806	9.00–10.00	Fill	—	—	0.007	—	1500	—	—	—	—	—	—

Table 2.1-4 (continued)

Part 4 (continued)

Sample ID	Location ID	Depth (ft)	Media	Pyrene	Tetrachloroethene	Toluene	Total Extractable Hydrocarbons	TPH-Diesel	Trichlorobenzene-[1,2,3-]	Trichlorobenzene-[1,2,4-]	Trimethylbenzene-[1,2,4-]	Trimethylbenzene-[1,3,5-]	Xylene (total)	Xylene[1,2-]
0100-96-1886	00-05806	26.00–27.00	Qbt 3	—	—	—	—	7.1	—	—	—	—	—	—
0100-96-1888	00-05807	3.00–4.00	Fill	—	—	0.006	—	35	—	—	—	—	—	—
0100-96-1887	00-05807	10.50–11.50	Qbt 3	—	—	0.006	—	36	—	—	—	—	—	—
0100-96-1891	00-05808	3.80–4.50	Soil	—	—	0.026	—	45	—	—	—	—	—	—
0100-96-1883	00-05809	13.30–14.00	Fill	—	—	0.016	—	5300	—	—	4.9	2.5	1.3	—
0100-96-1910	00-05810	2.50–3.00	Fill	—	—	0.001 (J)	—	—	—	—	—	—	—	—
0100-96-1911	00-05810	9.50–10.00	Fill	—	—	0.002 (J)	—	—	—	—	—	—	—	—
0100-96-1914	00-05811	1.50–2.00	Soil	—	0.001 (J)	—	—	—	—	—	—	—	—	—
0100-96-1919	00-05812	9.50–10.00	Qbt 3	—	—	—	—	—	—	—	—	—	—	—
0100-96-1925	00-05813	17.00–17.50	Qbt 3	—	—	0.004 (J)	—	—	—	—	—	—	—	—
0100-96-1926	00-05813	24.50–25.00	Qbt 3	—	—	0.002 (J)	—	—	—	—	—	—	—	—
0100-96-1927	00-05813	27.50–28.00	Qbt 3	—	—	0.003 (J)	—	—	—	—	—	—	—	—
0100-96-1928	00-05814	8.50–9.10	Fill	—	—	—	6.2	—	—	—	—	—	—	—
0100-96-1930	00-05814	24.50–25.00	Qbt 3	—	—	—	—	—	—	—	—	—	—	—
0100-96-1931	00-05815	9.30–9.80	Fill	—	—	0.008	—	—	—	—	—	—	—	—
0100-96-1934	00-05815	29.50–30.00	Qbt 3	—	—	0.004 (J)	—	—	—	—	—	—	0.006	—
0100-96-1935	00-05816	3.40–3.90	Qbt 3	—	—	—	14	—	—	—	—	—	—	—
0100-96-1936	00-05816	12.00–12.50	Qbt 3	—	—	210	10000	—	—	—	160	38	440	—
0100-96-1937	00-05816	19.50–20.00	Qbt 3	—	—	440	17000	—	—	—	160	38	510	—
0100-96-1938	00-05816	29.00–29.50	Qbt 3	—	—	0.004 (J)	34	—	—	—	0.002 (J)	—	0.006	—
0100-96-1878	00-05820	4.80–6.00	Qbt 3	0.053 (J)	—	0.003 (J)	—	—	—	—	—	—	—	—

Notes: A dash indicates that the sample was not analyzed for the analyte or was not detected.
All units are mg/kg.

Table 2.1-5
Indoor Air Data from Knights of Columbus Hall, PRS 0-027

COPC	0100-97-0246 (ppbv) (background)	0100-97-0247 (ppbv) (bingo room door)	0100-97-0248 (ppbv) (bingo room wall)	0100-97-0249 (ppbv) (kitchen sink)	0100-97-0250 (ppbv) (bingo room center)	0100-97-0251 (ppbv) (men's room wall)	0100-97-0252 (ppbv) (meeting room intake)	0100-97-0253 (ppbv) (meeting room door)	0100-97-0255 (ppbv) (kitchen sink)
Benzene	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Toluene	<1.0	<1.0	<1.0	1.48	2.26	2.08	2.26	<1.0	1.18
Ethylbenzene	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Trimethylbenzene [1,3,5-]	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Trimethylbenzene [1,2,4-]	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,3-Xylene	<1.0	<1.0	<1.0	1.20	1.50	2.10	1.86	<1.0	1.22

Note: All values of <1.0 ppbv are reported as undetected.

(c) Screening Assessment Methods and Results

A human health screening assessment was performed for PRS 0-027 (Appendix H). An ecological screening assessment was not performed because the completely paved surface prevents access to ecological receptors; that is, the exposure pathways to ecological receptors are incomplete (Appendix D). In addition, the bulk of the COPCs are measured in soil/fill or tuff at depths greater than 5 ft bgs, which is the typical depth assumed for complete ecological exposure pathways. Therefore, ecological impacts are not expected because no complete exposure pathways or offsite transport pathways exist.

Table 2.1-6 shows there are no data gaps by chemical suite for PRS 0-027. Based on process knowledge of site operations, there was no reason to expect radiological contamination at PRS 0-027; therefore, samples were not analyzed for radionuclides.

Table 2.1-6
Data Gap Assessment for Former Drum Storage Area, PRS 0-027

Suite	<2 ft	2 to 5 ft	5 to 15 ft	>15 ft
PCBs	√	√	√	√
Pesticides	√	√	√	√
Polycyclic aromatic hydrocarbons (PAHs)	√	√	√	√
VOCs	√	√	√	√
SVOCs	√	√	√	√
Inorganics	√	√	√	√

√ = Data available for analysis, indicating no data gap.

The COPCs with the potential to adversely affect human health at PRS 0-027 are volatile or semivolatile organics in the subsurface (Tables H-1, H-2 and H-3). Potential risks posed by these COPCs for PRS 0-027 can be reduced with a readily available and cost-effective technology: SVE. Thus, SVE is

proposed as the remedial approach for this PRS. This remedial method is described in sections 4.2 and 4.3.

2.1,2 PRS 0-030(a), Septic System

2.1.2.1 PRS 0-030(a), Site Description and Operational History

PRS 0-030(a) consists of a septic system and associated inlet and outlet piping. The septic system was installed in about 1946 to handle sanitary wastes from the DP Road storage area fuel dispatch office. It probably remained in service until the site was decommissioned in the early 1960s. The RFI work plan (LANL 1992, 0781) identified the following as COPCs: VOCs, SVOCs, TPH, TAL metals, PCBs/pesticides, uranium, plutonium, americium-241, and tritium. Because no RFI activities were conducted at this site, the full suite of analyses was specified in the VCA plan (LANL 1996, 54353.3).

2.1.2.2 PRS 0-030(a), Previous Field Investigations

In the spring and summer of 1996, a VCA was conducted (instead of an RFI) to determine if the site had any COPCs to human health or the environment. To locate the positions of the former structures, a geodetic survey and a geophysical survey were conducted. The geophysical results were inconclusive; therefore, exploratory trenches were excavated to locate the tank or the tank inlet pipe. The foundation of the dispatch office building was located, as well as the inlet pipe into the septic tank. The 4-in. cast-iron pipe was found exiting the dispatch building below the bottom of the foundation at a depth of 9 ft bgs. The septic tank was found by following the pipe, but the pipe ended approximately 32 ft east of the dispatch building. The septic tank was located approximately 45 ft east of the building at a depth of 9 ft. The tank measured 6.67 ft long by 3.67 ft wide by 5.5 ft deep. A covered manhole was found in the northwest corner of the tank. The manhole was removed and the field team found that the tank was still intact and viable but had not been backfilled, and it contained only 3 to 4 in. of dry sludge (LANL 1996, 59576.1).

Two samples were collected from outside the tank, and one sample of the dry sludge material was collected from inside the tank at location 00-05101. One of the external samples was collected beneath the inlet pipe (location 00-05102) and the other was collected beneath the outlet pipe (location 00-0513). In accordance with the VCA plan (LANL 1996, 54353.3) all samples were submitted for fixed laboratory analysis of VOCs, SVOCs, TPH, TAL metals, PCBs/pesticides, toxicity characteristic leaching procedure (TCLP) metals, and radionuclides (total uranium, plutonium, and americium-241).

The outfall from the septic tank to the drainage in DP Canyon was not sampled, but a sample was collected beneath the outlet pipe location adjacent to the septic tank. The outfall was not located due to the depth of the septic tank and the outlet pipe and to the amount of fill covering this area.

2.1.2.3 PRS 0-030(a), Results of Previous Investigations

Several chemicals (inorganics, radionuclides, and organics) were detected in the sludge. According to the VCA report (LANL 1996, 59576.1), there was a small volume of dried sludge in the tank bottom. The field team reported difficulty in collecting an adequate amount of sample material to fill the containers. After the analytical data was received and reviewed, a decision was made to crush the tank in place. NMED approved the crushing of the tank and leaving it in place. Each wall of the tank, including the bottom and the top, was broken into small fragments and mixed with the surrounding debris and fill material. The trench was backfilled with existing fill material, then clean fill and gravel were brought in to level the disturbed areas and the site was graded.

The data collected for this septic tank was found to be adequate for defining the nature and extent of contamination because the tank was physically intact and devoid of cracks, holes, or other damage that might have allowed content release. Sludge in the tank was sampled, and two points of possible releases to the environment were also sampled (under the inlet and outlet pipes). According to the VCA completion report (LANL 1996, 59576.1), a human health risk assessment was conducted which determined that no pathway existed for exposure. Nature and extent was defined because the contaminant concentration values decreased from the inlet line to the outlet line. Pathways to ecological receptors are incomplete based on the depth of the tank, 9 ft below ground surface. The septic system was crushed and left in place as approved by NMED. Thus, NFA was proposed for PRS 0-030(a) under Criterion 5. Criterion 5 states that the site was characterized or remediated in accordance with current applicable state and/or federal regulations, and the available data indicate that contaminants do not pose an unacceptable level of risk, assuming current and projected future land use.

2.2 6th Street Warehouse PRSs [PRSs 0-004, 0-030(l,m), and 0-033(b)]

The 6th Street Warehouses, also known as the Zia Warehouses, include PRS 0-004, PRSs 0-030 (l,m), and PRS 0-033(b) (Figure 2.2-1). These PRSs are discussed together in this section based on their spatial proximity and similar operational histories. In addition, the drainages associated with PRS 0-004 connect with the drainages associated with PRS 0-033(b). These PRSs are located within the DP Road 4 (A11) land transfer parcel.

PRS 0-004 was a container storage area that was used for satellite storage of solvents. It was located in the 6th Street Warehouses (LANL 1990, 0145) but is no longer an active storage area.

PRS 0-030(l) is a septic system that served various Zia Company facilities. PRS 0-030(l) was reported (LANL 1990, 7511) to have served Zia Warehouses 3 and 4 and overflowed to an outfall. The SWMU report (LANL 1990, 7511) for PRS 0-033(b) states that, in 1946, there were five warehouse buildings and a cold storage plant. There were storm drains around the two buildings that were divided into Warehouse 1/2 and Warehouse 3/4, and these drains had outfalls into Los Alamos Canyon. In 1948, an MTL was constructed to the south of Warehouse 3/4. This MTL had three floor drains served by two drainlines that also had outfalls into Los Alamos Canyon.

PRS 0-033(b) includes soil contamination associated with the following: storm drains around Warehouse 1/2 and Warehouse 3/4 and their outfalls into Los Alamos Canyon, and MTL floor drains served by two drainlines with outfalls into Los Alamos Canyon.

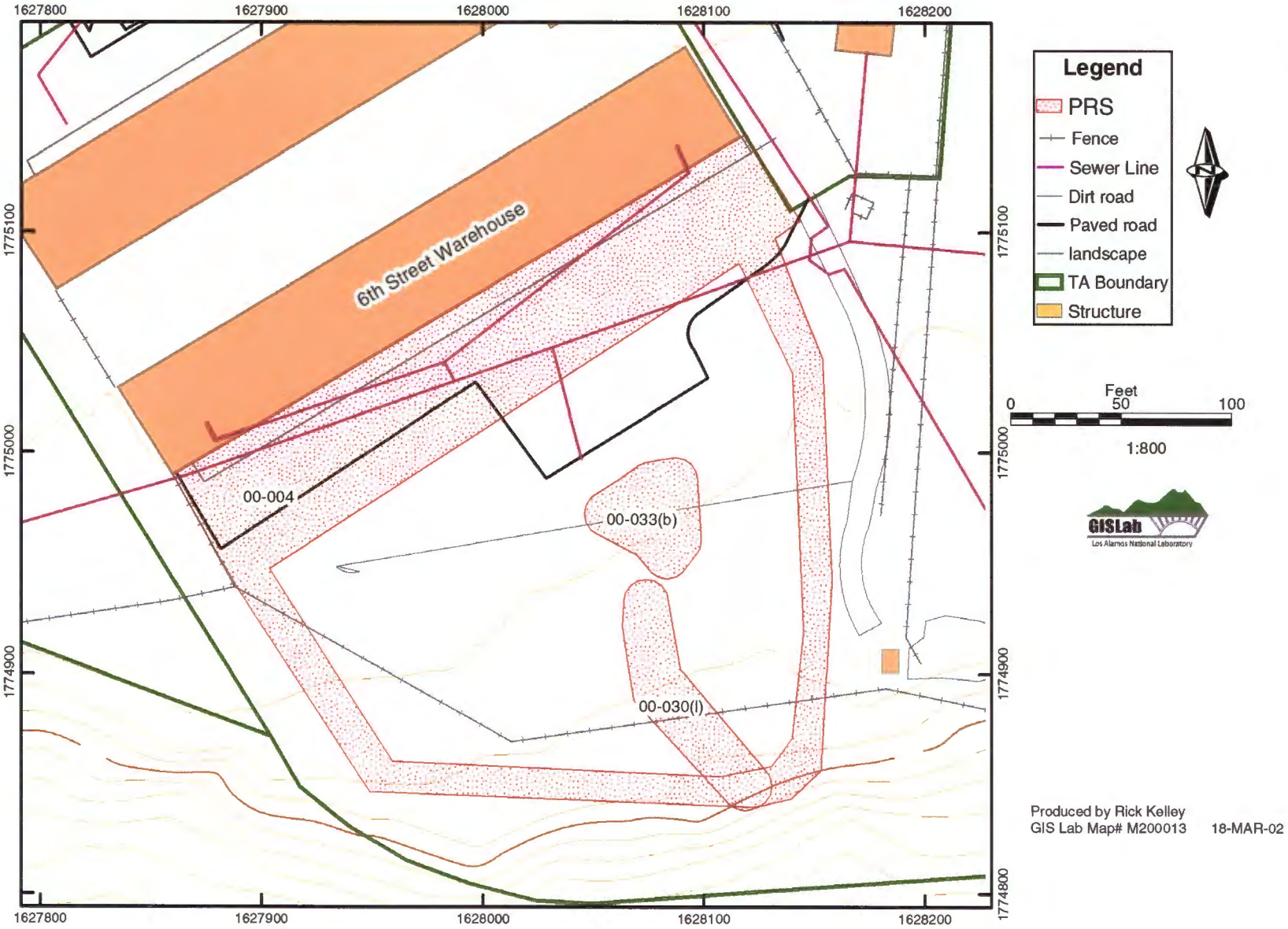


Figure 2.2-1. 6th Street Warehouse PRSs [PRSs 0-004, 0-030(l), and 0-033(b)]

The PRSs are discussed in the same section because their influence shares a common spatial boundary. The potentially impacted area is the drainage below the mesa top and the field, located immediately south of the 6th Street Warehouses, which drains the warehouse parking lots and outfalls and overlies former septic tank PRS 0-030(l). Possible contaminant releases include subsurface leaks from outfall pipes [PRS 0-033(b)] and a septic tank and associated plumbing [PRS 0-030(l)], and surface releases from spills (PRS 0-004) or outfall pipes [PRS 0-033(b)]. COPCs associated with these PRSs include VOCs, SVOCs, pesticides, PCBs, metals, and radionuclides. The 6th Street Warehouse PRSs are bordered by private property to the west, Los Alamos Canyon to the south, PRSs 0-030(b) and 0-030(m) to the east, and DP Road to the north. Commercial development exists within 50 ft to the east. The area of the 6th Street Warehouse PRSs has undergone heavy commercial and urban development. Soils have been disturbed through excavation and backfilling during construction activities.

2.2.1 PRS 0-004, Active Container Storage Area

2.2.1.1 PRS 0-004, Site Description and Operational History

PRS 0-004 was consolidated into PRS 00-030(b)-00, which resulted in PRS 0-004 being added to the HSWA permit. PRS 0-004 was a container storage area located inside 6th Street Warehouse 3/4. PRS 0-004 includes the drainages from the warehouses, and these drainages join the drainage from PRS 0-033(b). The storage area was primarily used to store solvents; however, other materials that may have been stored at this site by the Zia Company include asphalt, lubricants, pesticides, and herbicides.

On March 15, 1984, an undocumented quantity of methyl ethyl ketone peroxide (MEKP) spilled in one of the warehouses, and the potential interaction of chemicals posed a high-explosive risk. Several drums were temporarily removed from the warehouse to the parking lot and the entire area was hosed down by the fire department. Another incident involved solvents that had crystallized. The crystallized solvent containers were taken to the parking lot and washed down with water. The resulting effluent and the wash water drained from the parking lot into the unlined drainages ditches leading toward Los Alamos Canyon. PRS 0-004 connects to PRS 0-033(b) at the drainage ditches (Figure 2.2-1). Both spills occurred inside the warehouses, and this area was washed with water.

2.2.1.2 PRS 0-004, Previous Field Investigation

In 1995, five samples were collected to characterize the spills as part of the RFI activities. One sample was collected from a location upgradient of the outfall within an obvious sediment catchment of the drainage channel. A second sample was collected near the head of a drainage ditch approximately 25 ft south of the culvert and on the east side of the parking lot. Two surface samples were collected from a sediment catchment below the rim of the mesa in a natural drainage that appears to have existed before the storm water was physically directed to the west (Figure 2.2-2). The samples were analyzed for SVOCs, PCBs, pesticides, and radionuclides. Three samples were analyzed for metals by x-ray fluorescence (XRF). One sample was submitted to the MCAL for VOC analysis. The XRF measurements and the analyses performed in the MCAL have multiple shortcomings, including inadequate analytical rigor and/or elevated detection limits that preclude their use. Consequently, the lack of fixed-laboratory analytical data constitutes a data gap for VOCs and metals. This data gap will be addressed before human health and ecological risks associated with this PRS are evaluated.

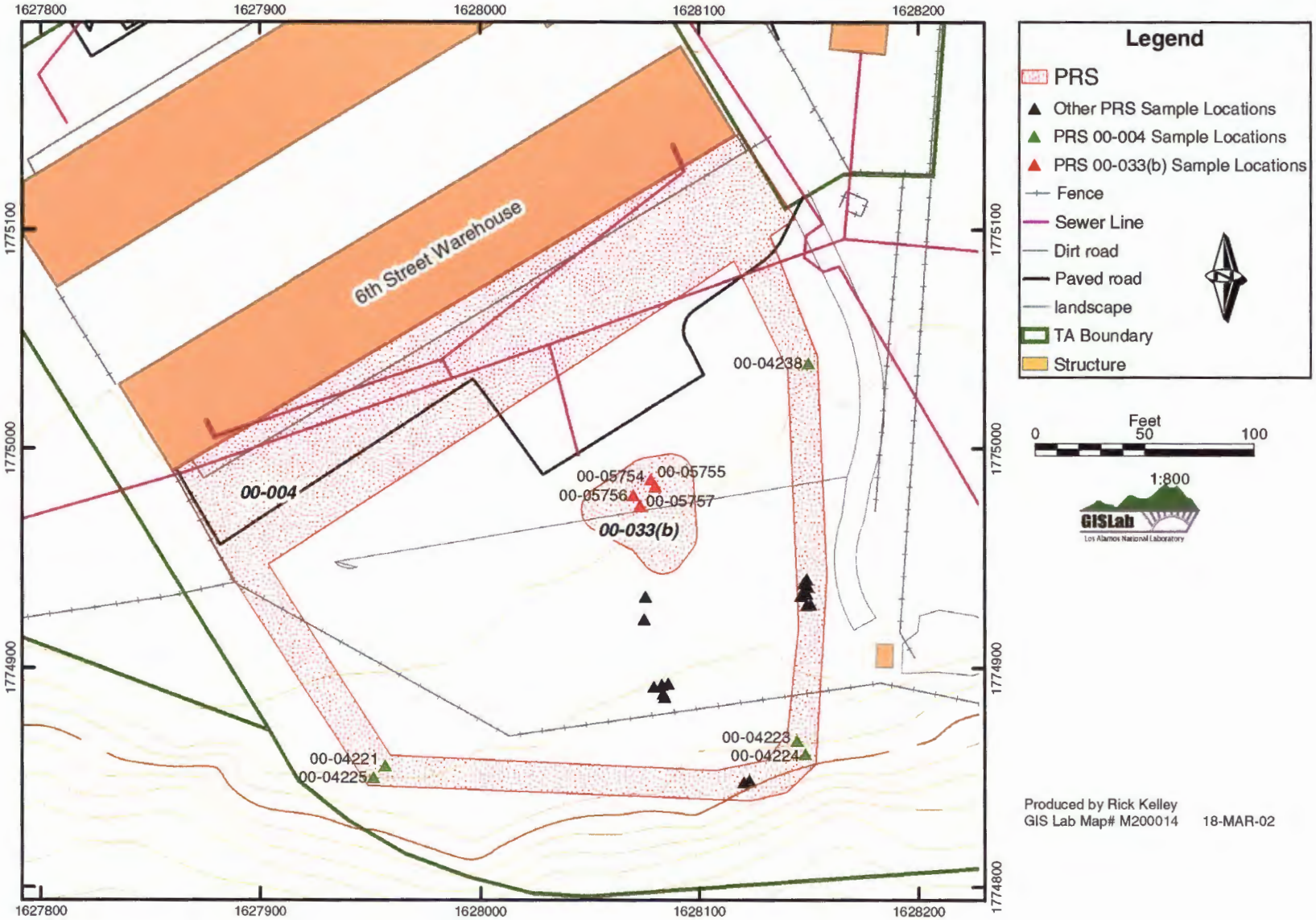


Figure 2.2-2. PRS 0-004 and PRS 0-033(b), sample locations

2.2.1.3 PRS 0-004, Results of Previous Investigations

In the 1996 RFI report (LANL 1996, 54616), no COPCs were retained by the human health screening assessment and the PRS was recommended for NFA based on Criterion 5. Five samples, as described in section 2.2.1.2, were collected to characterize the spills from this container storage area. Additional samples will be collected from the eastern and western drainages to provide information on the extent of potential contamination.

Table 2.2-1 shows existing information and data gaps for PRS 0-004. This PRS is characterized by surface releases. The surface hydrology of the site consists of runoff from rain events and snowmelt. Surface transport from overland flow and outfalls may cause contaminants to become concentrated in drainages. Consequently, contamination should be confined to the surface. Sampling to define the nature and extent of contamination will evaluate surficial (0–6 in.) and immediately subsurface (6–12 in.) soils to verify that contamination is limited to the surface (Appendix E).

Table 2.2-1
Data Gaps for Surface Drainage at 6th Street Warehouses, PRS 0-004

Suite	<2 ft
PCBs	√
Pesticides	√
PAHs	√
VOCs	No data
SVOCs	√
Inorganics	No data
Radionuclides	√

√ = Data available for analysis, indicating no data gap.

Because of the VOC and inorganic data gaps, this area will be resampled in order to collect enough information to determine nature and extent. The sampling design is described in Appendix E. If the screening assessments identify unacceptable risks to human health or the environment, an appropriate remedy will be developed and implemented, and will be presented in detail in the VCA completion report.

2.2.2 PRS 0-033(b), Soil Contamination, Drainlines, and Outfalls

2.2.2.1 PRS 0-033(b), Site Description and Operational History

The SWMU report (LANL 1990, 0145) describes PRS 0-033 as one unit which included soil contamination, a UST, storm drains and outfalls, and drainlines. Since that time, the UST has been labeled as PRS 0-033(a) and is described in section 2.5.3 of this plan. The rest of the area is designated as PRS 0-033(b) and includes soil contamination associated with the following areas: storm drains around Warehouse 1/2 and Warehouse 3/4 and their outfalls into Los Alamos Canyon, and MTL floor drains served by two drainlines with outfalls into Los Alamos Canyon. PRS 0-033(b) connects to PRS 0-004 at the drainage ditches.

PRS 0-033(b) includes potential soil contamination from the drainlines from the MTL. Operations at the testing laboratory involved the use of solvents, asphalt leaching, destructive tests of concrete cylinders, and sieve tests of aggregates for roadwork. COPCs at PRS 0-033(b) include PAHs, PCBs, SVOCs,

VOCs, pesticides, and metals originating in the 6th Street warehouses and in the MTL. Contamination from radionuclides is not expected.

2.2.2.2 PRS 0-033(b), Previous Field Investigations

A 1995 RFI field investigation (LANL 1996, 54616) at PRS 0-033(b) concentrated on the potential soil contamination surrounding the drainlines that served the MTL. It is possible that past spills at the MTL drained to the building storm drains. Five trenches were excavated to locate the pipelines and the alleged septic tank. The pipelines were excavated to the top of the tuff, approximately 3 to 10 ft bgs. Neither the excavation nor the geophysical surveys could locate the septic tank, the outlet pipeline, or the outfall. Sheet 5 of the blueprints for the MTL revealed that two liquid waste lines exited the south side of the building: one was cast iron and the other was vitrified clay pipe (VCP). Both liquid waste lines ended within the soil of the embankment, 13 to 15 ft south of the building. Although the waste lines did not daylight at the time of the field investigation, it is believed that they had at one time. As documented in the RFI report (LANL 1996, 54616), the construction activity related to removing the MTL and replacing it with transportables is believed to have resulted in additional soil being added to the embankment that covered the end of the waste lines. The waste lines may have ended in a small drainage ditch that led toward the berm, then around the berm and to the canyon. Three samples were collected from within and beneath the waste lines; they were analyzed for SVOCs, PCBs/pesticides, TAL metals, and radionuclides.

Because the initial RFI analytical results for PRS 0-033(b) indicated a potential increased risk to human health due to PAHs, alpha-chlordane, and gamma-chlordane, a VCA was conducted at the site (Figure 2.2-2) in July 1996 (LANL 1996, 62536). Both the VCP and the cast-iron pipe were located and removed. All soil to a depth of 1 ft under both pipes was removed and placed in drums. Eleven confirmatory samples, including a duplicate sample, were collected after the VCA. A confirmatory sample and a duplicate sample were collected from beneath the VCP drainline after it was removed. Two additional samples were collected from the trench where the cast-iron pipe was excavated. One of these samples was collected 5 ft from the south wall of the MTL foundation and 5 ft bgs. The other sample was collected 8.5 ft from the south wall of the MTL foundation and 4 ft bgs. Both were located 1 ft below the level of the cast-iron pipe. All four samples were submitted to a fixed analytical laboratory for pesticide/PCBs, SVOCs, and TAL metals analyses. Another sample was collected from beneath the former VCP, 12 ft south of the foundation. Six more samples were collected. Four of these were downgradient from both the VCP and cast-iron drainlines. The other two samples were collected upgradient from the two outfalls, one from the northwest side of the VCP outfall, and one from the northeast side of the cast-iron drainline outfall. These seven samples were analyzed for lead, SVOCs, and pesticides/PCBs by a fixed analytical laboratory.

2.2.2.3 PRS 0-033(b), Results of Previous Investigations

The analytical results for the confirmatory samples from the VCA activities did not show any concentrations of chemicals that present a potential risk to human health (LANL 1996, 62536). An assessment of risk to ecological receptors was not performed at that time. The lack of VOC and inorganic data (other than lead) represents a data gap which will be addressed by the sampling for this PRS as proposed in Appendix E.

Table 2.2-2 shows the data gaps identified by chemical suite and depth for PRS 0-033(b). Based on process knowledge, radiological contamination is not expected, nor is contamination above 2 ft or greater than 5 ft in depth.

Table 2.2-2
Data Gaps for Materials Testing Laboratory, PRS 0-033(b)

Suite	2 to 5 ft
PCBs	√
Pesticides	√
PAHs	√
VOCs	No data
SVOCs	√
Inorganics	√

√ = Data available for analysis, indicating no data gap.

To define nature and extent, additional data are required for this PRS. The additional sampling planned for this PRS is described in Appendix E. If the screening assessments identify unacceptable risks to human health or the environment, the selected remedy will be implemented and fully presented in the VCA completion report.

2.2.3 PRS 0-030(l), Septic System

2.2.3.1 PRS 0-030(l), Site Description and Operational History

PRS 0-030(l) consisted of a single, 1000-gal. concrete septic tank (10 ft long by 6 ft wide by approximately 5 ft deep) with VCP drainlines of 6 in. in diameter. The outlet line discharged to Los Alamos Canyon. This septic system reportedly handled sanitary wastes from Zia Warehouse 3/4 and discharged from a blow-down tank that released pressure from a boiler (LANL 1992, 0781). Chemicals used to descale boilers may have been released to the septic tank through the blow-down tank. The RFI work plan (LANL 1992, 0781) reports, "No information exists as to the nature of these chemicals." Thus, the COPCs for this site included SVOCs, PCBs/pesticides, radionuclides, and TAL metals.

2.2.3.2 PRS 0-030(l), Previous Field Investigation

The PRS 0-030(l) septic tank was sampled in July 1995 as part of an RFI (LANL 1996, 55203). Four soil samples were collected from inside the tank and all were submitted to a fixed analytical laboratory for SVOC, PCB/pesticide, and radionuclide analyses; two were analyzed for TAL metals.

Two tuff samples were collected from below the VCP inlet pipe and one sediment sample was collected from within the inlet pipe near its connection to the septic tank; all three samples were analyzed for SVOCs, PCBs/pesticides, and radionuclides. Additionally, one of the samples from below the VCP pipe and the sample from within the inlet pipe were analyzed for TAL metals. Two samples were collected from the outfall channel and analyzed for SVOCs, PCBs/pesticides, and radionuclides. Eleven samples were sent to the LANL MCAL for VOC analyses and metal analyses by XRF, but these data cannot be used to define nature and extent of contamination due to inadequate detection limits or lack of comparability of XRF data with published background values and no quality assurance.

The septic tank and approximately 40 ft of inlet line were excavated and removed in October 1995 during the VCA activities (Figure 2.2-3). Two confirmatory samples were collected from beneath the former tank location. These samples were analyzed for SVOCs, PCBs, pesticides, and radionuclides, and one sample

was submitted for TAL metals analysis. The excavation area from the tank and inlet pipe was backfilled and the area was restored to its original contour.

The confirmatory samples that were collected on the outside of the tank were composited; therefore, a data gap exists regarding the nature of the soil on the sides of the former septic tank. Soil below the outlet VCP was sampled to determine if any contaminants were in the outfall. These samples were analyzed for SVOCs, PCBs/pesticides, and radiological constituents, by a fixed analytical laboratory, and for metals by XRF. The XRF measurements have multiple shortcomings, including inadequate sensitivity and comparability to Laboratory background data, that preclude their use for defining the nature and extent of contamination. Therefore, a data gap exists for metals due to the lack of fixed analytical laboratory data. Additional samples will be collected from each side of the former tank location. The tank location will be determined based on the Global Positioning System (GPS) coordinates. This data gap will be addressed before human health and ecological risks potentially associated with soil contaminants are evaluated.

2.2.3.3 PRS 0-030(I), Results of Previous Investigations

Because the data gaps for this PRS are related to composite samples and analytical results from mobile chemistry analytical laboratory, additional sampling and analysis are needed to define the nature and extent of contamination. Once the nature and extent are defined, the COPCs at the PRS can be evaluated for potential human health and ecological risk. Table 2.2-3 shows the data gaps by chemical suite and the depth for PRS 0-030(I).

Previous remedial activities at PRS 0-030(I) did not remove the outlet pipe. Although this outlet pipe is inactive and the source was removed, the outlet pipe will be removed to prevent exposure to any residual concentrations of COPCs within the pipe. When the outlet pipe is removed, the soil in the trench can be visually inspected for staining as evidence of leaks from the pipe, then samples will be collected from visually stained areas and beneath selected pipe joints. The additional sampling for this PRS is described in Appendix E.

Table 2.2-3
Data Gap Identification for 6th Street Warehouse PRSs, PRS 0-030(I),

Suite	<2 ft	2 to 5 ft	5 to 15 ft
PCBs	√	√	√
Pesticides	√	√	√
PAHs	√	√	√
VOCs	No data	√	No data
SVOCs	√	√	√
Inorganics	No data	No data	√
Radionuclides	√	√	√

√ = Data available for analysis, indicating no data gap.

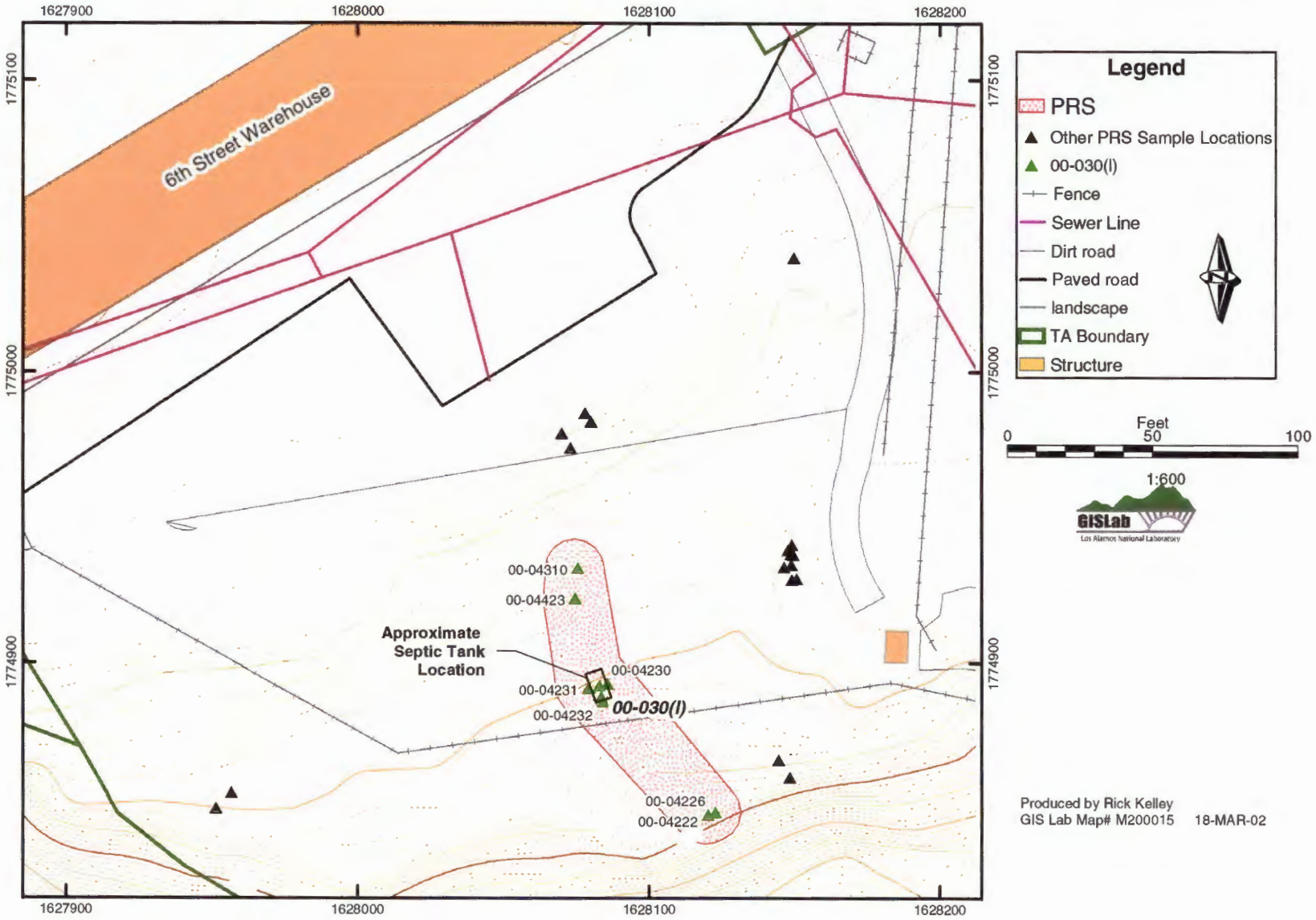


Figure 2.2-3. PRS 0-030(I)

2.3 6th Street Septic Systems [PRSs 0-030(b) and 0-030(m)]

PRSs 0-030(b) and 0-030(m) are discussed together because they are in close proximity and are connected to one another (Appendix D). The outlet pipe from PRS 0-030(m) joins the outlet pipe from PRS 0-030(b) approximately 400 ft east of the PRS 0-030(m) septic tank. From that point, the line runs at least an additional 600 ft to where the pipe daylights (Figures 2.3-1 and 2.3-2). The PRSs are located south of the intersection between DP Road and Trinity Drive, on the top and upper slopes of East Mesa north of Los Alamos Canyon. The Canyon defines the southern boundary and DP Road defines the northern boundary of the PRSs. Surface contamination from DP Road may impact the northern portion of the site. PRS 0-030(b) and PRS 0-030(m) are located within DP Road South and DP Road 4 land transfer parcels.

2.3.1 PRS 0-030(b), Septic System

2.3.1.1 PRS 0-030(b), Site Description and Operational History

PRS 0-030(b) is a septic system that served 6th Street Warehouses 1 through 4, an office building, the cold storage plant, and the eastern portion of TA-1 in the late 1940s. The septic system consisted of two diversion boxes that directed sewage flow to two septic tanks (a north tank with six cells and a south tank with two cells), which then directed the sewage via drainlines to a leach field and an outfall in BV Canyon to the east. The diversion boxes were located adjacent to 6th Street, between the street and Warehouse 1 (Figure 2.3-1). Available information indicates that the septic system handled only sanitary waste; however, since it served portions of TA-1, there is a potential for nonsanitary wastes in the system. COPCs include VOCs, SVOCs, PCBs/pesticides, TAL metals, and radionuclides.

In the early 1950s, the leach field, which is located east of the 6th Street Warehouses, was bulldozed and distributed on the mesa top as part of the site preparation and leveling for a mobile home park. By 1951, trailer homes had been placed on the site of the former leach field (Figure 2.0-2). By 1974, the trailers had been removed from the site and the site has been vacant since that time (Figures 2.0-5 and 2.0-6). The outlet piping extends southeast across a field, then bends and extends eastward to where it daylighted into BV Canyon.

2.3.1.2 PRS 0-030(b), Previous Field Investigations

RFI fieldwork for PRS 0-030(b) began in the summer of 1995 (LANL 1996, 54616) and continued into 1996 with the VCA activities (LANL 1996, 54760; LANL 1996, 62536). Trenching was conducted to map the pipeline (Figure 2.3-1).

The field team dug a trench along the line that led from the septic tanks to the manhole, and then to where the line presumably daylighted in Los Alamos Canyon. Along the southeast-trending section of the line, four trenches were dug and samples were collected from beneath the pipes. The team attempted to locate the outfall along the diagonal by trenching south of the fence along the mesa edge, but no evidence of an outfall was found. The field team then trenched back toward the north to locate the end of the pipe. The pipe was found connected to an eastward-trending metal pipe. Samples were collected from beneath this connection. Trenching was conducted at intervals along the metal pipe until the broken end of the pipe was found near BV Canyon. A sample was collected from the soil beneath the end of the pipe. The team attempted to determine if the pipe continued to the east, but the metal pipe could not be located. There has been much activity in the area by the Los Alamos County utility department, and it is believed that this activity resulted in the rest of the pipe being either removed or cut. All of the drainlines located by the field team were left in place.

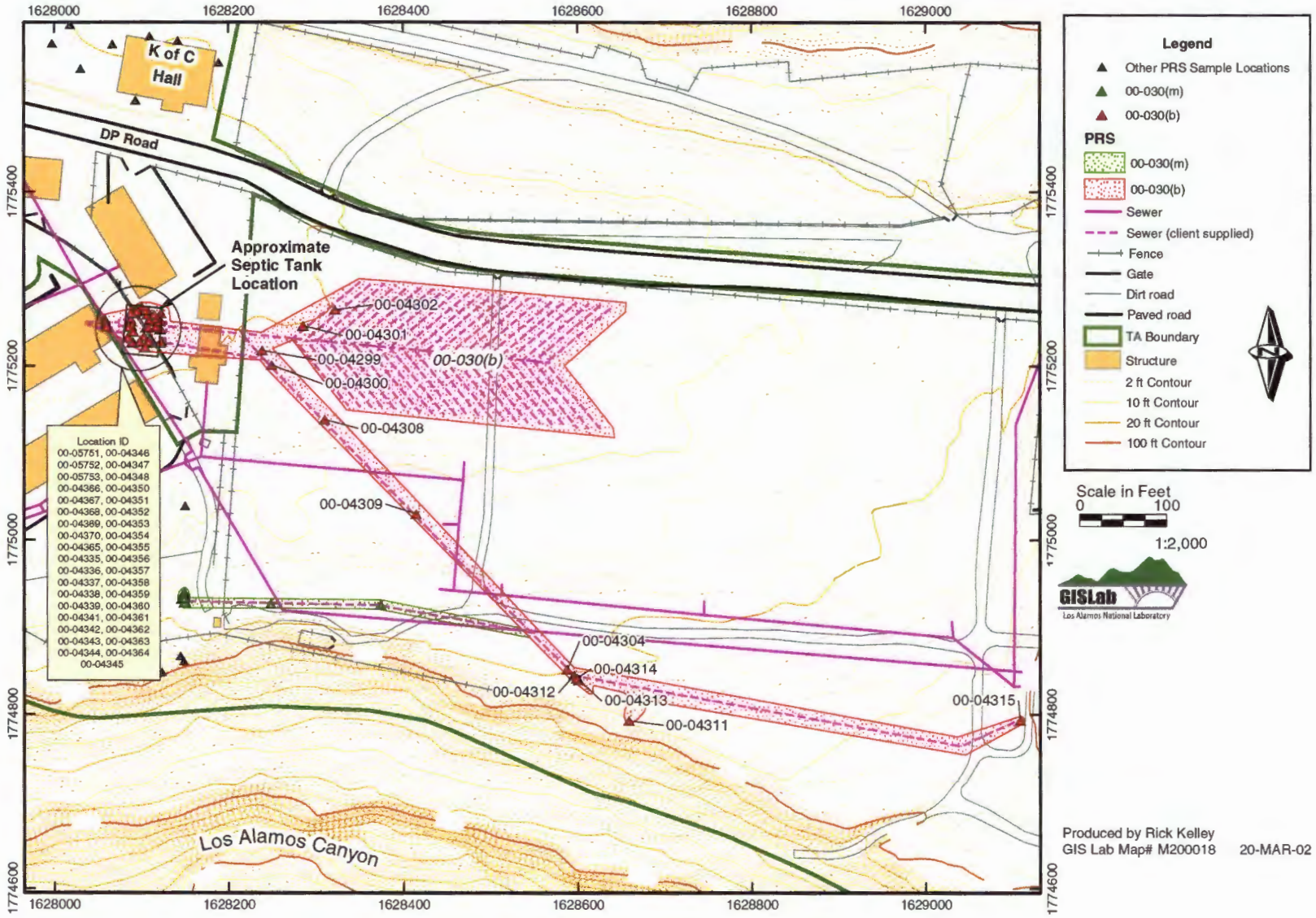


Figure 2.3-1. PRS 0-030(b)

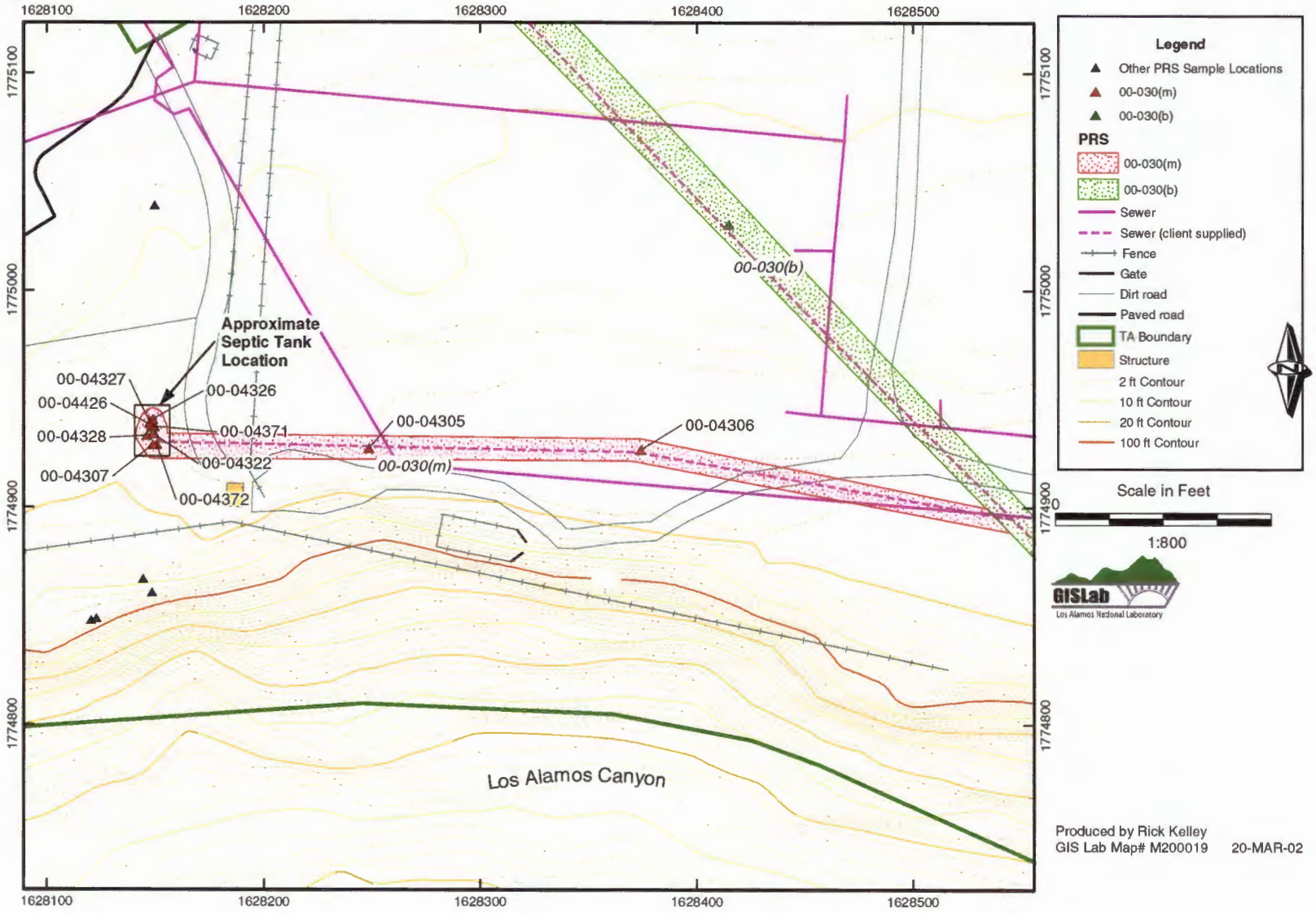


Figure 2.3-2. PRS 0-030(m)

The leach field associated with PRS 0-030(b) was approximately 325 ft long by 150 ft wide. Trenching was conducted within the former leach field to attempt to locate the central drainline and the lateral Y branches. In the northwest corner, four sections of 2-ft long VCP were located, but longer sections of piping were not found. Soil samples from two locations in the leach field were collected, both from the northwest corner because the associated piping had not been located during field investigations. The two samples were analyzed for SVOCs, PCBs, pesticides, and radionuclides by a fixed analytical laboratory, and for VOCs and metals by the MCAL. Additional trenching was conducted to locate the outfall drainline, and samples were collected from beneath joints and pipe pieces.

The south septic tank is composed of two cells divided by a concrete wall. The VCP outlet was found in the bottom of the tank as opposed to the side of the tank. The north septic tank is composed of three separate septic tanks, each constructed with the same two-cell design as the south septic tank. Two of the tanks share a common wall; this is interpreted to indicate that they were constructed at the same time. It is believed that those two tanks were added later because the 1943 engineering drawing shows two tanks instead of three.

The south diversion box, which was 2 ft by 3 ft, was constructed of brick and was partially demolished. During the characterization activities, it was discovered that the west and south walls were missing. The base was concrete and contained channels that were used for directing sewage flow. The north diversion box, which was 3 ft by 3.5 ft, was constructed of concrete. The field team speculated that it was a later addition to the system. The outlet lines were not exposed, but the inlet pipe was intact and was oriented northwest-southeast.

The 1995 field team found that the septic tanks and the diversion boxes had been backfilled with a silty sandy clayey fill material. Concrete chunks, presumably pieces of broken tank walls, were common within the fill material. It appeared that the original contents of the boxes had been mostly removed, but dark organic material was encountered infrequently near the bottom of the diversion boxes.

A total of 67 samples were collected from the septic system and analyzed. Three samples were collected from within and beneath the leach field Y branches. Twelve samples were collected from within and beneath the northwest-southeast-trending outlet pipeline, and 3 samples were collected from what was possibly the original outfall channel leading from the end of the VCP. One sample was collected from within and below the end of the steel outfall pipe. A total of 44 samples were collected from within and beneath the septic tanks and their outlet pipelines. Four samples were collected from within and beneath the diversion boxes and the inlet pipeline to the concrete diversion box.

2.3.1.3 PRS 0-030(b), Results of Previous Investigations

Based on the results of the 1995 RFI field activities at PRS 0-030(b), the decision was made to excavate the diversion box area, which showed chemical concentrations above SALs in the human health screening assessment (LANL 1996, 54616). The VCA took place during the summer of 1996 (LANL 1996, 62536). The contents of the concrete diversion box were removed, and the sides and floor were scraped and then swept clean. Before the concrete diversion box was removed, it was screened for waste characterization and found to have no detectable radioactivity.

The brick diversion box had been partially demolished, as described above. The remaining portions of the box, as well as the brick and concrete debris, were removed. Approximately 1 ft of soil was removed from below the box before collecting a confirmatory sample in July 1996. An additional confirmatory sample was collected from beneath the adjoining sides of the brick and concrete boxes. The first sample was collected 1 ft under the diversion box, the second was collected 1 ft under the area where the boxes were

joined, and the third was collected 1 ft under the midpoint of the concrete diversion box. All three samples were submitted to a fixed analytical laboratory for pesticide/PCB analysis.

Before backfilling the excavations, the inlet line to the concrete diversion box and all of the four outlet lines from the septic tanks were broken and sealed with concrete. The excavations were then backfilled with crushed tuff in 6- to 8-in. lifts and compacted.

According to the VCA completion report (LANL 1996, 62536), the analytical results for the confirmatory samples did not show any concentrations of chemicals that present a potential unacceptable risk to human health.

Only two samples were collected from within the leach field; therefore, a data gap exists for this part of PRS 0-030(b). (Two sample locations are not adequate to define nature and extent.) The two samples were analyzed for SVOCs, PCBs, pesticides, and radionuclides by a fixed analytical laboratory, and for VOCs and metals by the MCAL. XRF data for metals cannot be used to characterize sites because XRF sample results are not comparable to Laboratory background data and XRF samples lack the quality assurance of fixed laboratory data. The lack of inorganic data at this site is a data gap. In addition, there are also data gaps with regard to the vertical distribution of contaminants; while contamination was originally limited to the subsurface in the unpaved portion of PRS 0-030(b), the leach field has experienced significant recontouring activities following relocation of the former trailer park. This could have brought previously buried waste to the surface, as evidenced by numerous scraps of previously buried VCP observed on the ground surface throughout the site (Appendix D). VOCs are not considered a data gap because the surface soil would no longer contain VOCs associated with Laboratory operations; over 50 years have elapsed since there were any Laboratory activities in this area. Additional sampling to address these data gaps will be conducted as described in Appendix E.

Tables 2.3-1 and 2.3-2 list the data gaps by chemical suite and depth. The subareas within PRS 0-030(b) were divided according to whether they occurred in the proximity of the paved area or the leach field. In contrast to the leach field, contaminants in the area under pavement should be confined to depths greater than 2 ft because the diversion boxes were buried and the asphalt cover would have prevented activities (e.g., earth moving) that could have brought potential contamination closer to the surface.

Table 2.3-1
Data Gaps for 6th Street Warehouse PRS 0-030(b), Area Under Pavement

Suite	2 to 5 ft	5 to 15 ft
PCBs	√	√
Pesticides	√	√
PAHs	√	√
VOCs	No data	√
SVOCs	√	√
Inorganics	√	√
Radionuclides	√	√

√ = Data available for analysis, indicating no data gap.

Table 2.3-2
Data Gaps for 6th Street Warehouse PRS 0-030(b), Leach Field

Suite	<2 ft	2 to 5 ft	5 to 15 ft
PCBs	√	√	√
Pesticides	√	√	√
PAHs	√	√	√
VOCs	No data	No data	√
SVOCs	√	√	√
Inorganics	No data	√	√
Radionuclides	√	√	√

√ = Data available for analysis, indicating no data gap.

The data gaps that have created uncertainties in the nature and extent of contamination (e.g., lack of inorganic chemical data for shallow depths and lack of VOC sample results) for PRS 0-030(b) subareas will be addressed by additional sampling as described in Appendix E. If the screening assessments identify potential risks to human health or the environment, and if a cost-effective remedy is available, the remedy will be implemented and then presented in detail in the VCA completion report.

Previous remedial activities at PRS 0-030(b) did not remove the outlet pipe. Although this outlet pipe is inactive and the source is removed, the outlet pipe will be removed to prevent exposure to any residual concentrations of COPCs within the pipe. When the outlet pipe has been removed, the soil in the trench can be visually inspected for staining as evidence of leaks from the pipe and the soil can be sampled.

2.3.2 PRS 0-030(m), Septic System

2.3.2.1 PRS 0-030(m), Site Description and Operational History

PRS 0-030(m) consisted of a single wooden sanitary septic tank with 6-in.-diameter VCP drainlines. The system handled sanitary wastes from the incinerator building (LANL 1992, 0781), and the outlet line ran east along the edge of the mesa for approximately 400 ft, connecting to the outfall line from PRS 0-030(b) (Figure 2.3-2) and discharging into BV Canyon. This septic system also served an incinerator building where garbage collected from private residences was burned. Before incinerating the garbage, excess liquids of unknown chemical content were allowed to drain off and were piped into the septic tank (LANL 1992, 0781).

2.3.2.2 PRS 0-030(m), Previous Field Investigations

PRS 0-030(m) was investigated beginning in August 1995 during RFI activities. The septic tank was found by excavating trenches and was approximately 10 ft long by 6 ft wide by 6 ft deep. The tank had no lid and was filled with what appeared to be soil from the surrounding area. Two samples were collected from below the tank by hand-augering through the decayed wooden tank bottom; the samples were submitted for fixed laboratory analyses of SVOCs, PCBs/pesticides, TAL metals, and radionuclides. The field team found that the tank contained a few inches of soil that graded from moist to wet and from dark gray organic clay to silty sandy clay. Below the tank, approximately 1.1 ft of dark gray to black silt and very fine sand with occasional brownish pebbles and broken glass was encountered. This layer was in contact with reddish-gray tuff. Sixteen additional samples were collected, including a composite sample from outside and below the tank (the composite sample cannot be used to determine nature and extent of contaminants). Seven samples were collected from inside the tank, including one duplicate sample. Five of the samples were analyzed by a fixed laboratory for SVOCs, PCBs/pesticides, and radionuclides; one was analyzed for TAL metals, and one for radionuclides only.

Three samples were collected from inside and below the inlet pipeline, including one duplicate sample; these were analyzed for SVOCs, PCBs/pesticides, and radionuclides. Five samples were collected from inside and beneath the outlet pipeline; these were analyzed for SVOCs, PCBs/pesticides, and radionuclides.

The analytical results for PRS 0-030(m) indicated that the tank contained elevated concentrations of several pesticides, SVOCs (primarily PAHs), and metals. Based on the results of the screening assessment, a VCA was conducted in 1995 (LANL 1996, 55203).

A VCA was conducted in November 1995, and the septic tank and inlet pipeline were excavated and removed (LANL 1996, 55203). The silty sand layer below the tank also was removed, and approximately 6 to 8 in. of tuff was excavated from beneath and around the tank in an attempt to remove any residual contamination. The tank contents, surrounding soil and tuff, and inlet line were placed in four B-25 boxes, and 42 yd^3 of soil was placed into bags. As part of the removal with the backhoe, decayed wood from the tank itself was mixed with the soil in the B-25 boxes. Two confirmatory samples were collected after the tank, soil, and tuff were excavated. These samples were collected from beneath the tank and the removed sand and tuff. They were analyzed for SVOCs, PCBs/pesticides, and radionuclides. The tank and inlet pipe excavation were backfilled, and the area was restored to its original contour.

2.3.2.3 PRS 0-030(m), Results of Previous Investigations

The confirmatory sample results for PRS 0-030(m) indicated that there was no potential unacceptable risk to human or ecological health, and NFA was recommended based on Criterion 5 (LANL 1996, 55203).

The two confirmatory samples were analyzed for VOCs and metals by the MCAL. The metals analysis was conducted by XRF, and XRF data can no longer be used to characterize nature and extent at PRSs. The lack of inorganic data from a fixed laboratory at this site constitutes a data gap. In addition, the analytical quality assurance and detection limits associated with MCAL VOC analyses are less rigorous than that necessary for defining nature and extent of contamination. Consequently, the lack of useable VOC data constitutes a data gap.

No samples were collected from the outside of the tank. This constitutes a data gap because it is not known if the wooden tank leaked laterally. In addition, trenching was not conducted south of the tank to ensure that the tank did not have an outfall to the south leading to Los Alamos Canyon.

Tables 2.3-3 and 2.3-4 list the data gaps identified by chemical suite and depth. The subareas within PRS 0-030(m) were divided according to whether they represent the septic tank or the leach field that is also associated with PRS 0-030(b). Because contamination is expected to be limited to the buried drainage/tank structures, no contamination above 5 ft in depth is expected.

Table 2.3-3
Data Gaps for Wooden Septic Tank Receiving Incinerator Waste, Septic Tank Area, PRS 0-030(m)

Suite	5 to 15 ft
PCBs	√
Pesticides	√
PAHs	√
VOCs	No data
SVOCs	√
Inorganics	No data
Radionuclides	No tritium data

√ = Data available for analysis, indicating no data gap.

Table 2.3-4
Data Gaps for Wooden Septic Tank Receiving Incinerator Waste, Area Draining into Leach Field, PRS 0-030(m)

Suite	5 to 15 ft
PCBs	√
Pesticides	√
PAHs	√
VOCs	No data
SVOCs	√
Inorganics	No data
Radionuclides	No tritium, isotopic-uranium data

√ = Data available for analysis, indicating no data gap.

Previous remedial activities at PRS 0-030(m) did not remove the outlet pipe. Although this outlet pipe is inactive and the source is removed, the outlet pipe will be removed to prevent exposure to any potential residual concentrations of COPCs within the pipe. When the outlet pipe is removed, the soil in the trench will be visually inspected for staining as evidence of leaks from the pipe.

The data gaps for the PRS 0-030(m) subareas will be addressed by additional sampling as described in Appendix E. If the screening assessments identify potential risks to human health or the environment, and if a cost-effective remedy is available, the remedy will be implemented and presented in the VCA completion report.

2.4 Former PCB Transformer Sites [PRS 0-029(a,b,c)]

PRSs 0-029(a,b,c) are identified in the SWMU report (LANL 1990, 0145) as Aggregate 0-G, leakage from transformers containing PCBs (Figure 1.0-3). PRSs 0-029(a,b) were two former production well sites located on San Ildefonso Pueblo property, and PRS 0-029(c) was a production well site located on Santa Fe National Forest land in Guaje Canyon. The PRSs consist of potentially contaminated soil resulting from leaks from transformers located on power poles.

PRSs 0-029(a,b,c) were investigated in 1992, and an RFI phase report was written and submitted (LANL 1993, 26972). The report contains the final analytical data for these PRSs, but these data were not submitted to the ER Project's analytical database (the Facility for Information Management, Analysis, and Display). The quality assurance/quality control information for the sample data was not available, therefore, the use of the sample data is questionable. These PRSs will be resampled to obtain data that meets current LANL quality assurance/quality control requirements.

PRSs 0-029(a,b) are located in Los Alamos Canyon on San Ildefonso Pueblo property near Totavi, and PRS 0-029(c) is located in the Santa Fe National Forest in Guaje Canyon approximately 2 mi directly north of PRSs 0-029(a,b). Despite the distance separating PRSs 0-029(a,b) and PRS 0-029(c), these sites are evaluated together because of the similar sources and nature of contamination (PCBs). The 0-029 PRSs are located near (within 50 to 200 ft of) intermittent stream beds (Appendix D, Ecological Checklists).

2.4.1 PRS 0-029(a), Leakage from PCB Transformers

2.4.1.1 PRS 0-029(a), Site Description and Operational History

PRS 0-029(a) is the location of potential soil contamination due to releases from two transformers located on a power pole used for a groundwater production well (Well #5) in Los Alamos Canyon (Figure 1.0-3). The well is located in the bottom of Los Alamos Canyon, adjacent to a stream channel; the power pole is located about 20 ft from the PRS boundary closest to the stream channel. The two transformers were removed in October 1987 and contained oil with PCB concentrations of 162 ppm and 292 ppm (LANL 1990, 0145; Bailey 1992, 02007.2).

2.4.1.2 PRS 0-029(a), Previous Field Investigations

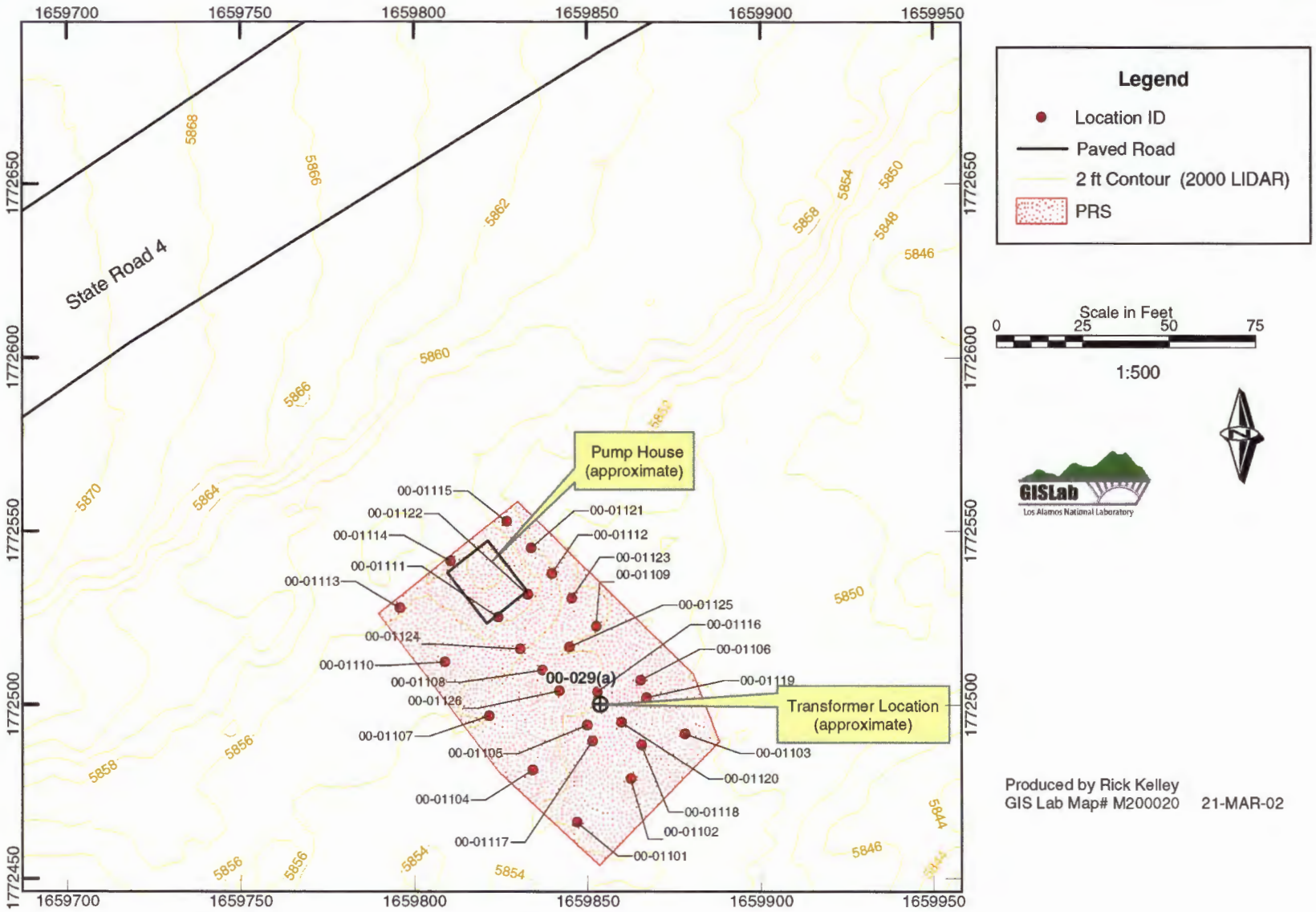
Sampling at PRS 0-029(a) was conducted in March 1992. A 100-ft by 50-ft grid was established, and fifteen soil samples were collected at regular intervals along the grid (Figure 2.4-1). Five additional samples were collected in the area around the power pole; one at the base. The analytical results indicated that the PCB levels in two of the samples were 0.09 ppm and that the remaining 18 samples were below the analytical detection limit of 0.06 ppm.

Although the PCB levels were an order of magnitude below the cleanup level of 10 ppm, a decision was made to define the nature and extent of the contamination. To define the nature and extent, six additional soil samples were collected in the area between the pump house and the power pole (Figure 2.4-1). The sampling sites were selected to more closely delineate the boundary of the suspected contaminated area (LANL 1993, 26972).

During the two sampling events, a total of 26 samples were collected and submitted to the LANL Environmental Chemistry Group (formerly EM-9, now C-ACS) for analysis of PCBs. For health and safety reasons, the soil samples were also screened for gross-alpha, -beta, and -gamma activity before submittal to the laboratory. One sample was collected and analyzed for VOCs by purge and trap gas chromatography/mass spectrometry analysis, and for petroleum hydrocarbons by Fourier transform infrared spectroscopy.

The original plan had been to remove the well house and to plug the well, but San Ildefonso Pueblo informed the Laboratory that they wanted the building and the well. Because the well house was left in place, additional samples were collected inside the well house. These samples included a swipe sample from the floor near the drain, and a sample of oil from inside a turbine located in the well house. The floor swipe contained 2.3 ppm of PCBs and the turbine oil less than 5 ppm of PCBs.

Figure 2.4-1. PRS 0-029(a), grid locations



During the second sampling event, an area of "oil-stained" soil was noted south of the pump house. An additional soil sample was collected from within this stained area and analyzed for VOCs, PCBs, and TPH. This sample had a PCB level below the detection limit of 0.06 ppm.

2.4.1.3 PRS 0-029(a), Results of Previous Investigations

Although the PCB contamination in the soil was below the Toxic Substances Control Act (TSCA) cleanup level of 10 ppm, the Laboratory elected to remove the contaminated soil. The boundary of the area identified for excavation was conservatively selected to ensure that all contaminated soil was removed. Approximately 20 yd^3 of soil was removed in August 1992 (LANL 1993, 26972). In addition to the soil removal, the well house was decontaminated. No confirmatory sampling was conducted because the levels of PCBs were less than the TSCA cleanup level.

The original data packages from the PRS 0-029(a) sampling events were not available for baseline or focused validation during preparation of this plan; thus the analytical data for these PRSs were not useable. Therefore, a PCBs data gap exists for this PRS. This PRS will be resampled for PCBs to obtain data that meet current LANL quality assurance/quality control requirements. The proposed sampling plan is described in Appendix E.

2.4.2 PRS 0-029(b), Leakage From PCB Transformers

2.4.2.1 PRS 0-029(b), Site Description and Operational History

PRS 0-029(b) is the location of potential soil contamination due to leaks from three transformers located on a power pole that supplied electric power to a groundwater production well (Well #4) in Los Alamos Canyon. The well was located in the bottom of Los Alamos Canyon, adjacent to a stream channel and approximately 1 mi upstream from Totavi. The power pole is located about 20 ft from the PRS boundary closest to the stream channel. The transformers were removed in October 1987 and contained oil with PCB concentrations of 231 ppm, 206 ppm, and 362 ppm (LANL 1992, 0781; Bailey 1992, 02007.2). The well was decommissioned and the well house removed in 1989 (Aldrich 1991, 71266).

2.4.2.2 PRS 0-029(b), Previous Field Investigations

Sampling at PRS 0-029(b) was conducted in March 1992. A 50-ft by 100-ft grid was established, and fifteen soil samples were collected at regular intervals along the grid (Figure 2.4-2). Five additional samples were collected at the base of the power pole.

2.4.2.3 PRS 0-029(b), Results of Previous Investigations

Twenty samples were collected and submitted to the LANL Environmental Chemistry Group (C-ACS) for analysis of PCBs. The soil samples were also screened for gross-alpha, -beta, and -gamma radioactivity before submittal. The PCB analytical data were less than the detection level of 0.06 ppm. Therefore, no additional action was performed or recommended at that time.

The original data packages were not available for baseline or focused validation during preparation of this plan; thus, the analytical data for these PRSs were not useable. Therefore, a data gap exists for this PRS for PCBs. This PRS will be resampled for PCBs to obtain data that meet current LANL quality assurance/quality control requirements.

2.4.3 PRS 0-029(c), Leakage from PCB Transformers

2.4.3.1 PRS 0-029(c), Site Description and Operational History

PRS 0-029(c) is the location of potential soil contamination due to leakage from a transformer located on a power pole that supplied electrical power to a groundwater production well (Well #1) in Guaje Canyon. The well was located about 30 m (100 ft) from a stream channel, approximately 3.2 km (2 miles) upstream of its confluence with Los Alamos Canyon. The power pole was located about 6 m (20 ft) from the PRS boundary closest to the stream channel. The transformer was removed in April 1986, and the oil contained less than 50 ppm of PCBs (Aldrich 1991, 71265).

2.4.3.2 PRS 0-029(c), Previous Field Investigations

Sampling at PRS 0-029(c) was conducted in March 1992. A 23-m by 20-m (75-ft by 65-ft) grid was established, and sixteen soil samples were collected. Five additional samples were collected from the area around the power pole (Figure 2.4-3).

2.4.3.3 PRS 0-029(c), Results of Previous Investigations

The analytical results for PRS 0-029(c) indicated that the PCB levels in the soil samples were less than 0.09 ppm. No additional action was performed or recommended in the RFI Report (LANL 1993, 26972).

The original data packages were not available for baseline or focused validation during preparation of this plan; thus, the analytical data for these PRSs were not useable. Therefore, a data gap exists for this PRS for PCBs. This PRS will be resampled for PCBs to obtain data meeting current LANL QA/QC requirements.

2.5 Non-HSWA PRSs near the 6th Street Warehouses [PRSs 0-010(a and b) and 0-033(a)]

PRSs 0-010(a and b) and PRS 0-033(a) are grouped together because they are non-HSWA PRSs that will not have additional sampling. Both PRS 0-010(a) and PRS 0-010(b) were approved by DOE for NFA under Criterion 2. PRS 0-033(a) was remediated, and an NFA was requested under Criterion 4. These PRSs are included in this VCA Plan because they are located within the DP Road land transfer boundary.

2.5.1 PRS 0-010(a), Surface Disposal

2.5.1.1 PRS 0-010(a), Site Description and Operational History

PRS 0-010(a) was identified originally as a surface disposal site located on a small mesa southwest of Material Disposal Area (MDA) B, along DP Road near TA-21 (Figure 1.0-2). It was first identified as a PRS based on a preliminary review of aerial photographs taken in the mid-1940s, which seemed to indicate the presence of a drum storage area and several trenches.

2.5.1.2 PRS 0-010(a), Previous Field Investigations

Figure 2.0-1, an aerial photo from 1946, clearly shows rows of material, not trenches. After an in-depth analysis of the photograph was performed before the submittal of the OU 1071 Work Plan (LANL 1992, 0781), the PRS was proposed for NFA under Criterion 2 (the site was never used for the management of RCRA solid or hazardous waste). Additional information gained in 1996 from an interview with a former Zia Company employee (LANL 1996, 71415) who had worked in the area identified the stored materials as canisters of roofing asphalt and roofing tar pitch. Thus, it was determined that the PRS had been incorrectly identified on the SWMU Report (LANL 1990, 0145).

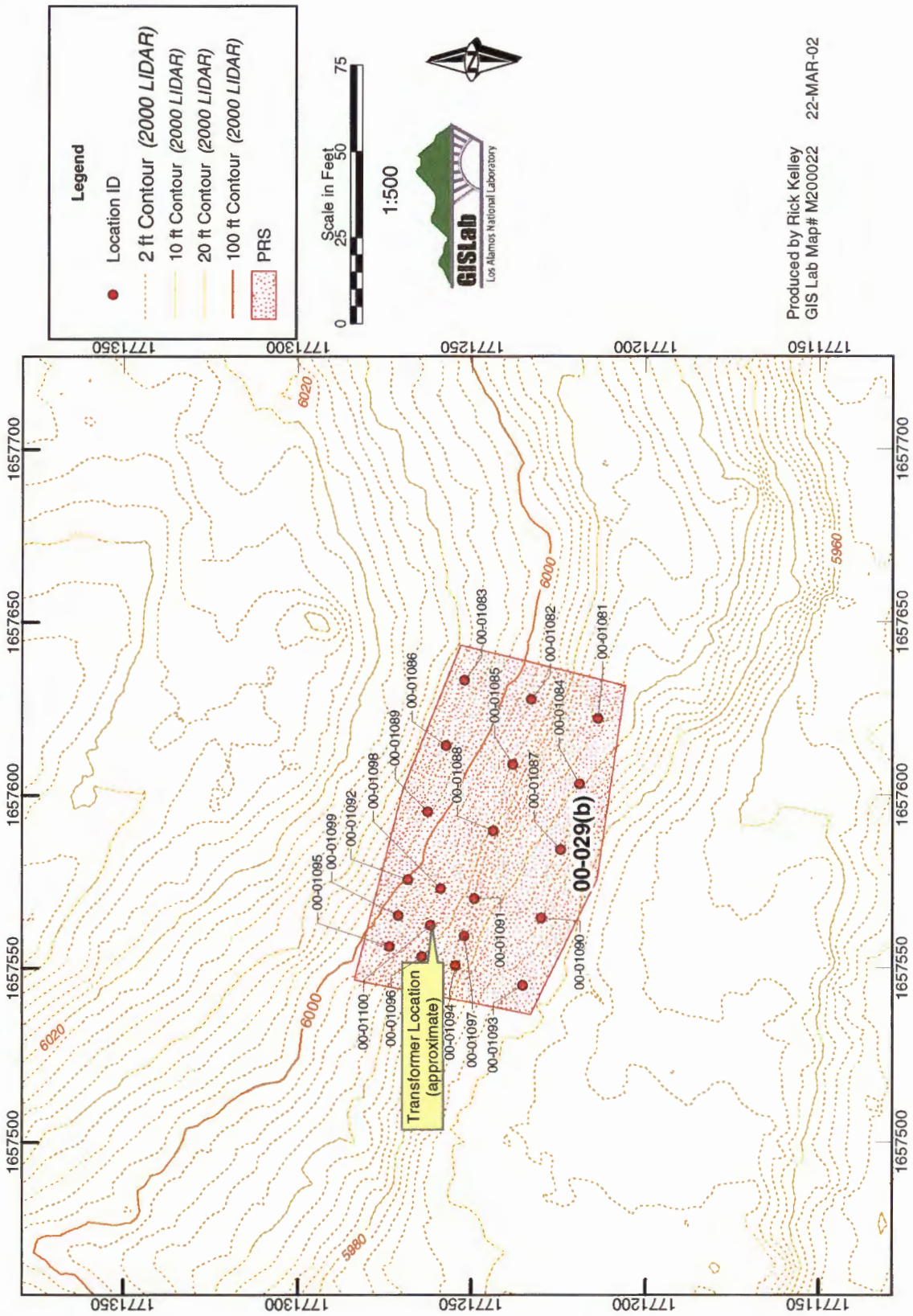


Figure 2.4-2. PRS 0-029(b), grid locations

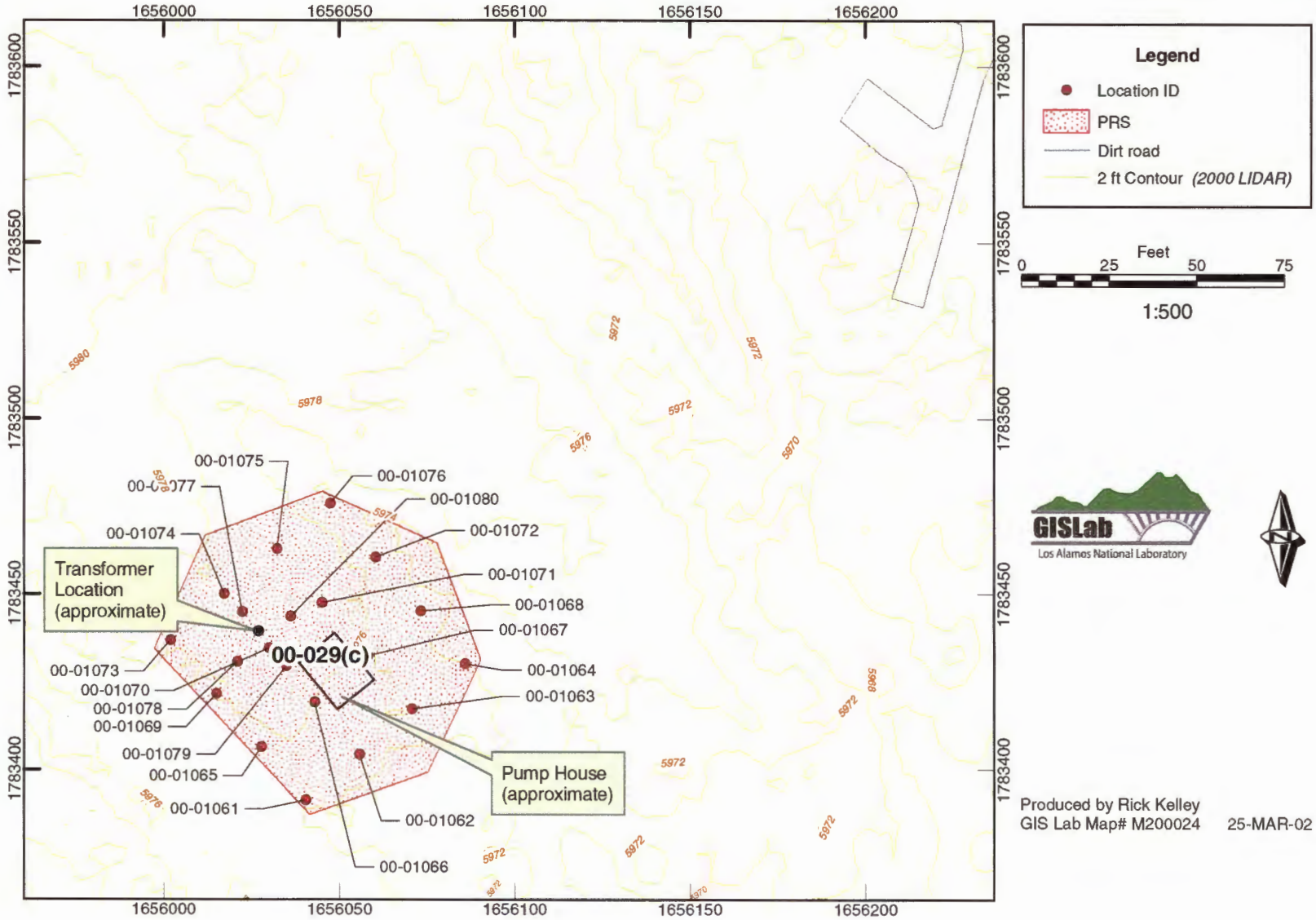


Figure 2.4-3. PRS 0-029(c), grid locations

2.5.1.3 PRS 0-010(a), Results of Previous Investigations

No field investigation has taken place at this site. An NFA was requested for this PRS under Criterion 2 (the site was never used for the management of RCRA solid or hazardous waste), based on the detailed re-evaluation of the aerial photograph that showed the open storage area in which supplies were stockpiled (Figure 2.0-1). EPA concurred with the NFA in October 1992 (LANL 1992, 71416). DOE approved the NFA on September 30, 1997, and the site is now considered complete, with no further action necessary.

2.5.2 PRS 0-010(b), Landfill

2.5.2.1 PRS 0-010(b), Site Description and Operational History

PRS 0-010(b) was a purported excavation to the east of 6th Street Warehouses 1 through 4. Aerial photographs taken in 1946 showed this area as a dark area (Figure 2.0-1). It was assumed that this area was an excavation adjacent to a warehouse building, and that it was used for some type of disposal activity. However, no definitive evidence of a waste disposal pit was available (LANL 1992, 0781).

Two aerial photos from November and December 1946 were closely examined (LANL 1996, 54616) and revealed no evidence of an excavation in the area as previously concluded during the RFI. Furthermore, no records or data were discovered suggesting that such an excavation existed or was used for waste disposal purposes. A visual survey of the area revealed no clues as to the existence of a former excavation. Based on this lack of evidence, it has been determined that no excavation ever existed at this PRS.

2.5.2.2 PRS 0-010(b), Previous Field Investigation

A field investigation included a walk-over survey of the site.

2.5.2.3 PRS 0-010(b), Results of Previous Investigations

Visual surveys and detailed administrative reviews of available records have been conducted for this site. As stated in the RFI report (LANL 1996, 54616), "The evidence for listing this supposed excavation as a PRS in the first place was insufficient, consisting of nothing more than an interpretation of a single aerial photograph that now cannot be found." Figure 2.0-1 does not show an excavation, and this photo was taken in the same year as the photo that was reported to have shown the excavation. Based on Criterion 2, an NFA request was made for this PRS. The request was approved by DOE on September 15, 1998. The site is now administratively complete.

2.5.3 PRS 0-033(a), UST

2.5.3.1 PRS 0-033(a), Site Description and Operational History

PRS 0-033(a) was a 5000-gal. steel fuel UST located adjacent to the north side of Warehouse 3. On November 13, 1995, the UST was excavated and removed pursuant to the NMED UST Bureau Regulations Section 401(a), which required all USTs installed before 1989 to be upgraded or removed before December 22, 1998.

2.5.3.2 PRS 0-033(a), Previous Field Investigations

After the excavation and removal of the UST, which was done with the concurrence of the NMED UST Bureau, a visual inspection revealed an approximately 2-in.-diameter hole in the lower west end of the tank (LANL 1996, 55203). The soil surrounding the UST appeared to have been contaminated with fuel oil. Following removal of the UST, the contaminated fill material was removed and the tuff below the tank was removed to a depth of approximately 10 ft. Four confirmatory samples of tuff from below the tank were collected and submitted to LANL's MCAL for TPH analysis.

Five boreholes were drilled and sampled, and a total of 43 samples were collected at 5-ft intervals and from zones of possible contamination. All samples were submitted for TPH analysis. TPH concentrations ranging from approximately 3000 to 10,000 ppm were detected in the samples. The depth of the boreholes ranged from 3 ft to 40 ft. One borehole was located within the footprint of the UST; the other four boreholes were located east, west, north, and south of the former UST.

2.5.3.3 PRS 0-033(a), Results of Previous Investigations

The analytical data adequately defined the vertical and horizontal extent of the TPH contamination (LANL 1996, 55203). At the lowest depth, the TPH concentrations did not exceed 5500 ppm, and the TPH values decreased with depth. The analytical data from sample location 00-04373, which is the borehole within the footprint of the former UST, show that the TPH plume does not extend deeper than 35 ft. Because the analytical data does not show contamination, the four surrounding boreholes are indicators that there has been little, if any, horizontal movement of the TPH. The Laboratory proposed three primary reasons for the apparent lack of significant migration of the fuel oil (LANL 1996, 55203). The first is that the moderately welded tuff lacks sufficient permeability for significant migration. The second is that the fractures in the tuff that were observed during drilling were mostly clay lined, which would inhibit migration. The third is that the wet zone at a depth of 30 to 35 ft at location 00-04373 has acted as a barrier to vertical migration.

The VCA report (LANL 1996, 55203) states that the NMED UST Bureau has determined that this site does not pose an immediate public or environmental threat. The following reasons were given:

- The horizontal and vertical extent of soil contamination has been adequately defined, and the soil contamination is greater than 900 ft above high-static groundwater.
- The contaminated soils were excavated and disposed of properly.

Therefore, the site was proposed for NFA under Criterion 4, and it was included on the requests for permit modification on September 30, 1996, and June 2000. Its status is still pending.

2.6 TA-21

TA-21 was used primarily for plutonium research and metal production and related activities from 1945 to 1978 (LANL 1994, 26073). These activities may have resulted in aerial dispersion of COPCs from the stacks at TA-21. Subsequent unrelated office and small-scale research activities have continued at this TA to the present time. Because the major industrial activities at TA-21 were related to plutonium production, the major waste disposal activities were also plutonium-related.

PRS 21-021 is described as the airborne emissions from the two incinerators, eleven stacks, and three filter houses within TA-21, which is located approximately 4000 ft east of the DP Road South land transfer area. Airborne emissions occurred from approximately 1945 until 1991. The available information about

the emissions that may be present in surface soil contaminations include incinerated tricresylphosphate contaminated with plutonium-239; plutonium waste; incinerated rags that were used for uranium-235 oxide; uranium-235; uranium-238; plutonium-239; tritium, deuterium-38; plutonium; and radionuclides (LANL 1991, 7528). The RFI work plan for TA-21 (LANL 1991, 7528) lists the radioactive airborne release summaries from 1951 to 1971 and from 1973 to 1989. It also references a document by J. W. Nyhan (Nyhan 1990, 12605) that provides a more detailed history of each stack, filter house, and incinerator, as well as their airborne emissions. A minimum of approximately 2 Ci of plutonium-239/240 per year exited all TA-21 stacks in the 1950s. High values occurred in 1973 when TA-21-12 emitted 1370 µCi of plutonium-239/240 itself. In 1989, the TA-21 stacks emitted 1.39 Ci of plutonium-239/240. Previous sampling has shown that the plutonium-239/240 concentration in the top 2 in. of soil is elevated above the worldwide fallout level (0.054 pCi/g) (LANL 1991, 7528).

MDA B (PRS 21-015) is the largest solid waste disposal site at TA-21, with an approximate area of 6.03 acres (LANL 1991, 7528). The buried waste pits occupy approximately 4,650 m^2 with an estimated volume of 21,240 m^3. MDA B consists of two areas: an unpaved eastern area and a paved, fenced western area.

MDA B was opened as a disposal area because the pits at MDA A were filling quickly. In 1945, four disposal pits were dug; these are believed to be 300 ft long, 15 ft wide, and 12 ft deep. These four disposal pits are believed to be parallel to the fence along DP Road and to at least one trench at the easternmost end of MDA B.

The waste that was disposed of in MDA B included solid wastes as well as radioactively contaminated paper, rags, rubber gloves, glassware, and metal. At least one truck contaminated with fission products from the Trinity Test is buried at MDA B. In addition, there are some indications that hazardous materials may be present at the east end. These chemicals included old bottles of organics, perchlorates, ethers, and solvents (LANL 1991, 7528).

Numerous sampling studies have taken place at MDA B, beginning in 1966, and continuing to the present. These sampling events have included surface and subsurface soil and vegetation.

In 1990, 1992, and 1994, surface sampling was conducted across the entirety of TA-21 for several reasons (LANL 1994, 26073). The first was to provide data about target analytes and establish a baseline for comparison to published regional background data. The second was to investigate airborne emission deposition. The final reason was to provide preliminary TA-wide information for a future baseline risk assessment.

Additional surface samples will be collected within the DP Road South land transfer area to ensure that no unacceptable risk to human health or the environment remains on the property before its transfer to Los Alamos County. The plan for these samples is described in Appendix E.

3.0 BASIS FOR VCA CLEANUP LEVELS

For most of the PRSs described in this VCA plan, no cleanup is anticipated. PRSs 0-029(a,b,c) are believed to have PCB levels less than the TSCA regulatory limit of 1 ppm, which the additional sampling will determine. PRSs 0-004, 0-033(b), and 0-030(b,l,m) have data gaps that will be addressed by additional sampling. If the analytical results from the sampling show contamination that is of potential concern to human or ecological health, then the site(s) will be remediated.

As discussed in section 2.1.1.3, contamination at PRS 0-027 is mainly confined to the subsurface soils. At depths greater than 10 ft bgs, the potential for direct receptor exposure to contaminants of concern in the

soil is minimal. Since some of the major risk drivers at the site are VOCs with low risk-based screening levels, such as benzene, removal of these compounds from the subsurface should substantially reduce the potential risk associated with the site.

In addition, the site is entirely paved or covered by the existing building, which would further limit direct contact exposure pathways with contaminated soil/fill or tuff. The primary mechanism by which contamination in the subsurface could result in exposure to people is via vapor migration through the soil profile and entrance into current or future onsite structures. Another potential exposure scenario involves excavation and redistribution of contaminated subsurface material to the surface. Under this scenario, subsurface material could be brought to the surface during future construction or utilities maintenance activities. However, it is assumed that the site will remain developed as it is today and that direct exposure pathways will be limited or nonexistent. However, the human health risk assessment was conducted using a residential scenario. It is also highly unlikely for COPCs to migrate to groundwater from the subsurface under PRS 0-027, given the depth to groundwater (approximately 600 ft) and the lack of saturated conditions to aid contaminant transport.

Implementation of an SVE approach will reduce the total concentration of volatile fraction of the contaminant mass, by removing vapor concentrations that have already volatilized into the soil pore spaces and reached equilibrium. Continuing removal of vapor phase mass from the pore spaces will induce continued volatilization from the mass adsorbed on the soil and/or present in any non-aqueous phase liquid state.

When simple analytical diffusion calculations are applied to the existing PRS 0-027 subsurface conditions and the range of benzene concentrations observed at the site, they suggest that diffusion-dominated vapor migration into a building footprint at the site will be limited (Thomas 1982, 71475; Johnson and Ettinger 1991, 71474). With removal of some contaminant mass from the system, it appears that the expected time-averaged exposure will meet risk-based cleanup levels based on the average site benzene concentration. More detailed discussion of these comparisons is provided in Appendix G; the intent of the SVE is to remove sorbed, dissolved, and gas phase hydrocarbons, and to demonstrate how mass removal from the system will reduce associated risk and contribute to the attainment of risk-based cleanup levels.

An active remediation is being proposed to further reduce and/or accelerate reduction of potential risk from the subsurface contamination at the site. Removal of benzene and other volatile chemical mass from the subsurface soils is expected to further reduce risk. The mass of contaminants that may be removed from the subsurface cannot be predicted until initial testing at the site has been conducted. Upon review of initial test data, SVE system operational benchmarks can be selected to help evaluate the ongoing effectiveness of the remedial system. A cleanup goal for the remediation will be to remove some fraction of volatile organic chemical mass from the subsurface; however, the quantity can not be predicted until more site-specific operational information has been collected.

TPHs are also present at elevated levels in the subsurface soils at PRS 0-027. The SVE approach will remove only a small fraction of the TPH. TPH does not, however, have an associated toxicity or carcinogenicity factor. Rather, it is the constituent chemicals (volatile or semivolatile COPCs) that typically occur in petroleum mixtures that result in associated risk. As discussed above, the SVE approach will address those volatile compounds that have been identified at the site. Remaining hydrocarbon concentrations that may persist in the subsurface soils are not typically considered hazardous to human health, nor will they have a pathway to reach receptors at the surface, due to their non-volatile nature. Based on the lack of hazard and exposure pathways, these remaining compounds are not expected to pose an unacceptable level of risk.

While soil vapor extraction will not volatilize and remove the non-volatile components of TPH, it will have a positive benefit in that vapor extraction will tend to encourage inflow of atmospheric air into the subsurface. This will result in increased oxygen levels in the subsurface soils, which may stimulate naturally occurring aerobic microbial action and enhance increased biodegradation of the remaining TPH. Because specific removal of petroleum hydrocarbon mass from the subsurface is not the goal or focus of the SVE remedial approach, cleanup levels or goals for hydrocarbon reduction cannot be set for the system. Ongoing collection of data during system operation, however, will allow an evaluation of increased oxygenation effects in the subsurface that may result in enhanced biodegradation of the remaining TPH mass.

4.0 PROPOSED CORRECTIVE ACTION/MEASURE

The piping associated with PRSs 0-030(b) and 0-030(m) will be removed to ensure that future contact with remnant waste will not occur. PRS 0-027 will be remediated in situ. An SVE system will be installed and operated to further reduce levels of VOCs (hydrocarbons) in subsurface soils and thereby reduce potential residual risk to human health and the environment.

4.1 Conceptual Model

PRS 0-027 was used as a fuel tank farm and then converted to a drum storage area. Contamination on the site can therefore be attributed to petroleum products leaking from storage tanks, drums, or lines.

Samples were collected from 20 of 21 investigatory boreholes that were installed at the site. Borehole locations were selected based on the locations of former storage cells and areas of contaminated soil (as identified by the site soil vapor study). Samples were collected from soil or fill overlying the Bandelier Tuff, at or near the soil/tuff interface, and from within the Bandelier Tuff. Borehole depths ranged from 20 ft bgs to 60 ft bgs.

Borehole soil samples were analyzed for VOCs, SVOCs, TPH, TAL metals, and pesticides/PCBs. A risk-based screening assessment of sample results yielded the following five COPCs, which are all TPH components:

- benzene
- ethylbenzene
- toluene
- trimethylbenzene
- xylene

Elevated levels of BTEX compounds (benzene, toluene, ethylbenzene, and xylene) were found in borehole locations 00-05802, 00-05803, 00-05804, 00-05805, 00-05816, and 00-05806. Unlike the distribution of TPH, the maximum concentrations in these boreholes were vertically constrained to depths between roughly 13 ft and 30 ft. Maximum BTEX concentrations and sample depths are presented in Table 4.1-1.

Soil contaminated by TPH and its components is mainly confined to an area near the center of the site, as shown in Figure 2.1-2. This area includes borehole locations 00-05802, 00-05803, 00-05804, 00-05805, 00-05806, 00-05809, 00-05812, and 00-05816 from the site investigation. Soil sample results indicate that each of these boreholes contains intervals with TPH concentrations in excess of 1000 mg/kg, with the exception of location 00-05812. Concentrations of TPH in excess of 10,000 mg/kg were found at borehole locations 00-05803, 00-05804, 00-05805, and 00-05816. Borehole locations 00-05820 and 00-05810,

which are located adjacent to the more highly contaminated area, contained maximum TPH concentrations of 550 and 460 mg/kg, respectively. The remaining borehole concentrations were either non-detects for TPH or contained less than 50 mg/kg TPH. The distribution of TPH contamination in the subsurface soils is of interest because it may represent areas where BTEX compounds exist as co-contaminants with the TPH in the soil or vapor phase, even if previous soil sampling did not explicitly identify detectable BTEX concentrations in the soils.

There is a large vertical distribution of TPH concentrations of 5000 mg/kg or greater. In borehole 00-05803, the maximum detected TPH concentration of 17,000 mg/kg occurred at a depth of 3.4 ft, whereas in adjacent borehole location 00-05802, the maximum detected concentration was 5000 mg/kg and occurred at a depth of 30 ft.

Table 4.1-1
Summary of Borehole Data from PRS 0-027

Location ID	Sample ID	Begin Depth	End Depth	TPH (mg/kg)	BTEX (mg/kg)*
00-05802	0100-96-1871	1.2	2	25	0.024
00-05802	0100-96-1872	2.6	3.7	700	15.25
00-05802	0100-96-1873	20	21	4700	459
00-05802	0100-96-1874	30	31	4900	588
00-05802	0100-96-1876	39.8	41	5000	422.4
00-05802	0100-96-1875	47	48.5	42	0.02
00-05803	0100-96-1894	3.4	4	17000	7.58
00-05803	0100-96-1895	5	5.8	6000	18.22
00-05803	0100-96-1896	14.2	15	9500	62.9
00-05803	0100-96-1897	29.2	30	270	0.0212
00-05803	0100-96-1898	38.2	40	5.3	0.021
00-05803	0100-96-1899	49.2	50	5.3	0.021
00-05804	0100-96-1901	8.4	8.9	16000	0.977
00-05804	0100-96-1902	12	12.5	7900	5.61
00-05804	0100-96-1903	19.2	20	6200	9.65
00-05804	0100-96-1904	29.4	30	5.6	0.023
00-05805	0100-96-1905	2.5	4	11000	0.19
00-05805	0100-96-1906	2.5	4	8900	0.197
00-05805	0100-96-1907	4	5	6200	0.0332
00-05805	0100-96-1908	19.2	20	5300	2.19
00-05805	0100-96-1909	34.5	35	5.4	0.0212
00-05806	0100-96-1889	9	10	1500	0.025
00-05806	0100-96-1886	26	27	7.1	0.02
00-05807	0100-96-1888	3	4	35	0.024
00-05807	0100-96-1887	10.5	11.5	36	0.021
00-05808	0100-96-1891	3.8	4.5	45	0.044
00-05809	0100-96-1883	13.3	14	5300	1.415
00-05810	0100-96-1910	2.5	3	4.8	0.019

Table 4.1-1 (continued)

Location ID	Sample ID	Begin Depth	End Depth	TPH(mg/kg)	BTEX (mg/kg)
00-05810	0100-96-1911	9.5	10	460	0.02
00-05811	0100-96-1914	1.5	2	4.6	0.024
00-05812	0100-96-1919	9.5	10	130	0.024
00-05813	0100-96-1925	17	17.5	5.9	0.022
00-05813	0100-96-1926	24.5	25	5.7	0.02
00-05813	0100-96-1927	27.5	28	5.9	0.021
00-05814	0100-96-1928	8.5	9.1	6.2	0.024
00-05815	0100-96-1931	9.3	9.8	6	0.026
00-05815	0100-96-1934	29.5	30	5.3	0.018
00-05816	0100-96-1935	3.4	3.9	14	0.024
00-05816	0100-96-1936	12	12.5	10000	940
00-05816	0100-96-1937	19.5	20	17000	1250
00-05816	0100-96-1938	29	29.5	34	0.017
00-05816	0100-96-1939	39.5	40	27	0.02
00-05817	0100-96-1940	11.4	11.9	27	0.02
00-05817	0100-96-1941	22	22.5	26	0.02
00-05817	0100-96-1942	29.5	30	27	0.02
00-05818	0100-96-1943	6.3	6.8	28	0.024
00-05818	0100-96-1944	11	12.5	28	0.024
00-05818	0100-96-1945	11	12.5	28	0.024
00-05818	0100-96-1946	19.5	20	28	0.024
00-05818	0100-96-1947	29.5	30	27	0.02
00-05819	0100-96-1948	4.5	5	30	0.024
00-05819	0100-96-2190	9.5	10	29	0.024
00-05819	0100-96-2191	19.2	20	27	0.02
00-05819	0100-96-2192	19.2	20	27	0.02
00-05819	0100-96-2193	29.5	30	26	0.02
00-05820	0100-96-1878	4.8	6	550	0.021

* BTEX concentrations are additive for benzene, toluene, ethylbenzene, and xylene.

The results of the previous soil sampling conducted at PRS 0-027 delineated the vertical and horizontal extent of BTEX and TPH contamination at the site. Maximum levels of both BTEX and TPH were identified at borehole location 00-05804, with the lateral extent of contamination extending approximately 100 ft in diameter from that central point. The vertical extent of contamination in the boreholes is generally to a depth of approximately 20 ft bgs, with limited occurrences of depths as great as 40 ft bgs.

The elevated BTEX and TPH concentrations detected at the site are probably related to petroleum products leaking from storage tanks, drums, and pipelines during past operations at the site. Isolated spills also may have occurred during site operation. Because the site was used as a fuel tank farm or drum storage area for approximately 15 years, it is likely that the contamination resulted from various leaks, spills, or poor housekeeping that occurred throughout the operational period. The facilities are no

longer in use, and all associated structures have been removed, so any continuing source of soil contamination has been eliminated.

4.2 Vapor Monitoring and Extraction Point Installation and Supplemental Sampling

An SVE approach is being proposed for remediation of PRS 0-027. Figure 4.2-1 depicts the basic components of an SVE system. The primary remediation mechanism will be a phase of active vapor extraction from the subsurface through a series of newly installed vapor extraction wells. Following a period of continuous active SVE at the site, the system operation may be converted to a pulsed SVE, passive or active bioventing, and/or barometric pumping operational phase, depending on the observed vapor extraction effectiveness and volumes of contaminant mass being removed, as determined by monitoring contaminant concentrations in the system off-gas stream. Based on field conditions encountered at the time of SVE system construction, some supplemental discrete small-scale soil excavation may be conducted to address specific target areas of very elevated, near-surface soil contamination. Any limited excavation would be done in conjunction with the trenching and construction associated with the SVE system installation, and would be dependent on the final SVE system configuration.

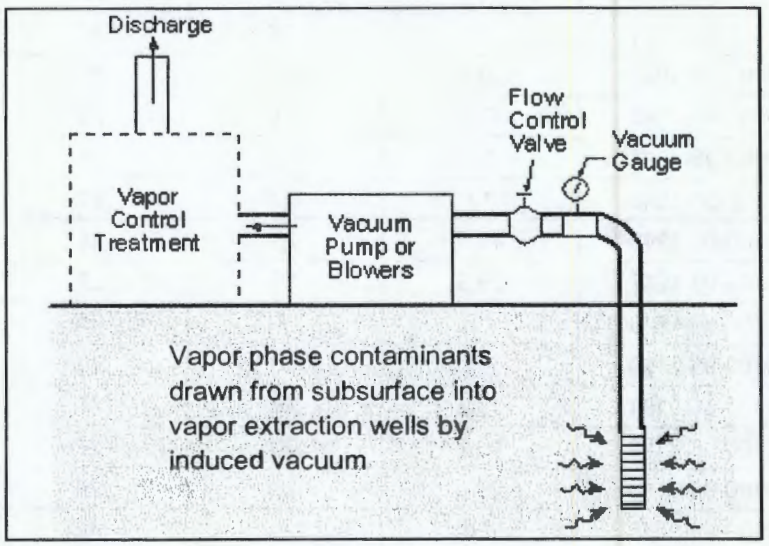


Figure 4.2-1. Basic SVE system configuration

The active SVE remedial approach will primarily address the volatile organic compounds of concern, such as BTEX. The SVE system may impact and remove some amount of petroleum hydrocarbons and semivolatile compounds, since some fraction of even these less volatile compounds can be induced to volatilize over time. More significantly, however, SVE will contribute to inducing air flow in the subsurface soils which may enhance any ongoing natural bioremediation as well as aid in further diffusion of the heavier compounds, both of which will contribute to further reducing the concentrations of these compounds.

4.2.1 Installation of SVE Wells

Three SVE wells will be installed at the site. The wells will be constructed of 4-in.-diameter PVC piping with 20-ft lengths of PVC screen. Wells will be installed to approximately 30 ft bgs. Final depths and screen placement will be based on observed subsurface conditions during drilling and PID field screening measurements. Wells will be installed with an appropriately sized gravel pack placed around the screen interval and brought roughly 2 ft above the top of the screen. A 3- to 5-ft seal of hydrated bentonite pellets or chips will be placed above the gravel pack, and the remaining annular space will be sealed with Portland cement.

The SVE wells will be located within the main BTEX plume area, with one well placed within the center of the highest detected BTEX concentrations on the western edge of the plume. The remaining two SVE wells will be triangulated to the north and southeast to provide overlapping radial coverage, based on an estimated radius of influence (ROI) of roughly 50 ft induced by each extraction well (Figure 4.2-2). The southeastern well location will also provide an extraction point adjacent to the Knights of Columbus building to help limit future migration of vapors into the structure. Due to the nature of the tuff at the PRS 0-027 site, it is difficult to predict the ROI that will be induced by SVE wells before site-specific testing has been performed. Because of the non-homogeneous distribution of fractures in the tuff, it is likely that different radii of influence will be induced by individual wells. For initial design considerations, a 50-ft radius of influence is being used, but more specific site information will be available following the pilot testing phase. The SVE system configuration and/or components may be modified at that time.

4.2.2 Installation of Vapor Monitoring Wells

In addition to vapor extraction wells, vapor monitoring wells will be installed at the site to help optimize the system operation and evaluate system effectiveness. Four monitoring wells will be installed on the exterior portions of the main BTEX plume, as shown in Figure 4.2-2. These wells will be constructed of 4-in.-diameter PVC and will have 20-ft PVC screens. Screen placement and well-completion depth will be the same as that for the vapor extraction wells. The top of the monitoring wells will be fitted with a barbed sampling port to allow collection of soil vapor samples from each well. The monitoring wells will be constructed of 4-in. PVC so that they can be converted to vapor extraction points if needed.

A fifth monitoring well will be installed in the interior portion of the BTEX plume, equidistant from the three vapor extraction wells. The interior monitoring location will be constructed as a nested set of three 1-in.-diameter PVC piezometer, each equipped with 2-ft-long screens. The three separate screen intervals at different depths will enable collection of data for evaluating vertical distribution of subsurface vacuum effects. The screen intervals for the nested piezometers are expected to be approximately 7–9 ft bgs within the overlying fill and approximately 15–17 ft bgs and 25–27 ft bgs within the tuff. The final depth will be based on observed subsurface conditions during drilling.

In addition to the nested screens, in-situ sensors specifically designed to monitor TPH and oxygen levels will be installed at the monitoring locations, based on availability of an appropriate supplier at the time. A BTEX sensor will be installed if an adequate product is available at the time of the installations. These sensors will be placed in the 1-ft interval directly beneath each of the nested screen intervals (i.e., roughly 9–10 ft, 17–18 ft, and 27–28 ft bgs). These sensors will be calibrated using analytical soil sample results collected from the corresponding interval and will allow continued collection of in-situ data, which will allow evaluation of system effectiveness.

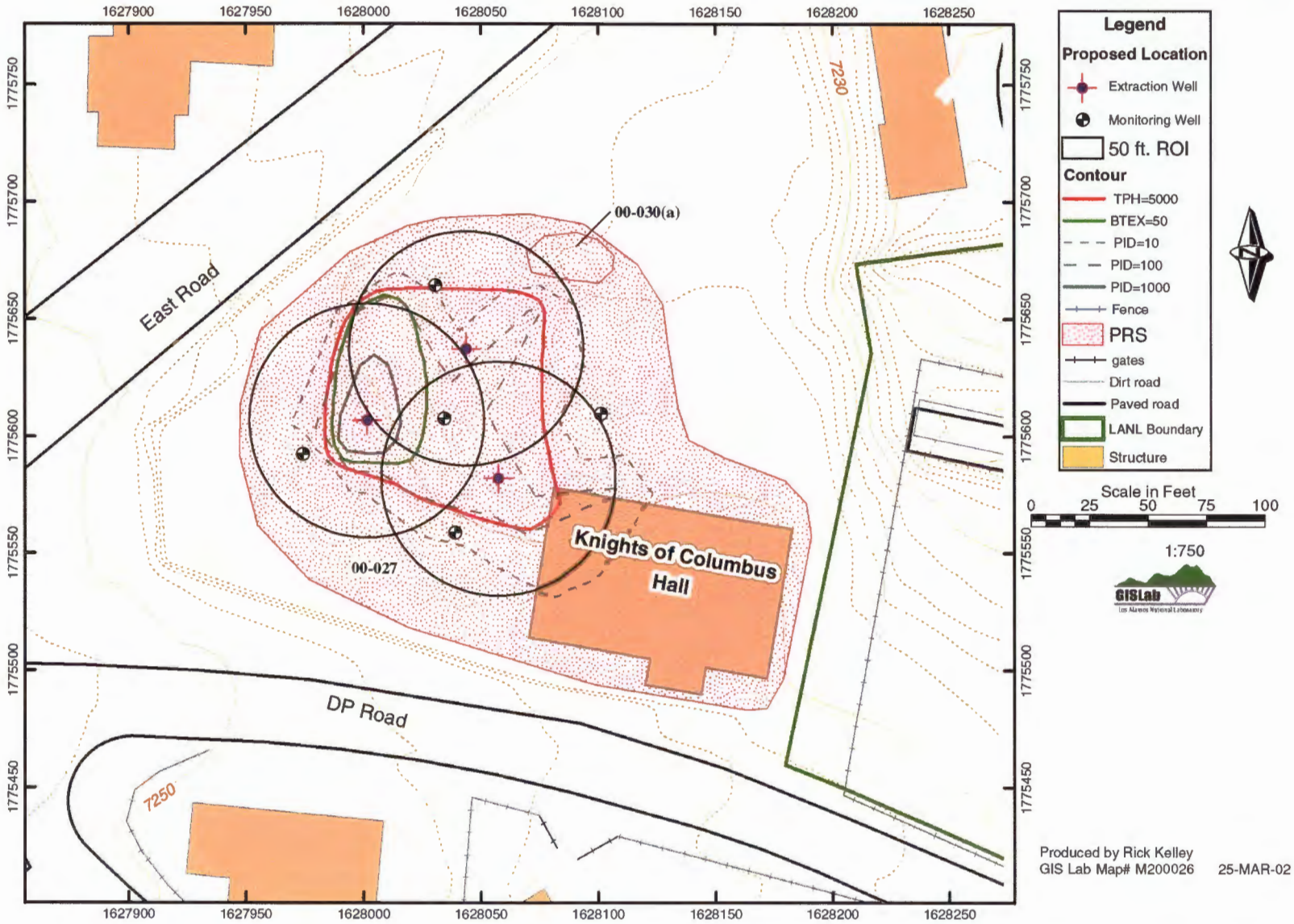


Figure 4.2-2. PRS 0-027, proposed well locations

Because of the nested screen intervals and possible in-situ sensor placements, the construction of the fifth interior monitoring well will be slightly different from the other well constructions. The in-situ sensor cables will be affixed to the exterior of each 1-in. PVC riser and screen, with the sensor itself placed to extend approximately 0.5 ft below the base of the screen. Installation of the deepest piezometer screen and sensor will occur first. An appropriately sized gravel pack will be installed from roughly 1 ft below the screen (encasing the underlying sensor) to approximately 2 ft above the top of the screen. The intervening 5 ft of annular space between the top of the bottom screen gravel pack and the placement location for the middle screen and sensor will be completed with hydrated bentonite pellets or chips. The installation procedure for the nested piezometer screens and sensors will be repeated for the middle and upper levels. Above the top piezometer screen interval, a 3- to 5-ft seal of hydrated bentonite pellets or chips will be placed above the gravel pack, and the remaining annular space will be sealed with Portland cement. The top of each piezometer will be fitted with a barbed sampling port.

4.2.3 System Pre-operation Data Collection

During advancement of all extraction and monitoring well boreholes, soil samples will be collected at 5-ft intervals. All samples will be field screened, and samples from 10 ft, 20 ft, and 30 ft bgs will be sent for laboratory analysis for TPH and BTEX, as will the sample with the highest field PID reading and the deepest sample depth (if different).

Additional soil samples will be collected from the interior nested monitoring well location from the 1-ft intervals in which the in-situ sensors are placed, approximately 7–8 ft, 15–16 ft, and 25–26 ft bgs. The samples will be analyzed for TPH and BTEX by EPA methods 8015B and 8260B, respectively. Analytical data from these samples will allow calibration of the in-situ sensors. All appropriate ER Project standard operating procedures (SOPs) will be followed for fieldwork and sample collection; these include SOP-1.01, -1.02, -1.03, -1.04, -1.05, -1.06, -1.08, -1.10, -1.12, -4.04, -5.01, -5.02, -5.03, -6.03, -6.09, -6.10, and -6.24.

4.3 Remedial Approach

4.3.1 SVE Pilot Operation

In order to select appropriate SVE hardware for purchase or extended rental, some site-specific vapor extraction data will need to be collected before specifying that equipment. Initially, a mobile SVE unit will be used to conduct a 3- to 5-day pilot operation. This will allow the collection of site-specific data to enable accurate sizing of the blower, estimates of off-gas treatment requirements, and prediction of the ROI that will result from extraction at various flow rates.

Data collection during the pilot operation will include

- collection of vacuum measurements from monitoring wells,
- collection of vapor samples from the system off-gas, and
- calibration and ongoing collection of data from in-situ loggers.

The vacuum measurements from the monitoring wells will be used to develop a relationship between flow and vacuum pressure at the wellhead. The ambient intake and flow control valve will be adjusted to create several flow conditions to assist in selecting an optimal operating vacuum condition and in sizing the blower for the final design.

Collected vapor samples will allow evaluation of expected contaminant concentrations in the system effluent and provide a basis for selecting off-gas treatment needs for the final system design.

4.3.2 Full-Scale SVE System Operation

4.3.2.1 Design of Full-Scale SVE System

Upon completion of the pilot operation phase, and based on the data collected during that phase as well as data from the monitoring well installations and previous site investigations, a final full-scale SVE system will be specified. A determination will also be made about whether the installed configuration of SVE wells and/or monitoring points are sufficient for the project, or if they need to be modified or supplemented.

Without considerable detailed geotechnical and vapor extraction pilot testing data, an observational approach must be taken to specifying the SVE system components and operation. Because of the relatively small size of the site, it is reasonable to make system component selections on the basis of a limited pilot testing phase. However, with this approach there is a possibility that the system may need to be modified in the future to more fully optimize its operation. Future modifications could include installation of additional extraction locations, further refinement of the intervals from which extraction occurs, an increase in blower size, or additional off-gas treatment needs.

The final system components that will be identified as part of the design process will include a blower, system piping, and off-gas treatment.

4.3.2.2 Full-Scale SVE System Description

The main component of the final vapor extraction system will be a system blower that will be connected to the SVE wells to extract vapor from the subsurface. The blower system will be connected to the extraction wells via underground piping that will be installed at the site. The SVE blower system inlet will have ports for measuring pressure and flow and for sampling. The inlet will also have a flow control valve, as well as an ambient air dilution valve to enable flow regulation.

The SVE system will also include a moisture separator, and the effluent gas will be exhausted through an off-gas treatment system (most probably granular activated carbon canisters). A redundant off-gas treatment system will be used in an attempt to achieve zero air emissions from the system. An electrical supply will be required, most likely provided by connecting a dedicated line to an onsite utility pole. System components will be contained in a small prefabricated building that will be placed on-site.

4.3.2.3 Full-Scale SVE System Construction, Installation, and Start-Up

The initial steps in installation of the full-scale system will be placement of the SVE blower assembly and connection of that system to the extraction wells through a series of subsurface pipes.

A variety of electrical and plumbing tasks will be required to make the system operational. Following initial system start-up, a 1- to 2-week testing phase will ensue to troubleshoot the system, optimize system operation, establish unattended operation, collect baseline off-gas data, make any modifications to off-gas treatment, and collect a series of baseline vacuum measurements and in-situ soil vapor sensor data from the monitoring wells.

4.3.2.4 Operation of SVE System

Initially, the SVE system will be expected to operate on a continuous basis. Analysis of off-gas samples during this preliminary operation phase will be at a higher frequency (e.g., weekly) to establish system operating effectiveness; analyses will be decreased to a lower frequency (quarterly) once the system operation is well established. Off-gas samples will be analyzed for TPH and target VOCs identified in the preliminary pilot operation.

Collection of data from the in-situ sensors will occur continuously. These data will be reviewed on a periodic basis to evaluate contaminant trends and identify system operating effects. Confirmation of in-situ sensor data will be provided by the analysis of soil vapor samples from monitoring wells at a quarterly or biannual frequency. An appropriate frequency will be selected based on changes observed in the in-situ data. Vapor samples will be analyzed for TPH and target VOCs as identified in the preliminary pilot operation.

Following a period of continuous active operation, system operation may be terminated or converted to an active pulsed operation, active or passive bioventing, or barometric pumping operation. Selection of the type of extended SVE operational phase will be based on the total and continuing contaminant mass being removed by the system, the reduction in risk, etc. An appropriate sampling schedule for system off-gas sampling and soil vapor sampling from the monitoring wells will be developed for the extended system operation.

4.4 Cleanup Activities

Decontamination of the drill rig after installation of the wells will be accomplished by pressure washing each auger flight that was used. A LANL radiological technician will screen the drill rig for radionuclides before its removal from the site. The decontamination of the sampling equipment will follow ER-SOP-1.08, "Field Decontamination of Drilling and Sampling Equipment."

4.5 Site Restoration

Upon termination of SVE system operations, the equipment will be demobilized from the site. If there is no need for continued monitoring or passive operation, the extraction wells, piping, and monitoring wells can be appropriately abandoned following ER-SOP-5.03, "Monitor Well and RFI Borehole Abandonment." The concrete on the parking lot will be replaced.

5.0 CONFIRMATORY SAMPLING

PRS 0-027 will receive ongoing monitoring of the SVE system efficiency for up to two years. The final plan for confirmatory samples will be refined over time, but the current expectation is that confirmatory samples will be collected from seven new boreholes, drilled near the previous SVE and monitoring well boreholes. Confirmatory samples will be collected from the same depths as the previous samples to document whether the SVE system effectively reduced the COPCs. A minimum of 21 soil/tuff samples will be collected. These samples will be taken from each of the three SVE locations and the four exterior monitoring well locations, for a total of seven locations and three depths: 10 ft, 20 ft, and 30 ft. Confirmatory samples will be analyzed for TPH, VOCs, and SVOCs. These samples will be collected at the completion of the two-year investigation.

At the PRSs where piping is removed, PRSs 0-030(b,m), confirmatory samples will be collected at two depths from locations that correspond to pipe joints. For the remaining PRSs, no cleanup activities are

currently planned, and samples will be collected to fill data gaps only. If any contamination is located, it will be remediated and confirmatory samples will be collected at locations appropriate to the specific site and remediation performed.

6.0 WASTE MANAGEMENT

6.1 Estimated Types and Volumes of Waste

The Waste Characterization Strategy Form (WCSF) will describe the waste characterization sampling, waste management, and waste disposal plans to be implemented during the VCA. Recycling opportunities will be explored and taken advantage of if the waste falls into the appropriate category.

6.1.1 Soil Cuttings from Installation of Wells and Pipe Trenches

Soil cuttings will be generated during installation of the SVE and monitoring wells, and during the trenching needed to install the subsurface system piping. An estimated 12 yd^3 of soil will be generated and disposed of based on waste characterization sampling.

6.1.2 Spent Off-Gas Treatment (Granular Activated Carbon)

Spent media used to treat the off-gas generated during the SVE system operation will require disposal based on waste characterization sampling. The quantity of treatment media that will be consumed and require disposal cannot be predicted until an estimate is made of the contaminant loading in the effluent (this will be done during the pilot phase operation).

6.1.3 Construction Waste

Some construction and/or domestic solid waste (i.e., leftover PVC piping, plastic and cardboard containers, etc.) will be generated during installation and setup of the remedial system at PRS 0-027. An exact quantity of construction waste cannot be predicted, but it is not expected to be a large volume.

6.2 Method of Management and Disposal

During sampling and remediation activities, any waste generated will be stored in a protective manner within the boundaries of the PRSs. This procedure will follow "Management of ER Project Wastes" (LANL-ER-SOP-1.06) and "Waste Characterization" (LANL-ER-SOP-1.10). Waste will be managed in defined staging areas, and all waste will be characterized and managed as described in the WCSF. The media will be characterized before generation so that waste can be transported off-site and disposed of at the proper facilities as soon as possible after VCA activities.

6.2.1 Soil Cuttings

Soil cuttings and excavated soil material will be staged onsite during characterization. If the geotechnical properties of the material excavated from the trenches for installation of the subsurface system piping are appropriate and the material is not contaminated, some portion of the material may be used to backfill the trench areas following installation of the system piping.

Samples will be collected from the volume of waste soil and analyzed for SVOCs, VOCs, and TPH. Based on analytical results, the soil may be removed from the site and disposed of at an appropriate disposal facility.

6.2.2 Spent Off-Gas Treatment Material

The expected method of off-gas treatment will be the use of granular activated carbon (GAC). The system effluent stream will be passed through containers of GAC until the media becomes saturated, at which point the spent containers will be replaced with new containers. The spent material will be removed from the site and disposed of at an appropriate facility or sent to an appropriate recycling facility.

6.2.3 Construction Waste

This material will be staged in waste receptacles at the site and regularly removed to an appropriate disposal facility for non-hazardous solid waste.

7.0 PROPOSED SCHEDULE AND UNCERTAINTIES

Work on this VCA is expected to begin in fiscal year 2002 and proceed through completion in accordance with the ER Project baseline schedule in effect at the time of approval of this VCA plan.

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Appendix A

Acronyms and Abbreviations

bgs	below ground surface
BTEX	benzene, toluene, ethylbenzene, and xylene
BV	background value
CLP	contract laboratory program
COC	chain of custody
COPC	chemical of potential concern
COPEC	chemical of potential ecological concern
CSM	conceptual site model
DDE	dichlorodiphenyldichloroethylene
DDT	p,p'-dichlorodiphenyltrichloroethane
DOE	Department of Energy
EDL	estimated detection limit
EM	electromagnetic
EPA	Environmental Protection Agency
EQL	estimated quantitation limit
ER	environmental restoration
FIMAD	Facility for Information Management, Analysis, and Display
FPL	field project leader
FY	fiscal year
GAC	granular activated carbon
GPS	global positioning system
HSWA	Hazardous and Solid Waste Amendments
IWP	Installation Work Plan
LANL	Los Alamos National Laboratory
LCS	laboratory control sample
MCAL	mobile chemical analytical laboratory
MDA	Material Disposal Area
MEKP	methyl ethyl ketone peroxide
MRAL	mobile radiological analytical laboratory
MTL	Material Testing Laboratory
NFA	no further action
NMED	New Mexico Environment Department
OU	operable unit
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PID	photo-ionization detector
ppbv	parts per billion by volume
PRS	potential release site
PVC	polyvinyl chloride
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
RCRA	Resource Conservation and Recovery Act

RFI	RCRA facility investigation
ROI	radius of influence
SAL	screening action level
SMO	Sample Management Office
SOP	standard operating procedure
SOW	statement of work
SSHASP	site specific health and safety plan
SVE	soil vapor extraction
SVOC	semivolatile organic compound
SWMU	solid waste management unit
TA	technical area
TAL	target analyte list
TCLP	toxicity characteristic leaching procedure
TPH	total petroleum hydrocarbons
TSCA	Toxic Substances Control Act
UST	underground storage tank
VCA	voluntary corrective action
VCP	vitrified clay pipe
VOC	volatile organic compound
WCSF	Waste Characterization Strategy Form
XRF	x-ray fluorescence

Appendix B

VCA Checklist

VOLUNTARY CORRECTIVE ACTION

Checklist and Fieldwork Authorization Form

PRS 0-027

√ COPC(s) defined.

√ Nature and extent defined or field-screening method available to guide where not defined.

√ Remedy is obvious.

____ Time for removal is less than 6 months.

√ Remedy is final.

√ Land use assumptions are straightforward.

√ Treatment, Storage, and Disposal (TSD) Facilities are available for waste type and volume.

√ Cleanup cost is reasonable for the planned action and meets accelerated decision logic criterion for decision to proceed with VCA.

Explain criteria not checked above: *The SVE system is expected to take 2 years to complete. The site can be closed now with a risk-based closure, although the SVE is a proactive method of removing contamination from the site more quickly than nature will.*

Through reviewing the above criteria associated with this site, I believe that a VCA is the appropriate accelerated cleanup approach.

Signatures of the representatives for UC-Laboratory, DOE-LAAO, and NMED-HRMB:

FPL: _____ Date 6/14/02

FPC: _____ Date 6/20/02

The undersigned have reviewed the plan and believe that it fully satisfies the appropriate accelerated cleanup approach.

FPL: _____ Date 6/14/02

FPC: _____ Date 6/20/02

Through reviewing the VCA plan for *PRS 0-027* and believing that the above criteria have been met, I authorize the fieldwork to proceed.

DOE ER Program Manager: _____ Date 6/20/02

VOLUNTARY CORRECTIVE ACTION

Checklist and Fieldwork Authorization Form

Consolidated Unit PRS 0-030(b)-00

√_____ COPC(s) defined.

√_____ Nature and extent defined or field-screening method available to guide where not defined.

√_____ Remedy is obvious.

√_____ Time for removal is less than 6 months.

√_____ Remedy is final.

√_____ Land use assumptions are straightforward.

√_____ Treatment, Storage, and Disposal (TSD) Facilities are available for waste type and volume.

√_____ Cleanup cost is reasonable for the planned action and meets accelerated decision logic criterion for decision to proceed with VCA.

Explain criteria not checked above: *Not applicable*

Through reviewing the above criteria associated with this site, I believe that a VCA is the appropriate accelerated cleanup approach.

Signatures of the representatives for UC-Laboratory, DOE-LAAO, and NMED-HRMB:

FPL: _____ Date 6/14/02

FPC: _____ Date 6/20/02

The undersigned have reviewed the plan and believe that it fully satisfies the appropriate accelerated cleanup approach.

FPL: _____ Date 6/14/02

FPC: _____ Date 6/20/02

Through reviewing the VCA plan for *Consolidated Unit PRS 0-030(b)-00* and believing that the above criteria have been met, I authorize the fieldwork to proceed.

DOE ER Program Manager: _____ Date 6/20/02

VOLUNTARY CORRECTIVE ACTION

Checklist and Fieldwork Authorization Form

PRSs 0-029(a,b,c)

√ _____ COPC(s) defined.

√ _____ Nature and extent defined or field-screening method available to guide where not defined.

√ _____ Remedy is obvious.

√ _____ Time for removal is less than 6 months.

√ _____ Remedy is final.

√ _____ Land use assumptions are straightforward.

√ _____ Treatment, Storage, and Disposal (TSD) Facilities are available for waste type and volume.

√ _____ Cleanup cost is reasonable for the planned action and meets accelerated decision logic criterion for decision to proceed with VCA.

Explain criteria not checked above: *Not applicable*

Through reviewing the above criteria associated with this site, I believe that a VCA is the appropriate accelerated cleanup approach.

Signatures of the representatives for UC-Laboratory, DOE-LAAO, and NMED-HRMB:

FPL: _____ Date 6/14/02

FPC: _____ Date 6/20/02

The undersigned have reviewed the plan and believe that it fully satisfies the appropriate accelerated cleanup approach.

FPL: _____ Date 6/14/02

FPC: _____ Date 6/20/02

Through reviewing the VCA plan for *PRSs 0-029(a,b,c)* and believing that the above criteria have been met, I authorize the fieldwork to proceed.

DOE ER Program Manager: _____ Date 6/20/02

Appendix C

SOP-2.01

Los Alamos National Laboratory

Environment, Safety & Health Division
ESH-18 Water Quality & Hydrology Group

Surface Water Assessment
Erosion Matrix for PRS 00-027

CRITERIA EVALUATED	Value	Erosion/Sediment Transport Potential Low 0.1	Medium 0.5	High 1.0	Calculated Score
Site Setting (43)					
On mesa top	1	Defined based on topographic setting			1.0
Within bench of canyon	4				
Within the canyon floodplain but not watercourse	13				
Within bottom of canyon channel in watercourse	17				
Estimated % ground and canopy cover	13	>75%	25-75%	<25%	1.3
Slope	13	0-10%	10-30%	>30%	1.3
Surface Water Factors-Run-off (46)					
Visible evidence of runoff discharging? (Yes/No)	5	If no, score of 0 for runoff section.			5.0
		If yes, score 5 and proceed with section.			
Where does runoff terminate?	19	Other	Bench Setting	Drainage/Wetland	1.9
Has runoff caused visible erosion? (Yes/No)	22	Sheet	Rill	Gully	0.0
		If no, score as 0. If yes, calculate as appropriate.			
Surface Water Factors-Run-on (11)					
Structures adversely affecting run-on (Yes/No)	7*	If yes, score as 7. If no, score as 0.			7.0
Current operations adversely impacting (Yes/No)	4	If yes, score as 4. If no, score as 0.			0.0
Natural drainages onto site (Yes/No)	7*	If yes, score as 7. If no, score as 0.			0.0
**Select either structures or natural drainages.*					
MAX. POSSIBLE EROSION MATRIX SCORE:	**100**			**Total Score**	17.5

REVISED PART B

Report Printed 4/10/02 11:35:07 AM.

Los Alamos National Laboratory
SURFACE WATER
SITE ASSESSMENT

Revised Part B. Please discard previous.

SITE INFORMATION

1a) PRS Number 00-027 **1b) Structure Number** **1c) FMU Number** ER

2. Date/Time (M/D/Y H:M am/pm) 11/30/01

SITE SETTING (check all that apply)

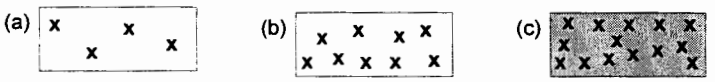
3. (•) **On mesa top (a).** ( ) **In the canyon floor, but not in an established channel (c).**

( ) **Within a bench of a canyon (b).** ( ) **Within established channel in the canyon floor (d).**

Explanation: Old fuel tank storage area at Knights of Columbus building.

4. Estimated ground and/or canopy cover at site: (deciduous leaves, pine needles, rocks, vegetation, trees, structures, asphalt, etc.)

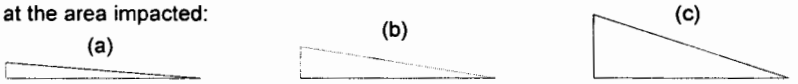
(illustration)



Estimated % of ground/canopy cover: ( ) 0% to 25% ( ) 25% to 75% (•) 75% to 100%

Explanation: Area cemented over for parking lot.

5. Steepest slope at the area impacted:



(•) Less than 10% ( ) 10% to 30% ( ) 30% and greater

Explanation: Gentle slope to the north east.

RUNOFF FACTORS

Y / N

☑ ☐ **6. Is there visible evidence of runoff discharging from site? If yes, answer a) - c) below:**

☑ ☐ 6a) Is runoff channelized? If yes, describe: (•) Man-made channel. ( ) Natural channel.

Explanation: Depression for run-off from parking lot.

RUNOFF FACTORS, CONT'D

6b) Where does evidence of runoff terminate?

- ○ **Drainage or wetland (name)** DP Canyon
- ○ **Within bench of canyon setting (name)**
- ● **Other (i.e., retention pond, meadow, mesa top)**

Explanation: 0-030(a) gets run-off from 0-027 parking lot drainage.

Y / N

☐ ☑ 6c) Has runoff caused visible erosion at the site? If yes, explain below: ○ Sheet ○ Rill ○ Gully

Explanation:

RUN-ON FACTORS

Please rate the potential for storm water to run on to this site: (Check EITHER #7 or #9)

☑ ☐ **7.** Are structures (i.e., buildings, roof drains, parking lots, storm drains) creating run-on to the site?

Explanation: Sloped roof of building creating run-on

☐ ☑ **8.** Are current operations (i.e., fire hydrants, NPDES outfalls) adversely impacting run-on to the site?

Explanation: Current operations are not adversely impacting run-on to the site.

☐ ☑ **9.** Are natural drainage patterns directing stormwater onto site?

Explanation:

ASSESSMENT FINDING:

☐ ☑ **10. Based on the above criteria and the assessment of this site, does soil erosion potential exist? (REFER TO EROSION POTENTIAL MATRIX.)**

Johnson, Randy

11. Signature of Water Quality/Hydrology Representative

_____ Initials of independent reviewer.

Check here when information is entered in database: ☑

This page is for ESH-18 notes, recommendations, and photos.

	Y / N	
12. a)	○ ●	Is there visible trash/debris on the site?
b)	○ ●	Is there visible trash/debris in a watercourse?

Description of existing BMPs:

○ ○ Are BMPs being properly maintained? If no, describe in "Other Internal Notes."

○ ○ Are BMPs effectively keeping sediment in place and reducing erosion potential?

OTHER INTERNAL NOTES:

The site was originally assessed on 8/5/97 (score 29.2). The site was revisited on 11/30/01, no changes to the site observations were made except that the straw bales observed on 08/25/01 are no longer present. The percent ground coverage was changed to 75-100% to reflect the concrete coverage for the parking lot.

Los Alamos National Laboratory

Environment, Safety & Health Division
ESH-18 Water Quality & Hydrology Group

Surface Water Assessment Erosion Matrix for PRS 00-030(a)

CRITERIA EVALUATED	Value	Erosion/Sediment Transport Potential Low 0.1	Medium 0.5	High 1.0	Calculated Score
Site Setting (43)					
On mesa top	1	Defined based on topographic setting			1.0
Within bench of canyon	4				
Within the canyon floodplain but not watercourse	13				
Within bottom of canyon channel in watercourse	17				
Estimated % ground and canopy cover	13	>75%	25-75%	<25%	6.5
Slope	13	0-10%	10-30%	>30%	1.3
Surface Water Factors-Run-off (46)					
Visible evidence of runoff discharging? (Yes/No)	5	If no, score of 0 for runoff section. If yes, score 5 and proceed with section.			0.0
Where does runoff terminate?	19	Other	Bench Setting	Drainage/Wetland	0.0
Has runoff caused visible erosion? (Yes/No)	22	Sheet	Rill	Gully	0.0
		If no, score as 0. If yes, calculate as appropriate.			
Surface Water Factors-Run-on (11)					
Structures adversely affecting run-on (Yes/No)	7*	If yes, score as 7. If no, score as 0.			0.0
Current operations adversely impacting (Yes/No)	4	If yes, score as 4. If no, score as 0.			0.0
Natural drainages onto site (Yes/No)	7*	If yes, score as 7. If no, score as 0.			0.0
**Select either structures or natural drainages.*					
MAX. POSSIBLE EROSION MATRIX SCORE:	**100**			**Total Score**	8.8**

** Indicates BMPs in place. Erosion potential without BMPs may be greater.

Report Printed 4/10/02 11:29:18 AM.

Los Alamos National Laboratory
SURFACE WATER
SITE ASSESSMENT

SITE INFORMATION

1a) PRS Number 00-030(a) **1b) Structure Number** **1c) FMU Number** 80

2. Date/Time (M/D/Y H:M am/pm) 8/5/97 10:45:00 AM

SITE SETTING (check all that apply)

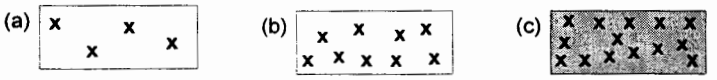
3. (●) **On mesa top (a).** ( ) **In the canyon floor, but not in an established channel (c).**

( ) **Within a bench of a canyon (b).** ( ) **Within established channel in the canyon floor (d).**

Explanation: Mesa top near 6th St Warehouse

4. Estimated ground and/or canopy cover at site: (deciduous leaves, pine needles, rocks, vegetation, trees, structures, asphalt, etc.)

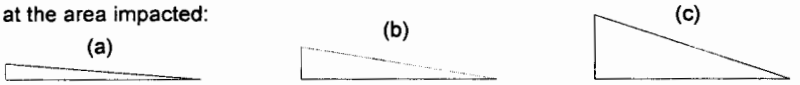
(illustration)



Estimated % of ground/canopy cover: ( ) 0% to 25% (●) 25% to 75% ( ) 75% to 100%

Explanation: Close to 25% all low ground cover.

5. Steepest slope at the area impacted:



(●) Less than 10% ( ) 10% to 30% ( ) 30% and greater

Explanation: Mostly flat with little slope

RUNOFF FACTORS

Y / N

☐ ☑ **6. Is there visible evidence of runoff discharging from site? If yes, answer a) - c) below:**

☐ ☑ 6a) Is runoff channelized? If yes, describe: ( ) Man-made channel. ( ) Natural channel.

Explanation: None observed

RUNOFF FACTORS, CONT'D

6b) Where does evidence of runoff terminate?

- ○ **Drainage or wetland (name)** Los Alamos Canyon
- ○ **Within bench of canyon setting (name)**
- ○ **Other (i.e., retention pond, meadow, mesa top)**

Explanation:

Y / N

☐ ☑ 6c) Has runoff caused visible erosion at the site? If yes, explain below: ○ Sheet ○ Rill ○ Gully

Explanation:

RUN-ON FACTORS

Please rate the potential for storm water to run on to this site: (Check EITHER #7 or #9)

☐ ☑ **7.** Are structures (i.e., buildings, roof drains, parking lots, storm drains) creating run-on to the site?

Explanation:

☐ ☑ **8.** Are current operations (i.e., fire hydrants, NPDES outfalls) adversely impacting run-on to the site?

Explanation:

☐ ☑ **9.** Are natural drainage patterns directing stormwater onto site?

Explanation:

ASSESSMENT FINDING:

☐ ☑ **10. Based on the above criteria and the assessment of this site, does soil erosion potential exist? (REFER TO EROSION POTENTIAL MATRIX.)**

C. McLean

11. Signature of Water Quality/Hydrology Representative

_____ Initials of independent reviewer.

Check here when information is entered in database: ☑

This page is for ESH-18 notes, recommendations, and photos.

	Y / N	
12. a)	○ ●	Is there visible trash/debris on the site?
b)	○ ●	Is there visible trash/debris in a watercourse?

Description of existing BMPs:

Reseeded after excavation. BMPs installed 8/31/96

○ ○ Are BMPs being properly maintained? If no, describe in "Other Internal Notes."

○ ○ Are BMPs effectively keeping sediment in place and reducing erosion potential?

OTHER INTERNAL NOTES:

Phase II drilling completed in early 1997. NOT submitted 9/97 Cleanup report Submitted. Site stable with no further actions needed.

Los Alamos National Laboratory

Environment, Safety & Health Division
ESH-18 Water Quality & Hydrology Group

Surface Water Assessment
Erosion Matrix for PRS 00-033(b)

CRITERIA EVALUATED	Value	Erosion/Sediment Transport Potential Low 0.1	Medium 0.5	High 1.0	Calculated Score
Site Setting (43)					
On mesa top	1	Defined based on topographic setting			1.0
Within bench of canyon	4				
Within the canyon floodplain but not watercourse	13				
Within bottom of canyon channel in watercourse	17				
Estimated % ground and canopy cover	13	>75%	25-75%	<25%	1.3
Slope	13	0-10%	10-30%	>30%	1.3
Surface Water Factors-Run-off (46)					
Visible evidence of runoff discharging? (Yes/No)	5	If no, score of 0 for runoff section.			0.0
		If yes, score 5 and proceed with section.			
Where does runoff terminate?	19	Other	Bench Setting	Drainage/Wetland	0.0
Has runoff caused visible erosion? (Yes/No)	22	Sheet	Rill	Gully	0.0
		If no, score as 0. If yes, calculate as appropriate.			
Surface Water Factors-Run-on (11)					
Structures adversely affecting run-on (Yes/No)	7*	If yes, score as 7. If no, score as 0.			7.0
Current operations adversely impacting (Yes/No)	4	If yes, score as 4. If no, score as 0.			0.0
Natural drainages onto site (Yes/No)	7*	If yes, score as 7. If no, score as 0.			*
**Select either structures or natural drainages.*					
MAX. POSSIBLE EROSION MATRIX SCORE:	**100**			**Total Score**	10.6

Report Printed 4/10/02 11:35:43 AM.

Los Alamos National Laboratory
SURFACE WATER
SITE ASSESSMENT

SITE INFORMATION

1a) PRS Number 00-033(b) **1b) Structure Number** **1c) FMU Number** ER

2. Date/Time (M/D/Y H:M am/pm) 11/30/01

SITE SETTING (check all that apply)

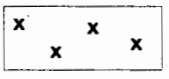
3. (●) **On mesa top (a).** ( ) **In the canyon floor, but not in an established channel (c).**

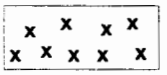
( ) **Within a bench of a canyon (b).** ( ) **Within established channel in the canyon floor (d).**

Explanation: PRS is located on the north rim of LA Canyon, south of building 1002 and its associated sheds. The area slopes to the south.

4. Estimated ground and/or canopy cover at site: (deciduous leaves, pine needles, rocks, vegetation, trees, structures, asphalt, etc.)

(illustration)

(a) 

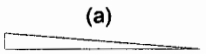
(b) 

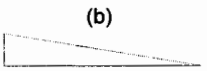
(c)

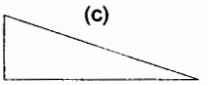
Estimated % of ground/canopy cover: ( ) 0% to 25% ( ) 25% to 75% (●) 75% to 100%

Explanation: Area is well vegetated with grasses and forbes.

5. Steepest slope at the area impacted:

(a) 

(b) 

(c) 

(●) Less than 10% ( ) 10% to 30% ( ) 30% and greater

Explanation: Area slopes to the south.

RUNOFF FACTORS

Y / N

☐ ☑ **6. Is there visible evidence of runoff discharging from site? If yes, answer a) - c) below:**

☑ ☐ 6a) Is runoff channelized? If yes, describe: (●) Man-made channel. ( ) Natural channel.

Explanation: There is no visible evidence of surface runoff discharging from the site. However, if present the surface runoff would flow into a manmade swale that directs flow to the west and away from the canyon rim. There is no evidence of runoff within the swale.

RUNOFF FACTORS, CONT'D

6b) Where does evidence of runoff terminate?

- ○ **Drainage or wetland (name)** Los Alamos Canyon
- ○ **Within bench of canyon setting (name)**
- ○ **Other (i.e., retention pond, meadow, mesa top)**

Explanation:

Y / N

☐ ☑ 6c) Has runoff caused visible erosion at the site? If yes, explain below: ○ Sheet ○ Rill ○ Gully

Explanation: There is no visible evidence of erosion.

RUN-ON FACTORS

Please rate the potential for storm water to run on to this site: (Check EITHER #7 or #9)

☑ ☐ **7.** Are structures (i.e., buildings, roof drains, parking lots, storm drains) creating run-on to the site?

Explanation: The parking lot north of the PRS contributes run-on to the site.

☐ ☑ **8.** Are current operations (i.e., fire hydrants, NPDES outfalls) adversely impacting run-on to the site?

Explanation: There are no operations at the site.

☑ ☐ **9.** Are natural drainage patterns directing stormwater onto site?

Explanation: The PRS is located on a slope with a parking lot up gradient of the PRS.

ASSESSMENT FINDING:

☐ ☑ **10. Based on the above criteria and the assessment of this site, does soil erosion potential exist? (REFER TO EROSION POTENTIAL MATRIX.)**

Johnson, Randy

11. Signature of Water Quality/Hydrology Representative

_____ Initials of independent reviewer.

Check here when information is entered in database: ☑

This page is for ESH-18 notes, recommendations, and photos.

	Y	N	
12. a)	○	●	Is there visible trash/debris on the site?
b)	○	●	Is there visible trash/debris in a watercourse?

Description of existing BMPs:

○	○	Are BMPs being properly maintained? If no, describe in "Other Internal Notes."
○	○	Are BMPs effectively keeping sediment in place and reducing erosion potential?

OTHER INTERNAL NOTES:

The area has been restored following an ER investigation. Restoration activities were successful.

Los Alamos National Laboratory

Environment, Safety & Health Division
ESH-18 Water Quality & Hydrology Group

Surface Water Assessment Erosion Matrix for PRS 00-004

CRITERIA EVALUATED	Value	Erosion/Sediment Transport Potential Low 0.1	Medium 0.5	High 1.0	Calculated Score
Site Setting (43)					
On mesa top	1	Defined based on topographic setting			1.0
Within bench of canyon	4				
Within the canyon floodplain but not watercourse	13				
Within bottom of canyon channel in watercourse	17				
Estimated % ground and canopy cover	13	>75%	25-75%	<25%	1.3
Slope	13	0-10%	10-30%	>30%	1.3
Surface Water Factors-Run-off (46)					
Visible evidence of runoff discharging? (Yes/No)	5	If no, score of 0 for runoff section.			0.0
		If yes, score 5 and proceed with section.			
Where does runoff terminate?	19	Other	Bench Setting	Drainage/Wetland	0.0
Has runoff caused visible erosion? (Yes/No)	22	Sheet	Rill	Gully	0.0
		If no, score as 0. If yes, calculate as appropriate.			
Surface Water Factors-Run-on (11)					
Structures adversely affecting run-on (Yes/No)	7*	If yes, score as 7. If no, score as 0.			7.0
Current operations adversely impacting (Yes/No)	4	If yes, score as 4. If no, score as 0.			0.0
Natural drainages onto site (Yes/No)	7*	If yes, score as 7. If no, score as 0.			*
**Select either structures or natural drainages.*					
MAX. POSSIBLE EROSION MATRIX SCORE:	**100**			**Total Score**	10.6**

** Indicates BMPs in place. Erosion potential without BMPs may be greater.

Report Printed 4/10/02 11:35:21 AM.

Los Alamos National Laboratory
SURFACE WATER
SITE ASSESSMENT

SITE INFORMATION

1a) PRS Number 00-004 **1b) Structure Number** 21-1002 **1c) FMU Number** ER

2. Date/Time (M/D/Y H:M am/pm) 1/7/98 10:25:00 AM

SITE SETTING (check all that apply)

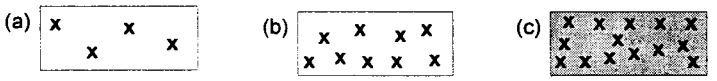
3. ◉ **On mesa top (a).** ○ **In the canyon floor, but not in an established channel (c).**

○ **Within a bench of a canyon (b).** ○ **Within established channel in the canyon floor (d).**

Explanation: Drainage ditch east of 6th Street Warehouses. Flows south, through CMP, then west about 30 ft from Los Alamos Canyon rim.

4. Estimated ground and/or canopy cover at site: (deciduous leaves, pine needles, rocks, vegetation, trees, structures, asphalt, etc.)

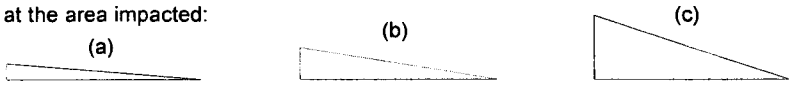
(illustration)



Estimated % of ground/canopy cover: ○ 0% to 25% ○ 25% to 75% ◉ 75% to 100%

Explanation: Ditch grassy, with tree-covered areas south of CMP and pine needle-covered area west of canyon rim fence.

5. Steepest slope at the area impacted:



◉ Less than 10% ○ 10% to 30% ○ 30% and greater

Explanation: Broad, shallow ditch graded to gradual grate.

RUNOFF FACTORS

Y / N

☐ ☑ **6. Is there visible evidence of runoff discharging from site? If yes, answer a) - c) below:**

☐ ☑ 6a) Is runoff channelized? If yes, describe: ○ Man-made channel. ○ Natural channel.

Explanation:

RUNOFF FACTORS, CONT'D

6b) Where does evidence of runoff terminate?

- ◯ **Drainage or wetland (name)** Los Alamos Canyon
- ◯ **Within bench of canyon setting (name)**
- ◯ **Other (i.e., retention pond, meadow, mesa top)**

Explanation:

Y / N

☐ ☑ 6c) Has runoff caused visible erosion at the site? If yes, explain below: ◯ Sheet ◯ Rill ◯ Gully

Explanation:

RUN-ON FACTORS

Please rate the potential for storm water to run on to this site: (Check EITHER #7 or #9)

☑ ☐ **7.** Are structures (i.e., buildings, roof drains, parking lots, storm drains) creating run-on to the site?

Explanation: Parking lot south of Building 21-1002.

☐ ☑ **8.** Are current operations (i.e., fire hydrants, NPDES outfalls) adversely impacting run-on to the site?

Explanation:

☑ ☐ **9.** Are natural drainage patterns directing stormwater onto site?

Explanation: As trench runs west along Los Alamos Canyon rim, it collects sheet flow from area south of Building 21-1002 parking lot.

ASSESSMENT FINDING:

☐ ☑ **10. Based on the above criteria and the assessment of this site, does soil erosion potential exist? (REFER TO EROSION POTENTIAL MATRIX.)**

D. Mays

11. Signature of Water Quality/Hydrology Representative

_____ Initials of independent reviewer.

Check here when information is entered in database: ☑

This page is for ESH-18 notes, recommendations, and photos.

	Y / N	
12. a)	○ ●	Is there visible trash/debris on the site?
b)	○ ●	Is there visible trash/debris in a watercourse?

Description of existing BMPs:

Geotextile in lower part of trench, degrading as vegetation becomes more well established. Also, riprap at rim fence to prevent gully deepening (not contiguous to PRS 0-004). BMPs installed 7/31/95 (V. Hesch, 4/98). BMPs inspected: 7/31/95 (V. Hesch, 4/98)

● ○ Are BMPs being properly maintained? If no, describe in "Other Internal Notes."

● ○ Are BMPs effectively keeping sediment in place and reducing erosion potential?

OTHER INTERNAL NOTES:

This erosion assessment replaces the one by R. Reynolds 12/10/97.

Los Alamos National Laboratory

Environment, Safety & Health Division
ESH-18 Water Quality & Hydrology Group

Surface Water Assessment
Erosion Matrix for PRS 00-029(a)

CRITERIA EVALUATED	Value	Erosion/Sediment Transport Potential Low 0.1	Medium 0.5	High 1.0	Calculated Score
Site Setting (43)					
On mesa top	1	Defined based on topographic setting			
Within bench of canyon	4				
Within the canyon floodplain but not watercourse	13				13.0
Within bottom of canyon channel in watercourse	17				
Estimated % ground and canopy cover	13	>75%	25-75%	<25%	1.3
Slope	13	0-10%	10-30%	>30%	6.5
Surface Water Factors-Run-off (46)					
Visible evidence of runoff discharging? (Yes/No)	5	If no, score of 0 for runoff section.			5.0
		If yes, score 5 and proceed with section.			
Where does runoff terminate?	19	Other	Bench Setting	Drainage/Wetland	1.9
Has runoff caused visible erosion? (Yes/No)	22	Sheet	Rill	Gully	11.0
		If no, score as 0. If yes, calculate as appropriate.			
Surface Water Factors-Run-on (11)					
Structures adversely affecting run-on (Yes/No)	7*	If yes, score as 7. If no, score as 0.			0.0
Current operations adversely impacting (Yes/No)	4	If yes, score as 4. If no, score as 0.			0.0
Natural drainages onto site (Yes/No)	7*	If yes, score as 7. If no, score as 0.			0.0
**Select either structures or natural drainages.*					
MAX. POSSIBLE EROSION MATRIX SCORE:	**100**			**Total Score**	38.7

Report Printed 4/10/02 11:28:46 AM.

Los Alamos National Laboratory
SURFACE WATER
SITE ASSESSMENT

SITE INFORMATION

1a) PRS Number 00-029(a) **1b) Structure Number** **1c) FMU Number** ER

2. Date/Time (M/D/Y H:M am/pm) 1/15/02

SITE SETTING (check all that apply)

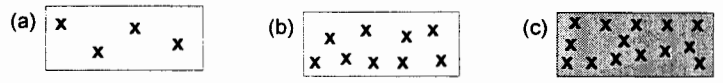
3. ○ **On mesa top (a).** ● **In the canyon floor, but not in an established channel (c).**

○ **Within a bench of a canyon (b).** ○ **Within established channel in the canyon floor (d).**

Explanation: The PRS is located on the floor of Los Alamos Canyon, approximately 75 ft north of and 10 ft higher in elevation than the stream channel. The PRS is surrounded by a chain link fence and there is a 10'x10' structure within the fenced area.

4. Estimated ground and/or canopy cover at site: (deciduous leaves, pine needles, rocks, vegetation, trees, structures, asphalt, etc.)

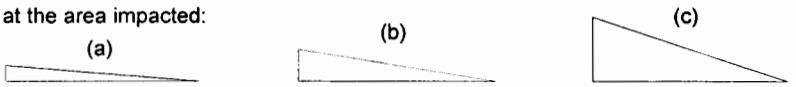
(illustration)



Estimated % of ground/canopy cover: ○ 0% to 25% ○ 25% to 75% ● 75% to 100%

Explanation: The area is well vegetated with mature sagebrush and native grasses.

5. Steepest slope at the area impacted:



○ Less than 10% ● 10% to 30% ○ 30% and greater

Explanation: The area slopes to the south towards the channel, which drains to the east.

RUNOFF FACTORS

Y / N

☑ ☐ **6. Is there visible evidence of runoff discharging from site? If yes, answer a) - c) below:**

☐ ☑ 6a) Is runoff channelized? If yes, describe: ○ Man-made channel. ○ Natural channel.

Explanation: Stormwater enters the PRS at the north east corner and flows across the eastern perimeter of the site.

RUNOFF FACTORS, CONT'D

6b) Where does evidence of runoff terminate?

- ( ) **Drainage or wetland (name)** Los Alamos Canyon
- ( ) **Within bench of canyon setting (name)**
- ( ) **Other (i.e., retention pond, meadow, mesa top)**

Explanation: Runoff infiltrates the ground surface prior to reaching the channel.

Y / N

☑ ☐ 6c) Has runoff caused visible erosion at the site? If yes, explain below: ( ) Sheet (•) Rill ( ) Gully

Explanation: There is minor rill erosion along the eastern perimeter/fence line.

RUN-ON FACTORS

Please rate the potential for storm water to run on to this site: (Check EITHER #7 or #9)

☐ ☑ **7.** Are structures (i.e., buildings, roof drains, parking lots, storm drains) creating run-on to the site?

Explanation: The roof of the structure does not contribute additional stormwater to the site.

☐ ☑ **8.** Are current operations (i.e., fire hydrants, NPDES outfalls) adversely impacting run-on to the site?

Explanation: Current operations are not adversely impacting run-on to the site.

☐ ☑ **9.** Are natural drainage patterns directing stormwater onto site?

Explanation: Natural drainage patterns are not directing stormwater onto the site. The road north of the site and its associated channels direct the majority of the stormwater away from the site.

ASSESSMENT FINDING:

☐ ☑ **10. Based on the above criteria and the assessment of this site, does soil erosion potential exist? (REFER TO EROSION POTENTIAL MATRIX.)**

Johnson, Randy

11. Signature of Water Quality/Hydrology Representative

_____ Initials of independent reviewer.

Check here when information is entered in database: ☑

This page is for ESH-18 notes, recommendations, and photos.

	Y	N	
12. a)	●	○	Is there visible trash/debris on the site?
b)	○	●	Is there visible trash/debris in a watercourse?

Description of existing BMPs:

○	○	Are BMPs being properly maintained? If no, describe in "Other Internal Notes."
○	○	Are BMPs effectively keeping sediment in place and reducing erosion potential?

OTHER INTERNAL NOTES:

A 55 gal. drum is located within the eroded area along the eastern fence.

Los Alamos National Laboratory

Environment, Safety & Health Division
ESH-18 Water Quality & Hydrology Group

Surface Water Assessment
Erosion Matrix for PRS 00-029(b)

CRITERIA EVALUATED	Value	Erosion/Sediment Transport Potential Low 0.1	Medium 0.5	High 1.0	Calculated Score
Site Setting (43)					
On mesa top	1	Defined based on topographic setting			
Within bench of canyon	4				4.0
Within the canyon floodplain but not watercourse	13				
Within bottom of canyon channel in watercourse	17				
Estimated % ground and canopy cover	13	>75%	25-75%	<25%	6.5
Slope	13	0-10%	10-30%	>30%	1.3
Surface Water Factors-Run-off (46)					
Visible evidence of runoff discharging? (Yes/No)	5	If no, score of 0 for runoff section.			5.0
		If yes, score 5 and proceed with section.			
Where does runoff terminate?	19	Other	Bench Setting	Drainage/Wetland	19.0
Has runoff caused visible erosion? (Yes/No)	22	Sheet	Rill	Gully	0.0
		If no, score as 0. If yes, calculate as appropriate.			
Surface Water Factors-Run-on (11)					
Structures adversely affecting run-on (Yes/No)	7*	If yes, score as 7. If no, score as 0.			0.0
Current operations adversely impacting (Yes/No)	4	If yes, score as 4. If no, score as 0.			0.0
Natural drainages onto site (Yes/No)	7*	If yes, score as 7. If no, score as 0.			7.0
**Select either structures or natural drainages.*					
MAX. POSSIBLE EROSION MATRIX SCORE:	**100**			**Total Score**	42.8

Report Printed 4/10/02 11:22:29 AM.

Los Alamos National Laboratory
SURFACE WATER
SITE ASSESSMENT

SITE INFORMATION

1a) PRS Number 00-029(b) **1b) Structure Number** **1c) FMU Number** ER

2. Date/Time (M/D/Y H:M am/pm) 1/15/02

SITE SETTING (check all that apply)

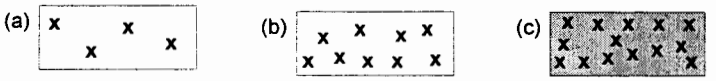
3. ○ **On mesa top (a).** ○ **In the canyon floor, but not in an established channel (c).**

● **Within a bench of a canyon (b).** ○ **Within established channel in the canyon floor (d).**

Explanation: PRS is located on a bench within Los Alamos canyon, approximately 100 ft north of the stream channel, the elevation of the bench is approximately 30 ft height than the stream channel.

4. Estimated ground and/or canopy cover at site: (deciduous leaves, pine needles, rocks, vegetation, trees, structures, asphalt, etc.)

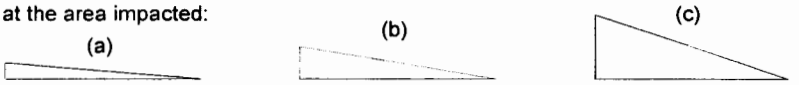
(illustration)



Estimated % of ground/canopy cover: ○ 0% to 25% ● 25% to 75% ○ 75% to 100%

Explanation: The area is vegetated with native grasses and sagebrush. Pinon and juniper tress surround the perimeter of the PRS.

5. Steepest slope at the area impacted:



● Less than 10% ○ 10% to 30% ○ 30% and greater

Explanation: The area slopes to the south and east towards the stream channel.

RUNOFF FACTORS

Y / N

☑ ☐ **6. Is there visible evidence of runoff discharging from site? If yes, answer a) - c) below:**

☐ ☑ 6a) Is runoff channelized? If yes, describe: ○ Man-made channel. ● Natural channel.

Explanation: These are minor eroded channels in the steep bank adjacent to the stream channel, this bank forms the southern border of the PRS. These is no visible evidence of erosion within the PRS.

RUNOFF FACTORS, CONT'D

6b) Where does evidence of runoff terminate?

- (●) **Drainage or wetland (name)** Los Alamos Canyon
- ( ) **Within bench of canyon setting (name)**
- ( ) **Other (i.e., retention pond, meadow, mesa top)**

Explanation:

Y / N

☐ ☑ 6c) Has runoff caused visible erosion at the site? If yes, explain below: ( ) Sheet ( ) Rill ( ) Gully

Explanation: There is no visible erosion within the PRS.

RUN-ON FACTORS

Please rate the potential for storm water to run on to this site: (Check EITHER #7 or #9)

☐ ☑ **7.** Are structures (i.e., buildings, roof drains, parking lots, storm drains) creating run-on to the site?

Explanation: There are no structures present.

☐ ☑ **8.** Are current operations (i.e., fire hydrants, NPDES outfalls) adversely impacting run-on to the site?

Explanation: There are no current operations.

☑ ☐ **9.** Are natural drainage patterns directing stormwater onto site?

Explanation: The slope north of the PRS directs stormwater across the site, natural channels east and west of the PRS direct much of the water away from the PRS.

ASSESSMENT FINDING:

☐ ☑ **10. Based on the above criteria and the assessment of this site, does soil erosion potential exist? (REFER TO EROSION POTENTIAL MATRIX.)**

Johnson, Randy

11. Signature of Water Quality/Hydrology Representative

_____ Initials of independent reviewer.

Check here when information is entered in database: ☑

This page is for ESH-18 notes, recommendations, and photos.

	Y / N	
12. a)	○ ●	Is there visible trash/debris on the site?
b)	○ ●	Is there visible trash/debris in a watercourse?

Description of existing BMPs:

○ ○ Are BMPs being properly maintained? If no, describe in "Other Internal Notes."

○ ○ Are BMPs effectively keeping sediment in place and reducing erosion potential?

OTHER INTERNAL NOTES:

Los Alamos National Laboratory

Environment, Safety & Health Division
ESH-18 Water Quality & Hydrology Group

Surface Water Assessment
Erosion Matrix for PRS 00-029(c)

CRITERIA EVALUATED	Value	Erosion/Sediment Transport Potential Low 0.1	Medium 0.5	High 1.0	Calculated Score
Site Setting (43)					
On mesa top	1	Defined based on topographic setting			
Within bench of canyon	4				
Within the canyon floodplain but not watercourse	13				13.0
Within bottom of canyon channel in watercourse	17				
Estimated % ground and canopy cover	13	>75%	25-75%	<25%	6.5
Slope	13	0-10%	10-30%	>30%	1.3
Surface Water Factors-Run-off (46)					
Visible evidence of runoff discharging? (Yes/No)	5	If no, score of 0 for runoff section.			0.0
		If yes, score 5 and proceed with section.			
Where does runoff terminate?	19	Other	Bench Setting	Drainage/Wetland	0.0
Has runoff caused visible erosion? (Yes/No)	22	Sheet	Rill	Gully	0.0
		If no, score as 0. If yes, calculate as appropriate.			
Surface Water Factors-Run-on (11)					
Structures adversely affecting run-on (Yes/No)	7*	If yes, score as 7. If no, score as 0.			0.0
Current operations adversely impacting (Yes/No)	4	If yes, score as 4. If no, score as 0.			4.0
Natural drainages onto site (Yes/No)	7*	If yes, score as 7. If no, score as 0.			7.0
**Select either structures or natural drainages.*					
MAX. POSSIBLE EROSION MATRIX SCORE:	**100**			**Total Score**	31.8

Report Printed 4/10/02 11:23:36 AM.

Los Alamos National Laboratory
SURFACE WATER
SITE ASSESSMENT

SITE INFORMATION

1a) PRS Number 00-029(c) **1b) Structure Number** **1c) FMU Number** ER

2. Date/Time (M/D/Y H:M am/pm) 1/15/02

SITE SETTING (check all that apply)

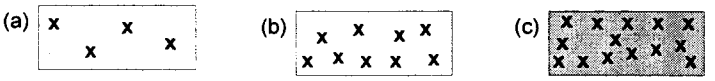
3. ○ **On mesa top (a).** ● **In the canyon floor, but not in an established channel (c).**

○ **Within a bench of a canyon (b).** ○ **Within established channel in the canyon floor (d).**

Explanation: PRS is located within the canyon floor of Guaje Canyon, approximately 200 ft north of the stream channel. The PRS is associate with Guaje Well #1and measures approximately 65'x75' with the well casing sited near the center of the PRS..

4. Estimated ground and/or canopy cover at site: (deciduous leaves, pine needles, rocks, vegetation, trees, structures, asphalt, etc.)

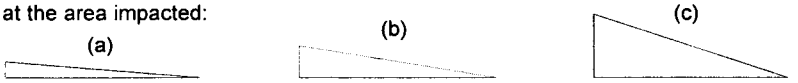
(illustration)



Estimated % of ground/canopy cover: ○ 0% to 25% ● 25% to 75% ○ 75% to 100%

Explanation: The northern half of the site is denuded to sparsely vegetated with native grasses. The southern half is vegetated with native grasses and forbs. Pinon and juniper trees are present in the north, east and southern perimeters.

5. Steepest slope at the area impacted:



● Less than 10% ○ 10% to 30% ○ 30% and greater

Explanation: The area has a slight slope to the south.

RUNOFF FACTORS

Y / N

☐ ☑ **6. Is there visible evidence of runoff discharging from site? If yes, answer a) - c) below:**

☐ ☑ 6a) Is runoff channelized? If yes, describe: ○ Man-made channel. ○ Natural channel.

Explanation: These is no visible evidence of runoff discharging from the site. There is an abandoned dirt road west and SW of the site that channels flow into a natural channel located south of the site. However, this road and channel are located outside of the PRS.

RUNOFF FACTORS, CONT'D

6b) Where does evidence of runoff terminate?

- ◯ **Drainage or wetland (name)** Guaje Canyon
- ◯ **Within bench of canyon setting (name)**
- ◯ **Other (i.e., retention pond, meadow, mesa top)**

Explanation:

Y / N

☐ ☑ 6c) Has runoff caused visible erosion at the site? If yes, explain below: ◯ Sheet ◯ Rill ◯ Gully

Explanation: There is no visible erosion within the PRS.

RUN-ON FACTORS

Please rate the potential for storm water to run on to this site: (Check EITHER #7 or #9)

☐ ☑ **7.** Are structures (i.e., buildings, roof drains, parking lots, storm drains) creating run-on to the site?

Explanation: These are to structures present to contribute run-on to the site.

☐ ☑ **8.** Are current operations (i.e., fire hydrants, NPDES outfalls) adversely impacting run-on to the site?

Explanation: Heavy equipment operations on the northern portion of the site have disturbed the soil and ground cover.

☑ ☐ **9.** Are natural drainage patterns directing stormwater onto site?

Explanation: The slight slope up gradient from the PRS directs some stormwater across the area.

ASSESSMENT FINDING:

☐ ☑ **10. Based on the above criteria and the assessment of this site, does soil erosion potential exist? (REFER TO EROSION POTENTIAL MATRIX.)**

Johnson, Randy

11. Signature of Water Quality/Hydrology Representative

_____ Initials of independent reviewer.

Check here when information is entered in database: ☑

This page is for ESH-18 notes, recommendations, and photos.

	Y	N	
12. a)	○	●	Is there visible trash/debris on the site?
b)	○	●	Is there visible trash/debris in a watercourse?

Description of existing BMPs:

○	○	Are BMPs being properly maintained? If no, describe in "Other Internal Notes."
○	○	Are BMPs effectively keeping sediment in place and reducing erosion potential?

OTHER INTERNAL NOTES:

Los Alamos National Laboratory

Environment, Safety & Health Division
ESH-18 Water Quality & Hydrology Group

Surface Water Assessment
Erosion Matrix for PRS 00-030(b)

CRITERIA EVALUATED	Value	Erosion/Sediment Transport Potential Low 0.1	Medium 0.5	High 1.0	Calculated Score
Site Setting (43)					
On mesa top	1	Defined based on topographic setting			1.0
Within bench of canyon	4				
Within the canyon floodplain but not watercourse	13				
Within bottom of canyon channel in watercourse	17				
Estimated % ground and canopy cover	13	>75%	25-75%	<25%	1.3
Slope	13	0-10%	10-30%	>30%	1.3
Surface Water Factors-Run-off (46)					
Visible evidence of runoff discharging? (Yes/No)	5	If no, score of 0 for runoff section.			5.0
		If yes, score 5 and proceed with section.			
Where does runoff terminate?	19	Other	Bench Setting	Drainage/Wetland	1.9
Has runoff caused visible erosion? (Yes/No)	22	Sheet	Rill	Gully	0.0
		If no, score as 0. If yes, calculate as appropriate.			
Surface Water Factors-Run-on (11)					
Structures adversely affecting run-on (Yes/No)	7*	If yes, score as 7. If no, score as 0.			7.0
Current operations adversely impacting (Yes/No)	4	If yes, score as 4. If no, score as 0.			0.0
Natural drainages onto site (Yes/No)	7*	If yes, score as 7. If no, score as 0.			0.0
**Select either structures or natural drainages.*					
MAX. POSSIBLE EROSION MATRIX SCORE:	**100**			**Total Score**	17.5

REVISED PART B

Report Printed 4/10/02 11:29:46 AM.

Los Alamos National Laboratory
SURFACE WATER
SITE ASSESSMENT

Revised Part B. Please discard previous.

SITE INFORMATION

1a) PRS Number 00-030(b) **1b) Structure Number** **1c) FMU Number** 80

2. Date/Time (M/D/Y H:M am/pm) 11/30/01

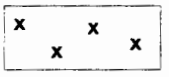
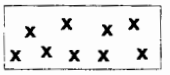
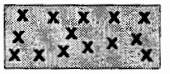
SITE SETTING (check all that apply)

3. (●) **On mesa top (a).** ( ) **In the canyon floor, but not in an established channel (c).**

( ) **Within a bench of a canyon (b).** ( ) **Within established channel in the canyon floor (d).**

Explanation: Near storage units on 6th St. east of Zia Warehouses and extends into old trailer park east of Zia Warehouse.

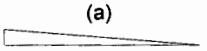
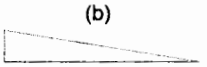
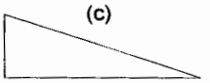
4. Estimated ground and/or canopy cover at site: (deciduous leaves, pine needles, rocks, vegetation, trees, structures, asphalt, etc.)

(illustration) (a)  (b)  (c) 

Estimated % of ground/canopy cover: ( ) 0% to 25% ( ) 25% to 75% (●) 75% to 100%

Explanation: Area in the vicinity of the warehouse consists of an asphalt parking lot, the ground cover in the vicinity of the old trailer park consists of native grasses and forbs. An area at the eastern limit of the PRS has recently been disturbed by road constr.

5. Steepest slope at the area impacted:

(a)  (b)  (c) 

(●) Less than 10% ( ) 10% to 30% ( ) 30% and greater

Explanation: Flat, with gentle slope to the south.

RUNOFF FACTORS

Y / N

☑ ☐ **6. Is there visible evidence of runoff discharging from site? If yes, answer a) - c) below:**

☐ ☑ 6a) Is runoff channelized? If yes, describe: ( ) Man-made channel. ( ) Natural channel.

Explanation: Sheet flow over asphalt. There is no visible evidence of runoff in the vegetated areas.

RUNOFF FACTORS, CONT'D

6b) Where does evidence of runoff terminate?

- ○ **Drainage or wetland (name)** Los Alamos Canyon
- ○ **Within bench of canyon setting (name)**
- ● **Other (i.e., retention pond, meadow, mesa top)** Roadway ditch

Explanation: Sheetflow runoff from parking lot terminates in a road ditch, SWMU in this local is beneath asphalt (not exposed).

Y / N

☐ ☑ 6c) Has runoff caused visible erosion at the site? If yes, explain below: ○ Sheet ○ Rill ○ Gully

Explanation: None

RUN-ON FACTORS

Please rate the potential for storm water to run on to this site: (Check EITHER #7 or #9)

☑ ☐ **7.** Are structures (i.e., buildings, roof drains, parking lots, storm drains) creating run-on to the site?

Explanation: Adjacent roadway (minimal)

☐ ☑ **8.** Are current operations (i.e., fire hydrants, NPDES outfalls) adversely impacting run-on to the site?

Explanation: None

☐ ☑ **9.** Are natural drainage patterns directing stormwater onto site?

Explanation: None

ASSESSMENT FINDING:

☐ ☑ **10. Based on the above criteria and the assessment of this site, does soil erosion potential exist? (REFER TO EROSION POTENTIAL MATRIX.)**

Johnson, Randy

11. Signature of Water Quality/Hydrology Representative

_____ Initials of independent reviewer.

Check here when information is entered in database: ☑

This page is for ESH-18 notes, recommendations, and photos.

	Y	N	
12. a)	○	●	Is there visible trash/debris on the site?
b)	○	●	Is there visible trash/debris in a watercourse?

Description of existing BMPs:

○	○	Are BMPs being properly maintained? If no, describe in "Other Internal Notes."
○	○	Are BMPs effectively keeping sediment in place and reducing erosion potential?

OTHER INTERNAL NOTES:

Site was assessed on 2/14/00 (score 17.5): VCA activities continued 7/30/96 to excavate and remove boxes as an extension to the original 1995 work. (EM/ER:96-417) Cleanup report Submitted. Site stable. No inspections or further actions needed. Site was revisited on 11/30/01 to include the portion of the PRS that includes the old trailer park. No changes to the site observations were made except to include the vegetative cover for the old trailer park and the recently disturbed area at the eastern limit of the PRS.

Los Alamos National Laboratory

Environment, Safety & Health Division
ESH-18 Water Quality & Hydrology Group

Surface Water Assessment
Erosion Matrix for PRS 00-030(I)

CRITERIA EVALUATED	Value	Erosion/Sediment Transport Potential Low 0.1	Medium 0.5	High 1.0	Calculated Score
Site Setting (43)					
On mesa top	1	Defined based on topographic setting			1.0
Within bench of canyon	4				
Within the canyon floodplain but not watercourse	13				
Within bottom of canyon channel in watercourse	17				
Estimated % ground and canopy cover	13	>75%	25-75%	<25%	1.3
Slope	13	0-10%	10-30%	>30%	13.0
Surface Water Factors-Run-off (46)					
Visible evidence of runoff discharging? (Yes/No)	5	If no, score of 0 for runoff section.			0.0
		If yes, score 5 and proceed with section.			
Where does runoff terminate?	19	Other	Bench Setting	Drainage/Wetland	0.0
Has runoff caused visible erosion? (Yes/No)	22	Sheet	Rill	Gully	0.0
		If no, score as 0. If yes, calculate as appropriate.			
Surface Water Factors-Run-on (11)					
Structures adversely affecting run-on (Yes/No)	7*	If yes, score as 7. If no, score as 0.			7.0
Current operations adversely impacting (Yes/No)	4	If yes, score as 4. If no, score as 0.			0.0
Natural drainages onto site (Yes/No)	7*	If yes, score as 7. If no, score as 0.			*
**Select either structures or natural drainages.*					
MAX. POSSIBLE EROSION MATRIX SCORE:	**100**			**Total Score**	22.3**

** Indicates BMPs in place. Erosion potential without BMPs may be greater.

REVISED PART B

Report Printed 4/10/02 11:30:01 AM.

Los Alamos National Laboratory
SURFACE WATER
SITE ASSESSMENT

Revised Part B. Please discard previous.

SITE INFORMATION

1a) PRS Number 00-030(I) **1b) Structure Number** NA **1c) FMU Number** 80

2. Date/Time (M/D/Y H:M am/pm) 11/30/01

SITE SETTING (check all that apply)

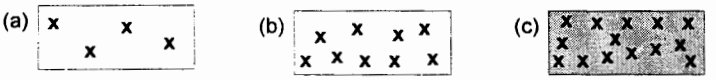
3. (●) **On mesa top (a).** ( ) **In the canyon floor, but not in an established channel (c).**

( ) **Within a bench of a canyon (b).** ( ) **Within established channel in the canyon floor (d).**

Explanation: In open area on the north rim of LA canyon. Based upon a revised map of the PRS, the PRS boundaries have been expanded to include an abandoned outfall that discharged onto a bench within LA Canyon.

4. Estimated ground and/or canopy cover at site: (deciduous leaves, pine needles, rocks, vegetation, trees, structures, asphalt, etc.)

(illustration) (a) (b) (c)

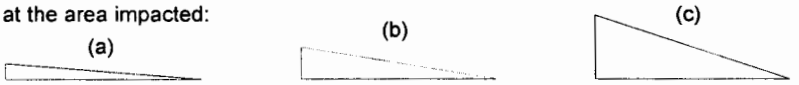


Estimated % of ground/canopy cover: ( ) 0% to 25% ( ) 25% to 75% (●) 75% to 100%

Explanation: Site has been remediated, final stabilization has been achieved. Site is planted and covered with natural grasses.

5. Steepest slope at the area impacted:

(a) (b) (c)



(●) Less than 10% ( ) 10% to 30% (●) 30% and greater

Explanation: PRS is located on the rim of LA Canyon, PRS includes an abandoned outfall that discharged over the canyon rim and onto a bench within LA Canyon.

RUNOFF FACTORS

Y / N

☐ ☑ **6. Is there visible evidence of runoff discharging from site? If yes, answer a) - c) below:**

☑ ☐ 6a) Is runoff channelized? If yes, describe: (●) Man-made channel. ( ) Natural channel.

Explanation: Man-made channel collects runoff from warehouse area and directs along southern edge of PRSs. However, there is no visible evidence of runoff within the trench. There is no visible evidence of erosion around the abandoned outfall.

RUNOFF FACTORS, CONT'D

6b) Where does evidence of runoff terminate?

- (●) **Drainage or wetland (name)** Los Alamos Canyon
- ( ) **Within bench of canyon setting (name)**
- ( ) **Other (i.e., retention pond, meadow, mesa top)** Diversion channel

Explanation: Terminates by infiltration in ditch, the ditch terminates at north edge of LA canyon.

Y / N

☐ ☑ 6c) Has runoff caused visible erosion at the site? If yes, explain below: ( ) Sheet ( ) Rill ( ) Gully

Explanation: None observed.

RUN-ON FACTORS

Please rate the potential for storm water to run on to this site: (Check EITHER #7 or #9)

☑ ☐ **7.** Are structures (i.e., buildings, roof drains, parking lots, storm drains) creating run-on to the site?

Explanation: The parking lot north of the PRS could contribute run-on to the site.

☐ ☑ **8.** Are current operations (i.e., fire hydrants, NPDES outfalls) adversely impacting run-on to the site?

Explanation: Current operation are not adversely impacting run-on to the site.

☑ ☐ **9.** Are natural drainage patterns directing stormwater onto site?

Explanation: Natural drainage on PRS, no other sources.

ASSESSMENT FINDING:

☐ ☑ **10. Based on the above criteria and the assessment of this site, does soil erosion potential exist? (REFER TO EROSION POTENTIAL MATRIX.)**

Johnson, Randy

11. Signature of Water Quality/Hydrology Representative

_____ Initials of independent reviewer.

Check here when information is entered in database: ☑

This page is for ESH-18 notes, recommendations, and photos.

	Y / N	
12. a)	○ ●	Is there visible trash/debris on the site?
b)	○ ●	Is there visible trash/debris in a watercourse?

Description of existing BMPs:

A manmade trench/swale transverses the PRS directing surface run-off away from the canyon, there i9s no evidence of runoff discharge from the swale.

○ ○ Are BMPs being properly maintained? If no, describe in "Other Internal Notes."

○ ○ Are BMPs effectively keeping sediment in place and reducing erosion potential?

OTHER INTERNAL NOTES:

Site originally assessed in 8/97 (score 46.3). Site re-evaluated on 152/03/01 (score 29.2) due to the success of revegetation efforts after remediation. Site was revisited on 11/30/01 due to expanded PRS boundaries. No changes to the site observations were made except to include the outfall into LA Canyon. The percent ground coverage was changed ton only 75-100% top reflect the observed ground coverage.

Los Alamos National Laboratory

Environment, Safety & Health Division
ESH-18 Water Quality & Hydrology Group

Surface Water Assessment
Erosion Matrix for PRS 00-030(m)

CRITERIA EVALUATED	Value	Erosion/Sediment Transport Potential Low 0.1	Medium 0.5	High 1.0	Calculated Score
Site Setting (43)					
On mesa top	1	Defined based on topographic setting			1.0
Within bench of canyon	4				
Within the canyon floodplain but not watercourse	13				
Within bottom of canyon channel in watercourse	17				
Estimated % ground and canopy cover	13	>75%	25-75%	<25%	1.3
Slope	13	0-10%	10-30%	>30%	1.3
Surface Water Factors-Run-off (46)					
Visible evidence of runoff discharging? (Yes/No)	5	If no, score of 0 for runoff section.			5.0
		If yes, score 5 and proceed with section.			
Where does runoff terminate?	19	Other	Bench Setting	Drainage/Wetland	1.9
Has runoff caused visible erosion? (Yes/No)	22	Sheet	Rill	Gully	0.0
		If no, score as 0. If yes, calculate as appropriate.			
Surface Water Factors-Run-on (11)					
Structures adversely affecting run-on (Yes/No)	7*	If yes, score as 7. If no, score as 0.			0.0
Current operations adversely impacting (Yes/No)	4	If yes, score as 4. If no, score as 0.			0.0
Natural drainages onto site (Yes/No)	7*	If yes, score as 7. If no, score as 0.			7.0
**Select either structures or natural drainages.*					
MAX. POSSIBLE EROSION MATRIX SCORE:	**100**			**Total Score**	17.5

REVISED PART B

Report Printed 4/10/02 11:34:49 AM.

Los Alamos National Laboratory
SURFACE WATER
SITE ASSESSMENT

Revised Part B. Please discard previous.

SITE INFORMATION

1a) PRS Number 00-030(m) **1b) Structure Number** NA **1c) FMU Number** 80

2. Date/Time (M/D/Y H:M am/pm) 11/30/01

SITE SETTING (check all that apply)

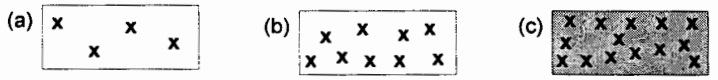
3. (●) **On mesa top (a).** ( ) **In the canyon floor, but not in an established channel (c).**

( ) **Within a bench of a canyon (b).** ( ) **Within established channel in the canyon floor (d).**

Explanation: In open area on the north rim of LA canyon.

4. Estimated ground and/or canopy cover at site: (deciduous leaves, pine needles, rocks, vegetation, trees, structures, asphalt, etc.)

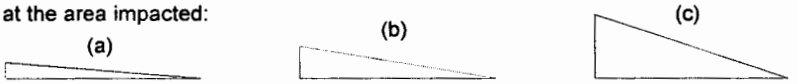
(illustration)



Estimated % of ground/canopy cover: ( ) 0% to 25% ( ) 25% to 75% (●) 75% to 100%

Explanation: Site has been remediated, final stabilization has been achieved. Site is planted and covered with natural grasses.

5. Steepest slope at the area impacted:



(●) Less than 10% ( ) 10% to 30% ( ) 30% and greater

Explanation: Mesa top area.

RUNOFF FACTORS

Y / N

☐ ☑ **6. Is there visible evidence of runoff discharging from site? If yes, answer a) - c) below:**

☑ ☐ 6a) Is runoff channelized? If yes, describe: (●) Man-made channel. ( ) Natural channel.

Explanation: Man-made channel collects runoff from warehouse area and directs along southern edge of PRSs. However, there is no visible evidence of runoff within the trench.

RUNOFF FACTORS, CONT'D

6b) Where does evidence of runoff terminate?

- ○ **Drainage or wetland (name)** Los Alamos Canyon
- ○ **Within bench of canyon setting (name)**
- ● **Other (i.e., retention pond, meadow, mesa top)** Diversion channel

Explanation: Terminates by infiltration in ditch, the ditch terminates at north edge of LA canyon.

Y / N

☐ ☑ 6c) Has runoff caused visible erosion at the site? If yes, explain below: ○ Sheet ○ Rill ○ Gully

Explanation: None observed.

RUN-ON FACTORS

Please rate the potential for storm water to run on to this site: (Check EITHER #7 or #9)

☐ ☑ **7.** Are structures (i.e., buildings, roof drains, parking lots, storm drains) creating run-on to the site?

Explanation: Structures are not contributing run-on to the PRS.

☐ ☑ **8.** Are current operations (i.e., fire hydrants, NPDES outfalls) adversely impacting run-on to the site?

Explanation: Current operations are not adversely impacting run-on to the site.

☑ ☐ **9.** Are natural drainage patterns directing stormwater onto site?

Explanation: Natural drainage on PRS, no other sources.

ASSESSMENT FINDING:

☐ ☑ **10. Based on the above criteria and the assessment of this site, does soil erosion potential exist? (REFER TO EROSION POTENTIAL MATRIX.)**

Johnson, Randy

11. Signature of Water Quality/Hydrology Representative

_____ Initials of independent reviewer.

Check here when information is entered in database: ☑

This page is for ESH-18 notes, recommendations, and photos.

	Y	N	
12. a)	○	●	Is there visible trash/debris on the site?
b)	○	●	Is there visible trash/debris in a watercourse?

Description of existing BMPs:

○	○	Are BMPs being properly maintained? If no, describe in "Other Internal Notes."
○	○	Are BMPs effectively keeping sediment in place and reducing erosion potential?

OTHER INTERNAL NOTES:

Site originally assessed in 8/97 (score 46.3). Site re-evaluated on 12-03/98 (score29.2) due to the success of revegetation efforts after remediation. Site was revisited on 11/30/01, no changes to the site observations were made. The percent ground coverage was changed to only 75-100% to reflect the stabilized state of the site, previously both 0-25% and 75-100% were selected.

Appendix D

Ecological Checklists

Section D-1.0 addresses the Knights of Columbus property; section D-2.0 addresses PRSs 0-030(b,m). Section D-3.0 addresses other 6th Street Warehouse PRSs, and section D-4.0 addresses PRSs 0-029(a,b,c).

D-1.0 PRSs 0-027 AND 0-030(a)

D-1.1 Part A—Scoping Meeting Documentation

Site ID	Former DP Road Storage Area PRSs: 0-027 and 0-030(a)
Form of site releases (solid, liquid, or 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.	PRS 0-027 was used as a fuel tank farm beginning in 1946 and converted to a drum storage area in mid-1948. A septic system [PRS 0-030(a)], consisting of a septic tank and associated piping, served a former fuel dispatch office associated with PRS 0-027. The PRS 0-030(a) septic system was crushed and left in place during a previous VCA.
List of primary impacted media **(Indicate all that apply.)**	**Surface soil** – leaks from drums potentially impacted surface soils that have since been covered with fill **Surface water/sediment** – NA **Subsurface** – leaks from USTs potentially impacted subsurface **Groundwater** – NA **Other; explain** – NA
FIMAD vegetation class based on ArcView vegetation coverage **(Indicate all that apply.)**	**Water** – NA **Bare ground/unvegetated** – NA **Spruce/fir/aspen/mixed conifer** – NA **Ponderosa pine** – NA **Piñon juniper/juniper savannah** – NA **Grassland/shrubland** – NA **Developed** – Yes
Is T&E habitat present? **If applicable, list species known or suspected to use the site for breeding or foraging.**	PRSs 0-027 and 0-030(a) are entirely within an area in which the Mexican spotted owl can be conservatively assumed to forage at a relatively moderate frequency and in which the bald eagle is conservatively assumed to forage at a relatively low frequency.
Provide list of neighboring/ contiguous/upgradient sites. Include a brief summary of COPCs and the form of releases for relevant sites. Reference a map as appropriate. **(Use this information to evaluate the need to aggregate sites for screening.)**	Site is located at the intersection of Trinity Drive (north) and DP Road (west and south). DP Tank Farm lies downgradient, to the immediate east. The site is the current location of the Knights of Columbus Hall. A gas station operated by DOE was formerly located upgradient at what is now the Hilltop House to the north. Contamination is attributable to petroleum products leaking from storage facilities. Suspected contaminants are primarily fuel products (e.g., BTEX and other VOCs, SVOCs, TPH, TAL metals, and PCBs).
Surface-water erosion potential information **Summarize information from SOP-2.01, including the runoff subscore (maximum of 46), terminal point of surface-water transport, slope, and surface-water run-on sources.**	PRS 0-027 has an erosion matrix score of 17.5 out of 100 (Appendix C). The factors (i.e., the runoff subscore) affecting surface-water runoff combined account for 6.9 of 46 points. While the soils are covered by concrete, there is a non-zero runoff subscore because runoff collects in a depression in the parking lot and terminates into DP Canyon and PRS 0-030(a) by sheet-flow processes (i.e., PRS 0-027 parking-lot runoff affects other PRSs). PRS 0-030(a) has an erosion matrix score of 8.8 with BMPs in place. The surface-water runoff subscore for PRS 0-030(a) is 0.
Other scoping meeting notes	Cracks in the parking lot that were above the highest recorded COPC concentrations (approximately the center of the parking lot) had few ant mounds.

D-1.2 Part B—Site Visit Documentation

Site ID	Former DP Road Storage Area PRSs: 0-027 and 0-030(a)
Date of site visit	21 September 2001
Site visit conducted by	Jim Markwiese, Tracy McFarland, Ralph Perona, John Tauxe, Randall Ryti

Receptor Information:

Estimate cover	**Relative vegetative cover (high, medium, low, none)** = none **Relative wetland cover (high, medium, low, none)** = NA **Relative structures/asphalt, etc., cover (high, medium, low, none)** = high
Field notes on the FIMAD vegetation class to assist in ground-truthing the ArcView information	PRS 0-030(a) currently consists of a gravel parking lot with large areas of bare ground and a few patches of weeds/grass. PRS 0-027 is almost entirely covered by the Knights of Columbus Hall and the associated concrete parking lot.
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.	While T&E habitat overlaps with the PRSs, these sites offer marginal habitat. Owls are known to forage on parking lots. However, prey (e.g., rodents) captured there are assumed to originate from off-site areas because of the lack of fossorial habitat (i.e., soils are covered by concrete).
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.**	No. The site is almost entirely covered by a parking lot. A few gopher burrows were observed on the periphery of the lot, in the vicinity of the previously remediated PRS 0-030(a). This area is outside of the boundary in which VOC contamination has been recorded for PRS 0-027. Consequently, ecological receptors are not expected to come in contact with impacted surface or subsurface soils onsite.

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).**	Runoff and infiltration from rain events and snowmelt are the only aspects of surface water hydrology at the PRS. Flow sheets off the parking lots into roadways or into DP Tank Farm to the east. The concrete cover prevents surface erosion or infiltration.
Are there any off-site transport pathways (surface water, air, or groundwater)? **(yes/no/uncertain)** **Provide explanation**	No. Subsurface contamination appears to have stabilized with regard to mobility, and no drivers exist to push a plume closer to groundwater. The parking lot cover prevents surface transport.
Interim action needed to limit off-site transport? **(yes/no/uncertain)** **Provide explanation/recommendation to project lead for IA SMDP.**	NA

Ecological Effects Information:

Physical disturbance **(Provide list of major types of disturbances, including erosion and construction activities; review historical aerial photos where appropriate.)**	Site is almost entirely developed.
Are there obvious ecological effects? **(yes/no/uncertain)** **Provide explanation and apparent cause (e.g., contamination, physical disturbance, other).**	NA.
Is 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.**	NA

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.

The current Knights of Columbus building and parking lot have been in place for three decades. No complete exposure pathways to ecological receptors exist, and no offsite transport pathways exist. Future construction activities are not anticipated. However, if the site were to be redeveloped, the basic layout (i.e., commercial buildings and paved parking lot) would likely remain unchanged.

Signatures and certifications:

Checklist completed by (provide name, organization and phone number):

Name (printed): James Markwiese

Name (signature):

Organization: Neptune & Company

Phone number: 505-662-0707 (ext. 24)

Date completed: 28 September 01

Verification by a member of the ER Project Ecological Risk Task Team (provide name, organization and phone number):

Name (printed): Randall Ryti

Name (signature):

Organization: Neptune & Company

Phone number: 505-662-0707 (ext. 12)

D-2.0 PRSs 0-004, 0-030(l), AND 0-033(b)

D-2.1 Part A—Scoping Meeting Documentation

Site ID	6th Street Warehouse PRSs: 0-004, 0-030(l), and 0-033(b)
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.	Solid and liquid wastes include VOCs, SVOCs, pesticides, PCBs, metals, radionuclides. Waste releases include subsurface leaks from outfall pipes [PRS 0-033(b)], septic tank and associated plumbing [PRS 0-030(l)], and surface releases from spills (PRS 0-004) or outfall pipes [PRS 0-033(b)]. The potentially impacted area is the field located immediately south of the 6th Street Warehouses, overlying septic tanks [i.e., 0-030(l) and related PRS 0-030(m)] that drain the warehouse parking lots, and outfalls.
List of primary impacted media **(Indicate all that apply.)**	**Surface soil** – warehouse spills washed through floor drains onto parking lot and from parking lot to site resulted in direct surface soil contamination. **Surface water/sediment** – NA **Subsurface** – Septic tank releases occurred in subsurface (sampled to 15 ft bgs). **Groundwater** – NA **Other; explain** – NA
FIMAD vegetation class based on ArcView vegetation coverage **(Indicate all that apply.)**	**Water** – NA **Bare ground/unvegetated** – NA **Spruce/fir/aspen/mixed conifer** – NA **Ponderosa pine** – YES (southern portion of site) **Piñon juniper/juniper savannah** – NA **Grassland/shrubland** – NA **Developed** – YES
Is T&E habitat present? **If applicable, list species known or suspected to use the site for breeding or foraging.**	PRS location information was intersected with T&E species habitat using GIS. The PRSs are in the vicinity of potential Mexican spotted owl nesting habitat, which is approximately 0 to 450 ft away from the potential habitat in Los Alamos Canyon and approximately 1000 to 1800 ft from the potential habitat in Pueblo Canyon. The PRSs are entirely within an area in which the Mexican spotted owl can be conservatively assumed to forage at a relatively high frequency.
Provide list of neighboring/ contiguous/upgradient sites. Include a brief summary of COPCs and the form of releases for relevant sites. Reference a map as appropriate. **(Use this information to evaluate the need to aggregate sites for screening.)**	The site is bordered by private property to the west, DP Canyon to the south, PRSs 0-030(b) and 0-030(m) to the east, and DP Road to the north. Commercial development exists within 50 ft to the east. Businesses immediately upgradient (north) from the 6th Street Warehouse PRSs include the Merrick Building and Automotive Professionals. PRSs 0-004, 0-033(b), and 0-030(l) are aggregated because their influence shares a common spatial boundary.
Surface-water erosion potential information **Summarize information from SOP-2.01, including the runoff subscore (maximum of 46), terminal point of surface-water transport, slope, and surface-water run-on sources.**	PRSs 0-004, 0-030(l), and 0-033(b) have erosion matrix scores of 10.6, 22.3, and 10.6 out of 100, respectively (Appendix C); PRSs 0-004 and 0-030(l) employ BMPs. There was no visible sign of runoff discharging offsite or of runoff causing visible erosion at the PRSs. Therefore, the runoff subscores are 0 in all cases. The sites may collect upgradient runoff (e.g., Merrick Building parking lot).
Other scoping meeting notes	

D-2.2 Part B—Site Visit Documentation

Site ID	6th Street Warehouse PRSs: 0-004, 0-030(l), and 0-033(b)
Date of site visit	21 September 2001
Site visit conducted by	Jim Markwiese, Tracy McFarland. Ralph Perona, John Tauxe, Randall Ryti

Receptor Information:

Estimate cover.	**Relative vegetative cover (high, medium, low, none)** = high **Relative wetland cover (high, medium, low, none)** = NA **Relative structures/asphalt, etc., cover (high, medium, low, none)** = low
Field notes on the FIMAD vegetation class to assist in ground-truthing the ArcView information	The mesa-top area of the 6th Street Warehouse PRSs has undergone heavy commercial and urban development. Although a dirt access road leads to PRS 0-030(l), the former structures [e.g., 0-033(b)] have been removed, and this type of relative cover is low. Ponderosa pine dominated in pre-urban conditions. Pines have been reduced to scattered stands. The area is characteristic of disturbed sites undergoing secondary succession. Ample forb ground cover exists: predominantly red sorrel and grasses. Soils have previously been disturbed by excavation and backfilling.
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.	NA (See comments Part A, T&E habitat)
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 mesa-top soils are exposed in a few patches, but they primarily support a continuous cover of grasses (buffalo grass, fescue) and forbs (red sorrel, chamisa, clover, aster, sweet pea). The invasive growth of forbs and grasses is characteristic of a disturbed area undergoing secondary succession. Ponderosa pine stands and other trees surround the southern portion of the area. Signs of animal life on the mesa top include evidence of small mammal use such as scattered gopher burrowing and observations of a garter snake, fence lizards, skink, and numerous birds (e.g., raven, American robin).

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)**	Runoff and infiltration from rain events and snowmelt are the only aspects of surface-water hydrology at the warehouse PRSs. Flow off the western and eastern ends of the Warehouse 3/4 parking lot is causing erosive gullies on-site. In addition, parking lot and roof runoff from upgradient businesses has the potential to contribute to surface flow in PRS 0-004. A small area of the parking lot immediately north of 0-033(b) is stained with oil residues. Surface transport may cause potential contaminants to become concentrated in drainages.
Are there any off-site transport pathways (surface water, air, or groundwater)? **(yes/no/uncertain)** **Provide explanation.**	Uncertain. Aeolian (wind-driven) contaminant entrainment and transport is unlikely considering extensive vegetation cover. Surface-water transport off the mesa top is minimized because of site topology and existing BMPs, although drainage into the canyon is evident. Considering depth to groundwater below the mesa top (600 ft), contamination of groundwater is unlikely. The potential impact on alluvial groundwater in Los Alamos Canyon is unlikely considering the distance from the mesa top to the ephemeral stream in the canyon.
Is interim action needed to limit off-site transport? **(yes/no/uncertain)** **Provide explanation/ recommendation to project lead for IA SMDP.**	No. BMPs were placed in pathway-of-erosion channels leading off the mesa top. Mesh netting was placed on surface soil to reduce erosion.

Ecological Effects Information:

Physical Disturbance **(Provide list of major types of disturbances, including erosion and construction activities; review historical aerial photos where appropriate.)**	Extensive excavation and backfilling from prior VCAs have disturbed the site, but vegetative regrowth is well established.
Are there obvious ecological effects? **(yes/no/uncertain)** **Provide explanation and apparent cause (e.g., contamination, physical disturbance, other).**	No. Although area has been physically disturbed, signs of stress on the mesa-top plant life are not apparent. Stressors on wildlife do not appear to be significant either because there are abundant signs of wildlife using the area.
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.**	NA

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.

This section is 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.)**	No. All PRSs have SVOC, pesticide, and PCB data. Site-specific information and data gaps include limited radiological data and no information about VOCs or inorganics for PRSs 0-004 and 0-030(l), and inorganic data but no information about VOCs or radiological data for PRS 0-033(b). The above data gaps increase uncertainties regarding the nature and extent of 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 be aggregated to characterize potential ecological risk.)**	No. Existing data do not address the potential for surficial transport of site contaminants off the mesa top (see above). For example, the west drainage of PRS 0-004 was not sampled, and limited information exists for contaminants potentially draining onsite (e.g., no metals data for 0-004 drainage). The berm that was built before 1951 collects and directs runoff but surficial data are lacking. Proposed sampling will address data gaps for areal extent and nature of contamination.

Additional Field Notes:

Provide additional field notes on the site setting and potential ecological receptors. The area was heavily disturbed by remedial actions associated with VCAs, although vegetative regrowth has become well-established.

D-2.3 Part C—Ecological Pathways Conceptual Exposure Model

Provide answers to questions A to V in order to develop the 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-m^3/mol and molecular weight <200 g/mol).**

Answer (likely/unlikely/uncertain): uncertain

Provide explanation:

VOCs have not been quantified previously for the 6th Street Warehouse PRSs. Process knowledge indicates that a potential source term exists for VOCs [PRS 0-033(a) USTs]. However, the USTs at PRS 0-033(a) were remediated in 1996. Unspecified crystallized solvents (PRS 0-004) were washed onto the site soils, and fuel-related USTs were located upgradient from sites.

Because of their high volatility, residual VOCs could have dissipated from the surface soil. The extent to which VOCs are present is unknown.

Question B:

Could the soil contaminants reach receptors via 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:

Extensive ground cover would prohibit air entrainment of contamination on particulates on the mesa top. Signs of burrowing activity (e.g., tunnels) were observed. Persistent organics (pesticides, SVOCs) were detected in subsurface. Dust inhalation could be a pathway for fossorial mammals.

Question C:

Can contaminated soil be transported to aquatic ecological communities? (Use the SOP-2.01 runoff score and terminal point of surface-water runoff to help answer this question.)

- **If the SOP-2.01 runoff score* for each PRS included in the site is equal to 0, this suggests that erosion at the site is not a transport pathway. (*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 were no visible signs of runoff discharging offsite, or of erosion. Therefore, contaminated soil is not expected to be transported off the mesa top into Los Alamos Canyon below. There is no aquatic habitat on the mesa top or hillslope. Potential impact of aquatic habitat in Los Alamos Canyon is unlikely given the distance from the mesa top to the ephemeral stream in the canyon.

Question D:

Is contaminated groundwater potentially available to biological receptors via 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 deep).**
- **Terrestrial wildlife receptors generally will not contact groundwater unless it is discharged to the surface.**

Answer (likely/unlikely/uncertain): unlikely

Provide explanation:

Offsite groundwater contamination is unlikely from mesa-top surface transport into Los Alamos Canyon for the following reasons: the potential for surface erosion is low, based on a lack of evidence for offsite transport; the depth to groundwater is about 600 ft, which would preclude groundwater as a significant exposure pathway.

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 deep).**
- **Terrestrial wildlife receptors generally will not contact groundwater unless it is discharged to the surface.**

Answer (likely/unlikely/uncertain): unlikely

Provide explanation:

The depth to groundwater is over 1000 ft from the mesa-top surface.

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 erodibility of surficial material and the geologic processes of canyon/mesa edges.**

Answer (likely/unlikely/uncertain): surface=unlikely; subsurface=likely

Provide explanation:

Vegetative cover overlies the surface contamination. There is evidence of upgradient surface flow coming into the sites, but existing BMPs (berm, riprap, and geotextile) appear to be a termination point for surface flow. Subsurface erosion could be a release mechanism because subsurface PRSs [e.g., PRS 0-030(l)] daylight at the cliff face.

Question G:

Could airborne contaminants interact with receptors via 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: 2

Terrestrial animals: 2

Provide explanation:

Volatile chemicals were not quantified in fill material or soil on the mesa top. Volatiles are typically lost rapidly from surface soil, and at least 5 years have passed since volatile source terms were remediated. However, the extent to which this is the case is uncertain because VOC data were not collected. If present, volatiles could represent an exposure pathway for burrowing animals, but the contribution of inhalation to exposure is considerably less important (order of magnitude or more) than other routes (e.g., soil ingestion).

Question H:

Could airborne contaminants interact with plants via deposition of particulates or with animals via 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:

Ground cover should minimize entrainment of dust particles and pathway to aboveground receptors is likely minor. However, dust could be a pathway for fossorial animals.

Question I:

Could contaminants interact with plants via 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:

Root uptake could be an important transport mechanism. Root uptake is most important for chemicals that can partition into soil aqueous phases. Metals go into solution readily, but metals data are limited for the PRSs. Rain splash could represent a minor contaminant transport pathway.

Question J:

Could contaminants interact with receptors via 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: 3

Provide explanation:

Several measured constituents (e.g., DDE, DDT, chlordane, endrin, BEHP, DBP, Aroclor-1260) are known bioaccumulators. Bioaccumulators in surficial soils make transport and bioaccumulation of contaminants via terrestrial pathways more likely.

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: 3

Provide explanation:

Surface releases have occurred at the 6th Street Warehouse PRSs. Contaminants in surficial soils could interact with receptors via incidental ingestion or grooming themselves clean of soil.

Question L:

Could contaminants interact with receptors via 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: 2

Provide explanation:

The majority of measured analytes are organic contaminants that are lipophilic and can cross epidermal barriers. This makes exposure via dermal contact with surficial soils a pathway. Fur and feathers act as barriers to dermal uptake and dermal uptake is less important than other pathways such as ingestion.

Question M:

Could contaminants interact with plants or animals via 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: 3

Terrestrial animals: 3

Provide explanation:

Gamma-emitting radionuclides (e.g., cesium-137) were detected in surficial soils. It is likely that receptors will come into contact with radionuclides.

Question N:

Could contaminants interact with plants via direct uptake from water and sediment or sediment rain splash?

- **Contaminants may be taken up by terrestrial plants whose roots are in contact with the surface waters.**
- **Terrestrial plants may be exposed to particulates deposited on leaf and stem surfaces by rain striking the contaminated sediments (i.e., rain splash) in an area that is only periodically inundated with water.**
- **Contaminants in the 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:

Contaminants detected in surficial soils. Transport via rain splash could deposit dissolved and particle-bound contamination on plants.

Question O:

Could contaminants interact with receptors via 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:

No aquatic environment exists on the mesa top or the hillslope.

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 the 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:

No aquatic environment exists on the mesa top or the hillslope.

Question Q:

Could contaminants interact with receptors via 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:

No aquatic environment exists on the mesa top or the hillslope.

Question R:

Could contaminants interact with plants or animals via 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:

No aquatic habitat exists on the mesa top or the hillslope.

Question S:

Could contaminants bioconcentrate in free-floating aquatic or attached aquatic plants, or in emergent vegetation?

- **Aquatic plants are in direct contact with water.**
- **Contaminants in the 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:

No aquatic environment exists on the mesa top or the hillslope

Question T:

Could contaminants bioconcentrate in sedimentary or water column organisms?

- **Aquatic receptors may actively or incidentally ingest the sediment while foraging.**
- **Aquatic receptors may be directly exposed to contaminated sediments or may be exposed to contaminants via osmotic exchange, respiration, or ventilation of the sediment pore waters.**
- **Aquatic receptors may be exposed via 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:

No aquatic environment exists on the mesa top or the hillslope

Question U:

Could contaminants bioaccumulate in sedimentary or water column organisms?

- **Lipophillic organic contaminants and some metals may concentrate in an organism's tissues.**
- **Ingestion of contaminated food items may result in contaminant bioaccumulation via 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:

No aquatic environment exists on the mesa top or the hillslope

Question V:

Could contaminants interact with aquatic plants or animals via 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

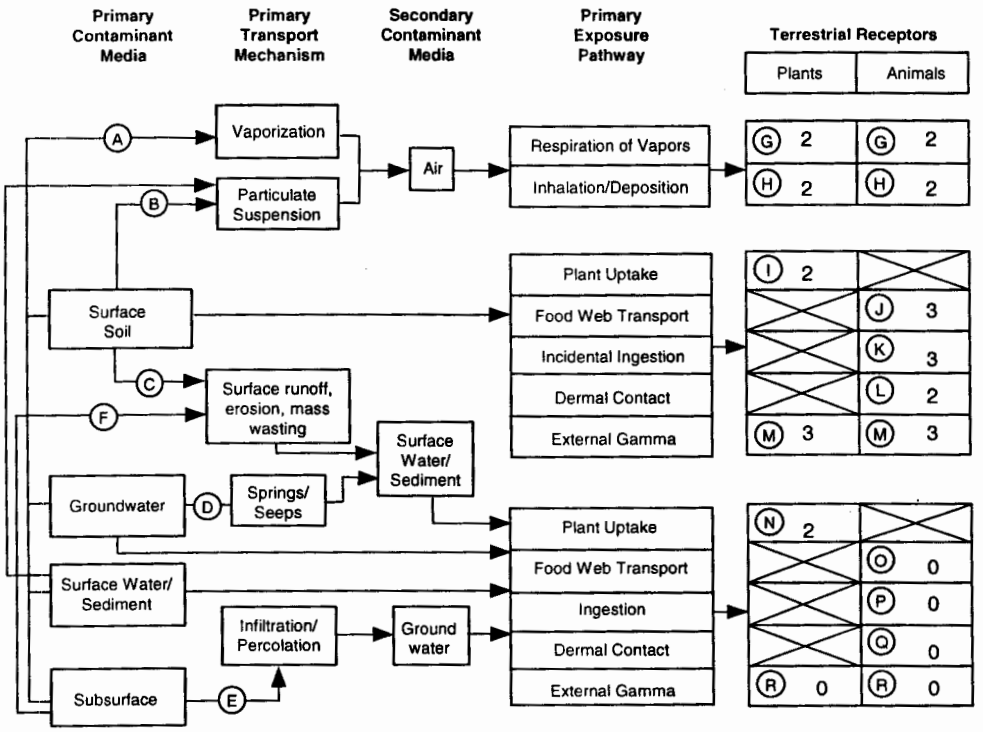
Aquatic animals: 0

Provide explanation:

No aquatic environment exists on the mesa top or the hillslope.

Ecological Scoping Checklist
Terrestrial Receptors
Ecological Pathways Conceptual Exposure Model

NOTE:
Letters in circles refer to questions on the Scoping Checklist



Signatures and certifications:

Checklist completed by (provide name, organization and phone number):

Name (printed): James Markwiese

Name (signature): James Markwiese

Organization: Neptune & Company

Phone number: 505-662-0707 (ext. 24)

Date completed: 28 September 01

Verification by a member of the ER Project Ecological Risk Task Team (provide name, organization and phone number):

Name (printed): Randall Ryti

Name (signature): Randall Ryti

Organization: Neptune & Company

Phone number: 505-662-0707 (ext. 12)

D-3.0 PRSs 0-030(b,m)

D-3.1 Part A—Scoping Meeting Documentation

Site ID	6th Street Leach Field and Septic Tank PRSs: 0-030(b,m)
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.	Solid and liquid wastes include VOCs, SVOCs, pesticides, PCBs, metals, and radionuclides. PRS 0-030(b) consists of soil contamination within and around two diversion boxes that directed sewage flow to two septic tanks. These tanks served 6th Street Warehouses 1/4, an office building, the cold storage plant, and the eastern portion of TA-1. The diversion boxes are located adjacent to 6th Street, between the street and Warehouse 1. In addition, 0-030(b) has contamination associated with drain lines and outfalls. PRS 0-030(m) consisted of a single wooden septic tank with VCP drain lines that received excess liquids of unknown chemical content from trash containers before incineration of the municipal and sanitary waste. The outlet ran east along the mesa edge for about 36 ft before connecting to the outfall line from 0-030(b), prior to discharging into Los Alamos Canyon.
List of primary impacted media **(Indicate all that apply.)**	**Surface soil** – While contamination was originally limited to the subsurface, at least PRS 0-030(b) has experienced significant recontouring activities following relocation of the former trailer park. This could bring previously buried waste to the surface (e.g., as evidenced by numerous shards of previously buried VCP observed throughout site). Discharge from outfalls could also have impacted surface soils. **Surface water/sediment** – NA **Subsurface** – Septic tank and leach field releases occurred in the subsurface. **Groundwater** – NA **Other; explain** – NA
FIMAD vegetation class based on ArcView vegetation coverage **(Indicate all that apply.)**	**Water** – NA **Bare ground/unvegetated** – NA **Spruce/fir/aspen/mixed conifer** – NA **Ponderosa pine** – NA **Piñon-juniper/juniper savannah** – NA **Grassland/shrubland** – NA **Developed** – YES
Is T&E habitat present? **If applicable, list species known or suspected to use the site for breeding or foraging.**	PRS location information was intersected with T&E species habitat using GIS. The PRSs are in the vicinity of potential Mexican spotted owl nesting habitat, approximately 0 to 450 ft away from the potential habitat in Los Alamos Canyon and approximately 1000 to 1800 ft from the potential habitat in Pueblo Canyon. The PRSs are entirely within an area in which the Mexican spotted owl can be conservatively assumed to forage at a relatively high frequency.
Provide list of neighboring/ contiguous/upgradient sites. Include a brief summary of COPCs and the form of releases for relevant sites. Reference a map as appropriate. **(Use this information to evaluate the need to aggregate sites for screening.)**	Sites are located south of the intersection between DP Road and Trinity Drive on the top and upper slopes of the East Mesa north of Los Alamos Canyon. The Canyon defines the southern boundary and DP Road defines the northern boundary. Surface contamination from DP Road may impact the northern boundary of the site. PRSs 0-030(b) and 0-030(m) are aggregated because of their linkage through common drain-line piping.

Surface-water erosion potential information **Summarize information from SOP-2.01, including the runoff subscore (maximum of 46), terminal point of surface-water transport, slope, and surface-water runon sources.**	The PRSs have a combined erosion matrix potential score of 17.5 each (Appendix C). There is evidence of runoff discharge, but no evidence of visible erosion at the sites. The surface water runoff subscores are both 6.9. Surface water terminates by infiltration at the western edge of BV Canyon.
Other scoping meeting notes	None

D-3.2 Part B—Site Visit Documentation

Site ID	6th Street Leach Field PRSs: 0-030(b,m)
Date of site visit	21 September 2001
Site visit conducted by	Jim Markwiese, Tracy McFarland. Ralph Perona, John Tauxe, Randall Ryti

Receptor Information:

Estimate cover.	**Relative vegetative cover (high, medium, low, none)** = high **Relative wetland cover (high, medium, low, none)** = NA **Relative structures/asphalt, etc., cover (high, medium, low, none)** = very low
Field notes on the FIMAD vegetation class to assist in ground-truthing the ArcView information	The mesa-top area of the 6th Street leach field PRSs has undergone heavy commercial and urban development. Soils have previously been disturbed, primarily through bulldozing the leach field [PRS 0-030(b)] and, to a lesser extent, through excavation and backfilling [e.g., around PRS 0-030(m)]. The area is characteristic of disturbed sites undergoing secondary succession. There is ample ground cover of forbs and grasses. Shallow soil has resulted in scattered patches of exposed tuff.
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.	NA [See comments Part A, T&E habitat]
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 mesa-top soils are exposed in a few patches; in some cases down to bedrock. The soils primarily support a continuous cover of grasses and forbs (chamisa, aster, mullein, and sunflower). The growth is characteristic of a disturbed area undergoing secondary succession. Ponderosa pine stands and other trees surround the area. Mature trees are mainly limited to the periphery of the leach field. Signs of animal life on the mesa top include numerous harvester ant mounds and evidence of small mammal usage, such as abundant gopher burrowing and rabbit scat. Deer scat was observed as well.

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).**	Runoff and infiltration from rain events and snowmelt are the only aspects of surface-water hydrology at the septic tank PRSs. Surface transport from overland flow and outfalls may cause contaminants to become potentially concentrated in drainages and may drive contaminants into subsurface soils/tuff.

Are there any off-site transport pathways (surface water, air, or groundwater)? **(yes/no/uncertain)** **Provide explanation.**	Uncertain. Aeolian (wind-driven) contaminant entrainment and transport is unlikely because of the extensive vegetation cover. However, surface-water transport off the mesa top is possible. Considering the depth to groundwater, contamination of groundwater is unlikely.
Interim action needed to limit off-site transport? **(yes/no/uncertain)** **Provide explanation/ recommendation to project lead for IA SMDP.**	No. While offsite transport to the north edge of Los Alamos Canyon was observed, there are no visible signs of erosion at the sites. Where asphalt is not present, vegetative cover is holding down the shallow soil across the majority of the area.

Ecological Effects Information:

Physical disturbance **(Provide a list of major types of disturbances, including erosion and construction activities; review historical aerial photos where appropriate.)**	Extensive contouring of the site, in addition to excavation and backfilling from prior VCAs, has disturbed the site.
Are there obvious ecological effects? **(yes/no/uncertain)** **Provide explanation and apparent cause (e.g., contamination, physical disturbance, other).**	No. Although the area has been physically disturbed, signs of stress on the mesa-top plant life are not apparent. Stressors on wildlife do not appear to be significant either, because there are abundant signs of wildlife using the area.
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

No Exposure/Transport Pathways:

If there are no complete exposure pathways to ecological receptors onsite and no transport pathways to off-site 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.

This section is 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.)**	Data collection concentrated on the eastern portion of PRS 0-030(b), around the septic tanks. Little information exists for media moving west into the leach field. Both PRSs have SVOC, pesticide, non-rad inorganic, radionuclide, and PCB data. Site-specific information exists for subsurface VOCs at PRS 0-030(b). PRS 0-030(m) has rad data, but no information on VOCs or metals. Much of the sampling for both PRSs was limited to sludge within septic tanks. Several samples were taken in the vicinity of the drain lines in order to document the extent of contamination associated with the piping.
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 be aggregated to characterize potential ecological risk.)**	No. Observed drainage patterns indicate that surficial transport of site contaminants off the mesa top and into Los Alamos Canyon exist, but existing data are insufficient to address what contaminants could be present in the surface flow. For example, pipeline samples represent only a small fraction of the total piping under the leach field. Data gaps exist for metals [PRS 0-030(m,] which available evidence shows to be elevated [PRS 0-030(b)]. Proposed sampling activity will address data gaps for areal extent and nature of the contamination.

Additional Field Notes:

Provide additional field notes on the site setting and potential ecological receptors.

Numerous examples of shattered VCP and cobbles were observed. Also, coal was observed across the surface soils. The area was leveled after relocation of the trailers, and this contouring significantly disturbed land. Numerous examples of bioturbation from gopher burrowing and ant (large harvester ant mounds) activity were observed.

D-3.3 Part C—Ecological Pathways Conceptual Exposure Model

Provide answers to questions A to V in order to develop the 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-m^3/mol and molecular weight <200 g/mol).**

Answer (likely/unlikely/uncertain): uncertain

Provide explanation:

VOCs have been quantified previously in only the subsurface (5 to 15 ft) for PRS 0-030(b). PRS 0-030(m) was never sampled for VOCs, and there is no information on surficial VOCs for PRS 0-030(b). Given their high volatility, however, residual VOCs could have dissipated (especially considering the time between active source terms and the rapid loss of VOCs from surface soil). The extent to which VOCs are still present is unknown.

Question B:

Could the soil contaminants reach receptors via fugitive dust carried in the 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:

Extensive ground cover would prohibit air entrainment of contamination on particulates on the mesa top. Signs of burrowing activity (e.g., tunnels) were observed. Persistent organics (pesticides) were detected in the subsurface soils. Dust inhalation could be a likely pathway for fossorial mammals.

Question C:

Can contaminated soil be transported to aquatic ecological communities? (Use SOP-2.01 runoff score and terminal point of surface water runoff to help answer this question.)

- **If the SOP-2.01 runoff score* for each PRS included in the site is equal to 0, this suggests that erosion at the site is not a transport pathway. (*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:

Visible evidence of runoff discharge offsite indicates that contaminated soil could be transported off the mesa top. However, the canyon bottom is outside of the assessment boundary; only the mesa top and hillslopes are under consideration. There is no aquatic habitat on the mesa top or the hillslopes. Potential impact on aquatic habitat in Los Alamos Canyon is unlikely considering the distance from the mesa top to the ephemeral stream in the canyon.

Question D:

Is contaminated groundwater potentially available to biological receptors via 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 the groundwater unless it is discharged to the surface.**

Answer (likely/unlikely/uncertain): unlikely

Provide explanation:

Signs of off-site surface water transport into BV Canyon were observed, but contaminants are unlikely to affect groundwater because the depth to groundwater is about 600 ft.

Question E:

Is infiltration/percolation from contaminated subsurface material a viable transport and exposure pathway?

- **Suspected ability of contaminants to migrate to the 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 the groundwater present within the root zone (~1 m depth).**
- **Terrestrial wildlife receptors generally will not contact the groundwater unless it is discharged to the surface.**

Answer (likely/unlikely/uncertain): unlikely

Provide explanation:

Depth to groundwater is over 1000 ft from the surface of the mesa top, and no hydraulic driver exists to push the contamination that far into the subsurface.

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 erodibility of surficial material and the geologic processes of canyon/mesa edges.**

Answer (likely/unlikely/uncertain): unlikely

Provide explanation:

Subsurface erosion is an unlikely release mechanism because subsurface PRSs are at some distance (about 25 ft) from the cliff face.

Question G:

Could airborne contaminants interact with receptors via 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: 2

Terrestrial animals: 2

Provide explanation:

Volatile chemicals were not quantified in fill material or in soil on the mesa top. Typically, volatiles are lost rapidly from surface soils, and at least 5 years have passed since volatile source terms were remediated. However, the extent to which exposure to volatiles is important is uncertain because, aside from the septic tank underlying the paved area at PRS 0-030(b) (at 5 to 15 ft bgs), VOC data were not collected. If present, volatiles could represent an exposure pathway for burrowing animals, but the contribution of inhalation to exposure is considerably less important (order of magnitude or more) than other routes (e.g., soil ingestion).

Question H:

Could airborne contaminants interact with plants via deposition of particulates or with animals via 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:

Ground cover should minimize entrainment of dust particles, and a pathway to aboveground receptors is likely minor. However, dust could be a pathway for fossorial animals.

Question I:

Could contaminants interact with plants via 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:

Root uptake could be an important transport mechanism. For example, deep-rooted chamisa is present, which could represent a means of subsurface material being brought to the surface. Also, surface metals can be taken up by more shallow-rooted plants, but surficial metals data are limited. Rain splash could represent a minor contaminant transport pathway.

Question J:

Could contaminants interact with receptors via 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: 3

Provide explanation:

Several COPCs [e.g., benzo(a)anthracene, benzo(a)pyrene, chrysene, DDE, and DDT] are known bioaccumulators. Bioaccumulators in surficial soils make transport and bioaccumulation of contaminants via terrestrial pathways more likely.

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: 3

Provide explanation:

Contaminants could interact with receptors via incidental ingestion of surficial soils or grooming themselves clean of soil. However, little information exists for surficial soils (<2 ft). While the contamination extent was originally confined to the subsurface, regrading of the leach field could have distributed buried contaminated material to the surface.

Question L:

Could contaminants interact with receptors via 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: 2

Provide explanation:

Measured analytes consisted of organic contaminants that are lipophilic and can cross epidermal barriers. This makes exposure via dermal contact with surficial soils a pathway. Fur and feathers act as barriers to dermal uptake; dermal uptake is less important than other pathways such as ingestion. While the contamination extent was originally confined to the subsurface, tilling of the leach field could have distributed buried contaminated material to the surface.

Question M:

Could contaminants interact with plants or animals via 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: 2

Terrestrial animals: 2

Provide explanation:

Gamma-emitting radionuclides were detected at low levels in subsurface soils. However, the extent of surficial contamination (i.e., the soil depths with the highest exposure potential) is unclear. Because of significant soil regrading activities, it is possible that receptors will come into contact with previously buried radionuclides.

Question N:

Could contaminants interact with plants via direct uptake from water and sediment or sediment rain splash?

- **Contaminants may be taken up by terrestrial plants whose roots are in contact with the surface waters.**
- **Terrestrial plants may be exposed to particulates deposited on leaf and stem surfaces by rain striking the contaminated sediments (i.e., rain splash) in an area that is only periodically inundated with water.**
- **Contaminants in the 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:

Rain splash transport of surficial contaminants could deposit dissolved and particle-bound contamination on plants.

Question O:

Could contaminants interact with receptors via 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:

No aquatic environment exists on the mesa top or the hillslope.

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 these 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:

No aquatic environment exists on the mesa top or the hillslope.

Question Q:

Could contaminants interact with receptors via 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:

No aquatic environment exists on the mesa top or the hillslope.

Question R:

Could contaminants interact with plants or animals via 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:

No aquatic environment exists on the mesa top or the hillslope.

Question S:

Could contaminants bioconcentrate in free-floating aquatic or attached aquatic plants, or emergent vegetation?

- **Aquatic plants are in direct contact with water.**
- **Contaminants in the 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:

No aquatic environment exists on the mesa top or the hillslope.

Question T:

Could contaminants bioconcentrate in sedimentary or water column organisms?

- **Aquatic receptors may actively or incidentally ingest sediments while foraging.**
- **Aquatic receptors may be directly exposed to contaminated sediments or may be exposed to contaminants via osmotic exchange, respiration, or ventilation of sediment pore waters.**
- **Aquatic receptors may be exposed via 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:

No aquatic environment exists on the mesa top or the hillslope.

Question U:

Could contaminants bioaccumulate in sedimentary or water column organisms?

- **Lipophillic 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:

No aquatic environment exists on the mesa top or the hillslope.

Question V:

Could contaminants interact with aquatic plants or animals via 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

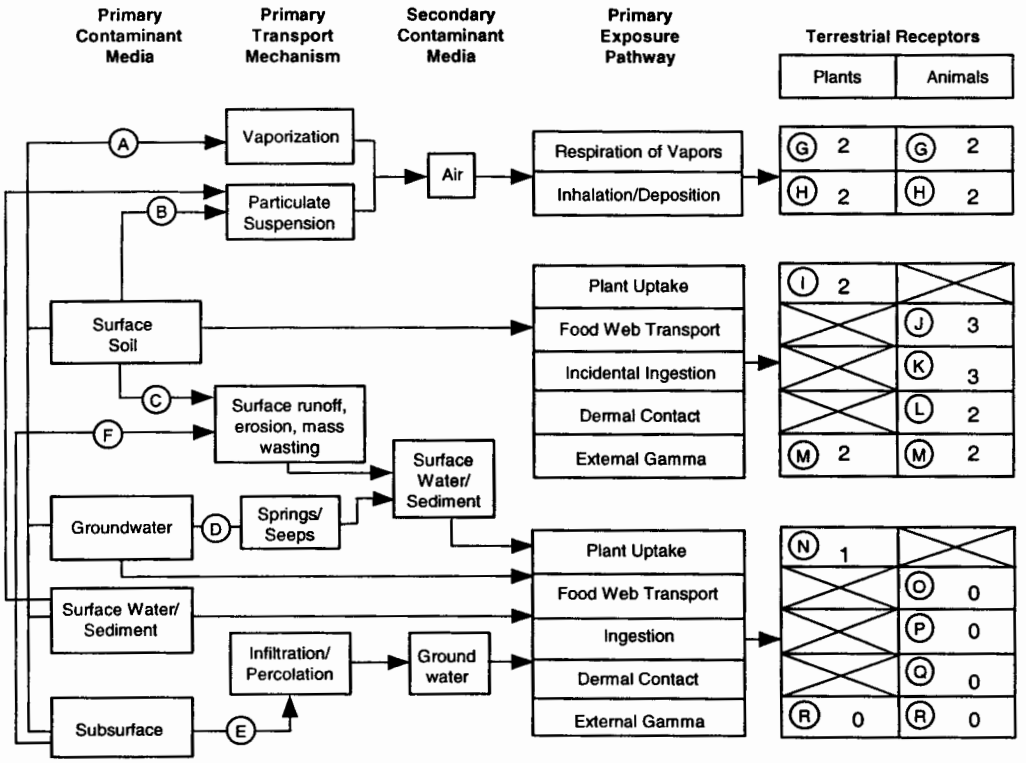
Aquatic animals: 0

Provide explanation:

No aquatic environment exists on the mesa top or the hillslope.

Ecological Scoping Checklist
Terrestrial Receptors
Ecological Pathways Conceptual Exposure Model

NOTE:
Letters in circles refer to questions on the Scoping Checklist



Signatures and certifications:

Checklist completed by (provide name, organization and phone number):

Name (printed): Jim Markwiese

Name (signature):

Organization: Neptune & Company

Phone number: 505-662-0707 (ext. 24)

Date completed: 28 September 01

Verification by a member of the ER Project Ecological Risk Task Team (provide name, organization and phone number):

Name (printed): Randall Ryti

Name (signature):

Organization: Neptune & Company

Phone number: 505-662-0707 (ext. 12)

D-4.0 PRSs 0-029(a,b,c)

D-4.1 Part A—Scoping Meeting Documentation

Site ID	PRSs 0-029(a,b,c)
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.	Liquid wastes limited to leakage from transformers containing PCB-bearing oil. The transformers were located on power poles used to supply electricity to the groundwater production wells associated with the PRSs. Leaked oil would have primarily affected areas directly below the transformers.
List of primary impacted media **(Indicate all that apply.)**	**Surface soil** – PCB-oil leaks may have impacted the surface soils. **Surface water/sediment** – NA **Subsurface** – NA **Groundwater** – NA **Other, explain** – NA
FIMAD vegetation class based on ArcView vegetation coverage **(Indicate all that apply.)**	**Water** – NA **Bare ground/unvegetated** – NA **Spruce/fir/aspen/mixed conifer** – NA **Ponderosa pine** – NA **Piñon juniper/juniper savannah** Yes **Grassland/shrubland** – NA **Developed** – NA
Is T&E habitat present? **If applicable, list species known or suspected to use the site for breeding or foraging.**	PRS location information was intersected with T&E species habitat using GIS. PRSs 0-029(a,b) are not in the vicinity of any potential T&E species habitat. PRS 0-029(c) is in the vicinity of potential Mexican spotted owl nesting habitat, located approximately 1 mi away. The Mexican spotted owl and bald eagle can be conservatively assumed to forage at very low frequency at PRSs 0-029(a,b). The Mexican spotted owl can be conservatively assumed to forage at a moderate frequency at PRS 0-029(c).
Provide list of neighboring/ contiguous/upgradient sites. Include a brief summary of COPCs and the form of releases for relevant sites. Reference a map as appropriate. **(Use this information to evaluate the need to aggregate sites for screening.)**	PRSs 0-029(a,b) are located adjacent to the intermittent stream bed in Los Alamos Canyon near Totavi; PRS 0-029(c) is located in the Santa Fe National Forest in Guaje Canyon, approximately 2 mi directly north. Despite the spatial scale separating PRSs 0-029(a,b) from PRS 0-029(c), these sites have been aggregated because of they share a nature of site contamination; that is, PCB-bearing oil leaked from transformers.
Surface-water erosion potential information **Summarize information from SOP-2.01, including the runoff subscore (maximum of 46), terminal point of surface water transport, slope, and surface water runon sources.**	PRS 0-029(a) had an erosion matrix score of 38.7 (out of 100). There is visible evidence of discharge at the site, and factors (i.e., the runoff subscore) affecting surface-water runoff combined account for 17.9 of 46 points. PRS 0-029(b) has an erosion matrix score of 42.8, with a runoff subscore of 24. PRS 0-029(c) has an erosion matrix score of 31.8, with a runoff subscore of 0. PRSs 0-029(a,b) are close enough to downslope streambeds (about 50 ft) to potentially impact surface water. Contamination from PRS 0-029(c) is unlikely to affect surface water due to its lack of runoff potential and its distance from streambed (200 ft).
Other scoping meeting notes	The stream in Los Alamos Canyon was flowing during the site visit on January 15, 2002. The Guaje Canyon streambed was dry at the time of the site visit.

D-4.2 Part B—Site Visit Documentation

Site ID	PRSs 0-029(a,b,c)
Date of site visit	15 January 2002
Site visit conducted by	Jim Markwiese, Tracy McFarland, Randall Ryti, Randy Johnson, Terry Rust, Gerald Martinez

Receptor Information:

Estimate cover.	**Relative vegetative cover (high, medium, low, none)** = medium [PRS 0-029(c)] and high [PRSs 0-029(a,b)] **Relative wetland cover (high, medium, low, none)** = NA **Relative structures/asphalt, etc., cover (high, medium, low, none)** = very low
Field notes on the FIMAD vegetation class to assist in ground-truthing the ArcView information	PRSs 0-029(a,b) had ground cover of forbs (primarily chamisa and sagebrush) and grasses. The grasses and shrubs covering the surface of PRS 0-029(b) were disturbed (apparently flattened by vehicular traffic). The northern half of PRS 0-029(c) is sparsely vegetated with native grasses. Piñon and juniper trees border the periphery of the sites.
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.	NA [See comments Part A, T&E habitat.]
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 soils primarily support a cover of grasses and forbs (chamisa and sagebrush). Signs of animal life on the mesa top include evidence of small mammal usage (burrows) and scat (likely coyote).

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).**	Signs of runoff from rain events and/or snowmelt were evident at 0-029(a). Surface transport from overland flow off New Mexico highway 502 may cause potential contaminants to become concentrated in drainages and may drive contaminants into subsurface soils/tuff at 0-029(a,b). Signs of runoff from 0-029(b,c) were not evident.
Are there any off-site transport pathways (surface water, air, or groundwater)? **(yes/no/uncertain)** **Provide explanation.**	Yes. Surface water transport to stream bed from 0-029(a,b) is possible. Water transport via erosion from 0-029(c) is not likely given the lack of contributing factors from surface water runoff. Groundwater could be impacted by precipitation events driving PCBs into subsurface. Aeolian (wind-driven) contaminant entrainment and transport is unlikely due to the fairly developed vegetation cover and the low volatility of PCBs.
Interim action needed to limit off-site transport? **(yes/no/uncertain)** **Provide explanation/ recommendation to project lead for IA SMDP.**	Uncertain. Interim action is not necessary at 0-029(b,c) because there was no evidence of runoff from the sites and fairly low, or no, potential for surface erosion. There was evidence of a rill created under the transformer at 0-029(a) at the northeast corner that flowed across the eastern perimeter of the PRS.

Ecological Effects Information:

Physical disturbance **(Provide a list of major types of disturbances, including erosion and construction activities; review historical aerial photos where appropriate.)**	PRS 0-029(c) had the most physical disturbance, as evidenced by a denuded flora over approximately half of the site. The vegetation was moderately disturbed (flattened grass and forbs) at PRS 0-029(b), probably because of vehicular traffic. The vegetation was minimally disturbed at 0-029(a) because of the chain-link fence enclosure; the disturbance that was evident resulted from the rill passing along the eastern periphery of the site.
Are there obvious ecological effects? **(yes/no/uncertain)** **Provide explanation and apparent cause (e.g., contamination, physical disturbance, other).**	No. Although two of the PRSs, 0-029(b,c), have been moderately disturbed, signs of stress on the mesa-top plant life were limited to what appeared to be physical (traffic) rather than chemical stressors. Stressors on wildlife do not appear to be significant either; there are abundant signs of wildlife using the area (e.g., evidence of burrowing activity and scat).
Interim action needed to limit apparent ecological effects? **(yes/no/uncertain)** **Provide explanation recommendation to mitigate apparent exposure pathways to project lead for IA SMDP.**	No

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 the likelihood that future construction activities could make contamination more available for exposure or transport.

This section is 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.)**	No. Contamination associated with the PRSs is limited to PCBs from oil leaking from the transformers. Previous investigations indicate that the PCB concentrations in soil around the transformers were non-detectable [PRS 0-029(b)] or infrequently detected at very low concentrations. PRS 0-029(a) had a maximum detected concentration of 0.4 ppm in the soil outside the well house (2.3 ppm inside the well house). Even though detected concentrations were well below the regulatory cleanup level of 10 ppm, approximately 20 yd^3 of soil were removed from the site. PRS 0-029(c) had a detection rate of <5% (1 detect in 21 samples), at a maximum concentration of 0.09 ppm PCB. Despite the relative lack of PCB detects, the low PCB concentrations where they were detected, and the cleanup at the site with the most PCBs, the site will be resampled for PCBs because the data associated with these past investigations are unavailable.

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 be aggregated to characterize potential ecological risk.)**	No. Previous investigations indicated that PCB contamination associated with all three PRSs is minimal. However, the data package and validation information to support this presumption for these PRSs is unavailable. Consequently, proposed sampling activity will re-address data gaps regarding the presence and/or areal extent of PCB contamination.

Additional Field Notes:

Provide additional field notes on the site setting and potential ecological receptors.

The sites are all within fairly close proximity (50 to 200 ft) to intermittent watercourses. The site closest to an actively flowing stream—PRS 0-029(a)—in Los Alamos Canyon had the highest potential for surface water erosion. This is the site where approximately 20 yd^3 of soil were previously removed. There was no sign of runoff from the next closest PRS to the stream in Los Alamos Canyon, PRS 0-029(b). There was estimated to be no erosion potential from PRS 0-029(c) to the adjacent stream in Guaje Canyon (which was dry at the time of the field visit).

D-4.3 Part C—Ecological Pathways Conceptual Exposure Model

Provide answers to questions A to V in order to develop the 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-m^3/mol and molecular weight <200 g/mol).**

Answer (likely/unlikely/uncertain): unlikely

Provide explanation:

PCBs are nonvolatile.

Question B:

Could the soil contaminants reach receptors via 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): unlikely

Provide explanation:

Fairly extensive ground cover would prohibit air entrainment of contamination on particulates at most of the PRSs. The non-volatile nature and relative lack of detectable PCBs at the PRSs indicate that exposure to burrowing animals is unlikely. While roughly half of the surface of PRS 0-029(c) is exposed soil/sand (potentially facilitating air entrainment), the source of potential contamination was removed 15 years ago and past records indicate that PCBs were largely undetectable in soils.

Question C:

Can contaminated soil be transported to aquatic ecological communities? (Use SOP-2.01 runoff score and terminal point of surface water runoff to help answer this question.)

- **If the SOP-2.01 runoff score* for each PRS included in the site is equal to 0, this suggests that erosion at the site is not a transport pathway. (*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:

Contaminated soil could, theoretically, be transported from PRS 0-029(a), but the low levels of PCBs detected at the site were previously remediated. Signs of surface transport (erosion) were not evident at PRS 0-029(b), and surface transport is not expected at PRS 0-029(c).

Question D:

Is contaminated groundwater potentially available to biological receptors via 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:

The groundwater in Los Alamos Canyon near the PRSs is unlikely to be affected because PCBs are highly insoluble. In addition, previous investigations indicated that surficial PCB contamination was minimal or nonexistent.

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 the 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:

The groundwater is unlikely to have been impacted at these PRSs because PCBs are insoluble or, at best, sparingly soluble. Thus, infiltration/percolation is unlikely to be a transport mechanism, and the

suspected level of contamination precludes consideration of infiltration/percolation as a significant route of exposure.

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 erodibility of surficial material and the geologic processes of canyon/mesa edges.**

Answer (likely/unlikely/uncertain): unlikely

Provide explanation:

Vegetative cover overlies most of the soil surface at the PRSs, and the reportedly low PCB levels preclude attributing much significance to erosion as a significant transport mechanism. Mass wasting is not applicable because these PRSs are located in canyon bottoms.

Question G:

Could airborne contaminants interact with receptors via 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:

PCBs are nonvolatile.

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: 1

Terrestrial animals: 1

Provide explanation:

Ground cover should minimize entrainment of dust particles, and a pathway to above-ground receptors is likely minor. However, dust could be a potential, but probably insignificant, pathway for fossorial animals (inhalation is of much less importance than other exposure routes like ingestion).

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: 1

Provide explanation:

Root uptake is an unlikely transport mechanism because hydrophobic PCBs are unlikely to enter soil pore water, thereby limiting the potential for root uptake.

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:

PCBs are known bioaccumulators. The presence of bioaccumulators in surficial soils makes possible the transport and bioaccumulation of contaminants through terrestrial pathways. However, the relative lack of contamination reported for these PRSs detracts from the importance of PCBs to food web transport considerations.

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:

Contaminants could interact with receptors through incidental ingestion of surficial soils or grooming themselves clean of soil. However, the relative lack of contamination reported for these PRSs detracts from the importance of PCBs to incidental ingestion considerations.

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:

PCBs are lipophilic and can cross epidermal barriers. This makes exposure via dermal contact with surficial soils a pathway. However, fur and feathers act as barriers to dermal uptake, so dermal uptake is less important than other pathways such as ingestion. The relative lack of contamination reported for these PRSs detracts from the importance of PCBs to dermal contact considerations.

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:

PCBs are the only COPCs at these PRSs.

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:

PCBs could deposit on plants through rain splash. However, the relative lack of contamination reported for this site detracts from the importance of PCBs to considerations related to this exposure route.

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:

Given that PCBs are highly insoluble, aquatic pathways are not applicable. Previous investigations at the PRSs indicate that PCB contamination was negligible, and sampling in the Lower Los Alamos Canyon Reach LA-4 did not provide evidence of PCB contamination.

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:

See response to Question O.

Question Q:

Could contaminants interact with receptors via 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:

See response to Question O.

Question R:

Could contaminants interact with plants or animals via 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:

The only COPCs expected at the PRSs are PCBs.

Question S:

Could contaminants bioconcentrate in free-floating aquatic or attached aquatic plants, or in 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:

See response to Question O.

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 via osmotic exchange, respiration, or ventilation of sediment pore waters.**
- **Aquatic receptors may be exposed via 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:

See response to Question O.

Question U:

Could contaminants bioaccumulate in sedimentary or water column organisms?

- **Lipophillic organic contaminants and some metals may concentrate in an organism's tissues.**
- **Ingestion of contaminated food items may result in contaminant bioaccumulation via 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:

See response to Question O.

Question V:

Could contaminants interact with aquatic plants or animals via 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

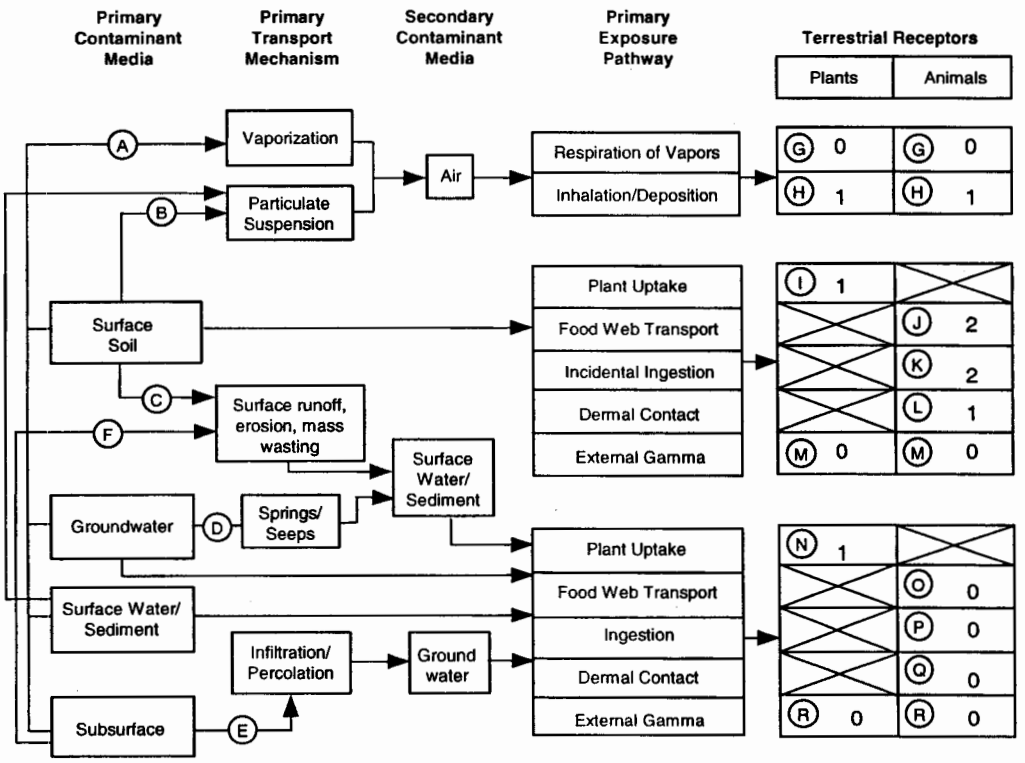
Aquatic animals: 0

Provide explanation:

PCBs are the only expected COPCs at this site.

Ecological Scoping Checklist
Terrestrial Receptors
Ecological Pathways Conceptual Exposure Model

NOTE:
Letters in circles refer to questions on the Scoping Checklist



Signatures and certifications:

Checklist completed by (provide name, organization and phone number):

Name (printed): Jim Markwiese

Name (signature):

Organization: Neptune & Company

Phone number: 505-662-0707 (ext. 24)

Date completed: 18 January 2002

Verification by a member of the ER Project Ecological Risk Task Team (provide name, organization and phone number):

Name (printed): Randall Ryti

Name (signature):

Organization: Neptune & Company

Phone number: 505-662-0707 (ext. 12)

Appendix E

Supplemental Sampling Approach

E-1.0 Introduction

The general objective of this sampling plan is to provide supplemental information to guide the need for remedial actions by the ER Project at the DP Land Transfer PRSs, where the data gathered will provide analytical results to address data gaps identified in the VCA plan. The main objective of this sampling plan is to better define the nature and extent of potential contaminants. This sampling plan is largely equivalent to activities described in the EPA-approved "RFI Work Plan for Operable Unit 1071" (LANL 1992, 0781). This sampling plan is an attachment to the VCA plan for the DP Road land transfer and is not intended to be a standalone document. For information about site history and operations and previous sampling, please read the pertinent sections of the VCA plan for each PRS. Additional detailed information can be found in the following documents:

- "RFI Work Plan for Operable Unit 1071" (LANL 1992, 0781)
- "RFI Report for Potential Release Sites 0-030(b), 0-004, 0-010(b), 0-033(b), 6th Street Warehouses" (LANL 1996, 54616)
- "Voluntary Action Completion Report for Activities at TA-0, PRSs 0-030(l), 0-030(m), and 0-033(a)" (LANL 1996, 55203)
- "Voluntary Corrective Action Plan for Potential Release Site 0-030(a)" (LANL 1996, 54353.3)
- "Voluntary Corrective Action Report for Solid Waste Management Unit 0-030(a)" (LANL 1996, 59576.1)
- "Voluntary Corrective Action Plan for Potential Release Sites at TA-0, PRSs 0-033(b) and 0-030(b)" (LANL 1996, 54760)
- "Voluntary Corrective Action Completion Report for PRSs 0-033(b) and 0-030(b)" (LANL 1996, 62536)
- "RFI Phase Report, Operable Unit 1071, SWMU Aggregate 0-G, Leakage from PCB Transformers" (LANL 1993, 26972)
- "Phase Report 1B: TA-21 Operable Unit RCRA Facility Investigation Operable Unit-Wide Surface Soil, Deposition Layer and Filter Building Investigation" (LANL 1994, 26073)

This sampling plan provides information about the conceptual site model (CSM), sampling objectives, sampling design, and data validation.

E-2.0 Conceptual Site Model

The CSM is developed to address potential contamination associated with PRSs on the land transfer property (6th Street Warehouse PRSs). The site model also addresses potential PCB contamination from transformers located on San Ildefonso Pueblo and Santa Fe National Forest property [PRSs 0-029(a,b,c)]. The conceptual model for PRS 0-027 is provided in section 4.1 of this document.

It is useful to view the 6th Street Warehouse PRSs as two distinct and related subareas: the 6th Street septic tank/leach field, and the area directly south of the warehouses. The 6th Street Warehouse PRSs on the mesa top and hillslopes are unlikely to influence aquatic receptors and habitat. PRSs 0-029(a,b,c) are located fairly close (50 to 200 ft) to potential aquatic habitat from intermittent streambeds. However, the relative lack of PCB contamination reported for PRSs 0-029 (a,b,c) and the highly insoluble nature of PCBs obviates aquatic exposure concerns for ecological receptors (Appendix D). Consequently, the 6th

Street Warehouse PRSs and PRSs 0-029(a,b,c) are presented in a single, terrestrial conceptual site model (Figure E-2.0-1).

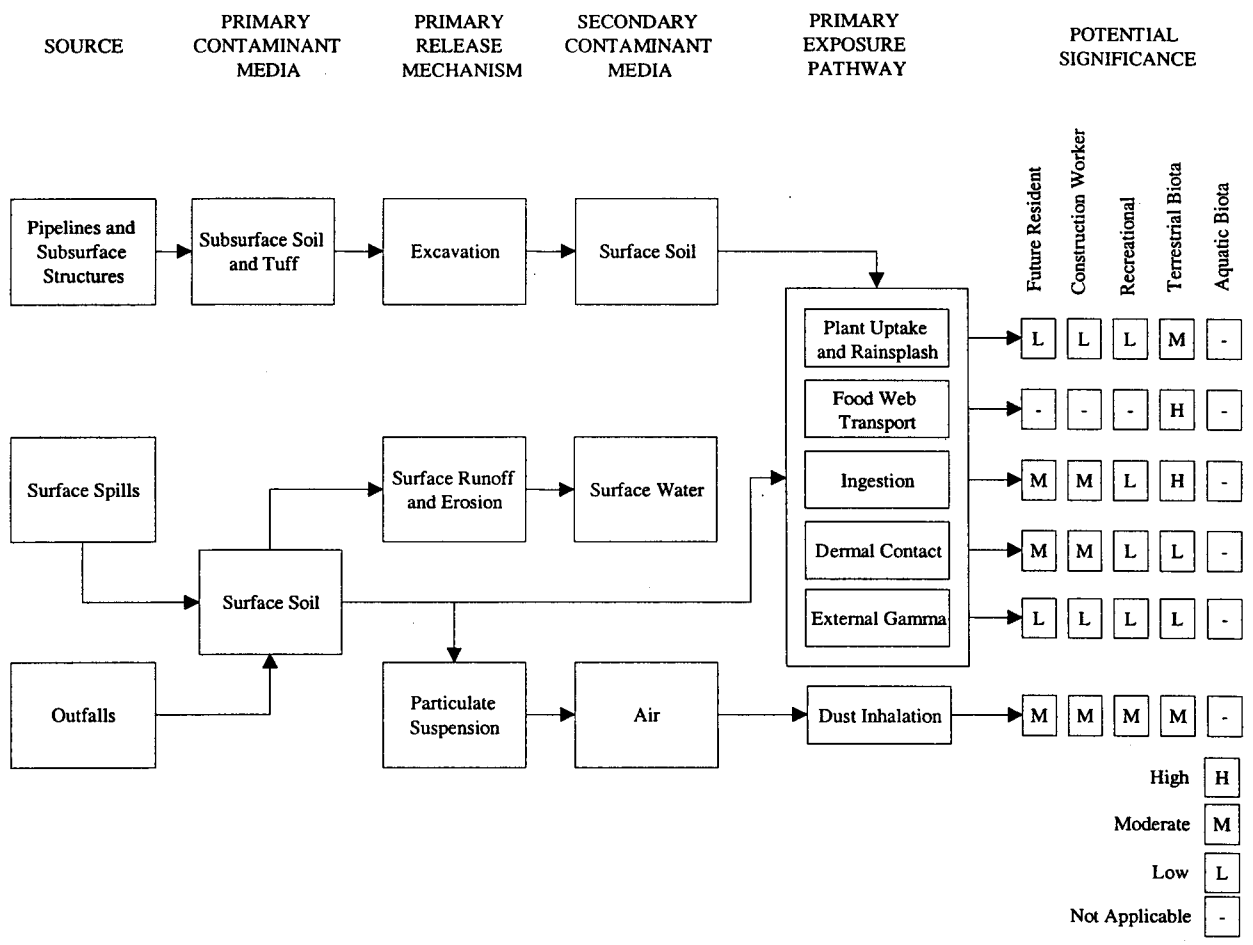


Figure E-2.0-1. CSM of contaminant transport and exposure at 6th Street Warehouse PRSs

PRSs 0-030(b,m) received sanitary and industrial wastes associated with the 6th Street Warehouses [PRS 0-030(b)] and an incineration building [PRS 0-030(m)]. More specifically, PRS 0-030(b) consists of soil contamination associated with a septic system consisting of an inlet drain line, two diversion boxes, two septic tanks, outlet drain lines, leach field, and outfall. These tanks served 6th Street Warehouses 1 through 4, an office building, the cold storage plant, and the eastern portion of Technical Area (TA)-1. The diversion boxes are located adjacent to 6th Street, between the street and Warehouse 1. PRS 0-030(m) consisted of a single wooden septic tank with VCP drain lines that received incinerated municipal and sanitary waste and excess liquids of unknown chemical content. The outlet ran east along the mesa edge for approximately 400 ft before connecting to the outlet line from 0-030(b) prior to discharging into BV Canyon. Because these leach field PRSs are linked by common drain lines, they are assessed as an aggregate.

PRSs 0-004, 0-030(l), and 0-033(b) are linked by their close proximity and because their associated releases are likely to influence a common spatial area. Waste releases include subsurface leaks from outfall pipes [PRS 0-033(b)], a septic tank and associated plumbing [PRS 0-030(l)], and surface releases from spills (PRS 0-004) or outfall pipes [PRS 0-033(b)]. The potentially impacted area is a field, located

immediately south of 6th Street Warehouses and overlying septic tanks [i.e., PRS 0-030(l) and related PRS 0-030(m)], that drains the warehouse parking lots and outfalls. This aggregate will be referred to as the 6th Street south field.

Field visits to the leach field found that the majority of the mesa-top surface has been historically disturbed as a result of bulldozing large tracts of land associated with the former trailer park. Because this area was disturbed over 50 years ago and has been unoccupied for more than 25 years, the leach field site shows evidence of advanced secondary succession. Numerous pieces of broken VCP are scattered throughout the site overlying the leach field, but little VCP debris is located outside this historical boundary, indicating that contouring of leach field soils was confined to the general area above the former drain lines. Additional scattered debris (cobble and coal) and patches of exposed tuff are also evident. The operational history associated with the PRS indicates that contamination originating in the subsurface (septic tank and drain lines) was released to the surface via outfalls and possibly as a result of soil recontouring activities. Ecological receptors are abundant, and there were regular signs of fossorial activity (gopher burrows and harvester ant mounds) in the loosely packed soil of the mesa top.

Field visits to the paved portion of PRS 0-030(b) and PRS 0-004 show a well-used road, parking area, and paved front yard of a private residence. The pavement at each of the areas is well maintained, with only minor cracks in the pavement. There is no evidence of plant or animal life.

Although much of the 6th Street south field surface has been highly disturbed by excavation and backfilling associated with previous VCAs, plant cover is abundant. Primarily, the soils support a continuous cover of shallow-rooting grasses (buffalo grass and fescue) and deeper-rooting forbs (red sorrel, chamisa, clover, aster, and sweet pea). The invasive growth is characteristic of a disturbed area undergoing secondary succession. Ponderosa pine stands and other trees surround the area. Signs of animal life on the mesa top include evidence of small mammals, including scattered gopher burrowing and observed garter snake, fence lizards, skink, and birds (e.g., raven and American robin).

The CSM for the 6th Street Warehouse PRSs is presented graphically in Figure E-2.0-1. Potential contaminant sources include warehouse drainage into the south field, septic tanks and drain lines, and outfalls. For the mesa top, this area, and the leach field site, leaks from, or the contents of, the subsurface piping and septic tanks [e.g., PRS 0-030(m) was a porous wooden tank] represent a possible source of subsurface contamination. For subsurface exposure to human or ecological receptors to occur, one or both of the following scenarios must occur: either deep-rooted plants encounter this potential subsurface contamination, or site-excavation activities (e.g., leach field bulldozing) redistribute this subsurface material to the surface. The historic outfall effluent releases are subject to surface water runoff and erosion. Surface transport from overland flow and outfalls may cause potential contaminants to become concentrated in drainages and may drive contaminants into subsurface soils/tuff. Surface materials not directly associated with outfalls (e.g., PRS 0-004) on the mesa slope are subject to water erosion (e.g., sheet-flow runoff), wind erosion, and dust suspension. Existing information does not indicate a pathway for aquatic receptors (runoff and infiltration from rain events and snowmelt are the only aspects of surface water hydrology at the 6th Street PRSs). Therefore, aquatic receptors will not be considered unless new information suggests otherwise.

Thus, surface soil and air are considered the two potentially contaminated media associated with the mesa slope. The general types of contaminants include SVOCs, PCBs, pesticides, inorganic chemicals, and radionuclides. Pertinent exposure pathways from these media and contaminants include biotic uptake (plants or animals) from soil, direct ingestion of soil, dermal contact with soil, external gamma radiation from surface soil, and inhalation of airborne particulate matter.

The physical model of contaminant transport is based on knowledge of the operational history of the 6th Street Warehouses. Based on the documented construction of the subsurface piping, leaks are most likely to occur at joints or connections. The most likely release points are the connections between pipe segments made of different materials (e.g., VCP). It is assumed that leaks represent small volumes of liquid released to the subsurface environment because the system was engineered to deliver fluid through the pipe by gravity flow and so had little head to drive possible leaked fluids into the surrounding media. Also, the leach field was designed to leak, whereas the non-leach-field septic tanks were designed to release to effluent outfalls.

Process knowledge does not limit the expected nature of contamination, so the current understanding of contaminant nature is guided by the existing RFI sample data for the PRSs. No analytical suites were eliminated by these data; however, VOCs associated with current unrelated operations should be eliminated from surface soil (0 to 6 in.) because of the unlikely presence of volatiles in surface media given the time (5 decades) since Laboratory operations ceased, and because of the extensive reworking of the site surface. Lateral dispersion of the listed COPCs for the various PRSs may to be dominated by particle-related movement (sediments in water or dust in air). However, instead of relying on theoretical considerations of contaminant fate and transport, an empirical evaluation of contaminant distribution in and around the outfalls is needed.

As mentioned, process knowledge for PRSs 0-029(a,b,c) indicates that PCBs are the only COPCs. The transformer releases are subject to surface contamination and surface water transport erosion (e.g., sheet-flow runoff). Wind erosion and dust suspension are unlikely given the largely vegetated status of the PRSs [excepting PRS 0-029(c)] and the nonvolatile nature of PCBs. Surface transport from overland flow may cause potential contaminants to become concentrated in drainages, and the contaminants may infiltrate into subsurface soils/tuff. For subsurface exposure to human or ecological receptors to happen, excavation would have to occur because the hydrophobic PCBs will not partition into soil water for subsequent plant root uptake.

A previous report indicated that PCB contamination associated with the transformer leaks was minimal (LANL 1993, 26972). Given the relative lack of contamination (infrequently detected and at low levels when detected), the small scale affected, and the insolubility of PCBs, it is unlikely that humans or ecological receptors will experience exposure through anything but dermal contact or direct ingestion (therefore, food web pathways are not applicable). Even this pathway is probably negligible because of past remedial activity. While ecological terrestrial receptors will have relatively greater (compared to humans) exposure potential to contaminants in the soil, their fur and feathers generally preclude dermal exposure from being a significant pathway (EPA 2000, 70094).

Surface soils within the vicinity of TA-21 are potentially contaminated with radionuclides from past airborne emissions from incinerators, stacks, and filter houses.

Field visits to the east end of the field show that the most of the mesa top has been disturbed by a former road associated with the former trailer park, a county building located near the end of PRS 0-030(b) piping, and bulldozed tracts of land associated with the former trailer park. Pieces of dishware, cobbles, and coal are scattered around the site. Ecological receptors are abundant and there were regular signs of fossorial activity (gopher burrows and harvester ant mounds) in the loosely packed soil of the mesa top.

E-3.0 Data Quality Objectives

E-3.1 Sampling Objectives

The main sampling objective is to address the data gaps that were identified in section 2.0 of this document. The additional data will be used to determine if the various PRSs have been characterized fully and to define the nature and extent of contamination, if it exists. Evaluations of the 1995 and 1996 sample data were performed, and VCAs were conducted at several of the PRSs. The VCAs involved removal of septic tanks and associated piping. The current screening for human and ecological health did not evaluate the sample data from the samples of material that had been removed, but was confined to analytical data from the samples of material still in place. Also, for the reasons described in the VCA plan, the analytical data from the XRF and the MCL, and the composite sample data, were not used to assess the data from each PRS. Additional samples will be collected from locations likely to have received contamination and from settings expected to be undisturbed by the VCAs.

The second objective is to resample in locations for which the validated analytical data are not available. At these PRSs [PRSs 0-029(a,b,c)], the samples were collected in 1992 and submitted to the LANL Environmental Chemistry Group (formerly EM-9, now C-ACS) for analysis of PCBs. A VCA was conducted at PRS 0-029(a), and stained soil was removed. Because the analytical data from both the preliminary investigation and the VCA are not available, the sites will be resampled and re-evaluated.

The third objective is to resample surface samples within the field at PRS 0-030(b) to ensure that stack emissions from TA-21 are not causing a human or ecological health concern in that area.

The fourth objective, which is described in the VCA plan, is monitoring the SVE system by collecting baseline and confirmatory samples. When the boreholes for the SVE and monitoring wells are put in place, baseline samples will be collected. At the completion of the project, in approximately 2 years, new boreholes will be drilled near the SVE and monitoring wells. These boreholes will be sampled at the same depth intervals as the baseline samples.

E-3.2 Sampling Design

Sampling and sample handling will be conducted in accordance with the current revision of all applicable LANL Environmental Restoration (ER) Project standard operating procedures (SOPs). For sampling, these include ER-SOP-1.02, "Sample Container and Preservation"; ER-SOP-1.03, "Handling, Packaging and Shipping of Samples"; ER-SOP-1.04, "Sample Control and Field Documentation"; ER-SOP-1.05, "Field Quality Control Samples"; ER-SOP-6.09, "Spade and Scoop Method for Collection of Soil Samples"; and ER-SOP-6.10, "Hand Auger and Thin-Wall Tube Sampler." Field activities will be conducted in accordance with the approved SSHASP.

Samples scheduled for VOC analysis will be collected with an En Core VOC sampling device and analyzed by EPA Method 8260B. Samples scheduled for inorganic, radionuclide, SVOC, TPH, pesticide, and PCB analyses will be homogenized before they are placed into the appropriate containers.

E-3.2.1 PRS 0-027

PRS 0-027 is a former drum storage area and was a fuel tank farm for 2 years (1946 to mid-1948). The drum storage area stored drums of lubricants until they were redistributed to various job sites and craft shops, and the area could store up to 700 drums. Previous sampling has indicated that potentially unacceptable human health risks exist at this PRS because of volatile organic COPCs in the subsurface. These include benzene, ethylbenzene, toluene, trimethylbenzene, and xylene.

As discussed in section 4.2.3.2 of this document, soil samples (see Table E-3.2-1) will be collected at 5-ft intervals during the advancement of all extraction and monitoring well boreholes. At a minimum, samples from 10 ft, 20 ft, and 30 ft will be submitted to a fixed analytical laboratory for TPH-DRO, TPH-GRO, and VOC analyses. These samples will be collected as a baseline to ensure that the SVE reduces the amount of BTEX contamination. These depths were chosen to get a vertical profile of the contamination. As stated in section 4.1 of this document, the maximum values of BTEX were constrained to depths between approximately 13 ft and 30 ft bgs, although one previous borehole showed BTEX contamination to a 40-ft depth. The analytical data will be used to determine if the SVE process worked by collecting samples from similar depths at the completion of the SVE process. During the pilot study, SUMMA samples will not be collected for VOC analyses; during the full-scale SVE system operation, the VOC samples will be collected.

Table E-3.2-1
PRS 0-027 Sampling Design

Location Description	Depth (ft)	Analytical Suites	Objective
Extraction well boreholes	10 ft, 20 ft, 30 ft*	VOCs, SVOCs, TPH, TAL metals	Baseline information about COPCs and TPH before SVE startup
Monitoring well boreholes	10 ft, 20 ft, 30 ft	VOCs, SVOCs, TPH, TAL metals	Baseline information about COPCs and TPH before SVE startup
Three vapor extraction wells	Integrated over entire depth (0–20 ft)	VOCs	Monitor progress of SVE
Five monitoring wells	Integrated over entire depth (0–20 ft)	VOCs	Final data to determine how well the SVE worked
Confirmatory samples near extraction well boreholes	10 ft, 20 ft, 30 ft	VOCs, SVOCs, TPH	Final data to determine how well the SVE worked
Confirmatory samples near monitoring well boreholes	10 ft, 20 ft, 30 ft	VOCs, SVOCs, TPH	Final data to determine how well the SVE worked

* Additional samples submitted based on high PID readings.

Sampling of the three vapor extraction wells will be conducted using a SUMMA canister and following ER-SOP-6.31. SUMMA canisters measure VOCs using EPA method TO-14A. Three wells will be positioned to provide maximum coverage of the SVE process over the site and will be focused within the areas of the highest BTEX and TPH concentrations. The data collected will be used to determine if the SVE system is working properly, or if any adjustments to the system need to be made.

Sampling of the five monitoring wells will be conducted using a SUMMA canister. The fifth monitoring well in the interior of the SVE wells will be screened at three separate depth intervals to evaluate the vertical distribution of the subsurface vacuum effects. The screen intervals are expected to be approximately 7 to 9 ft, 15 to 17 ft, and 25 to 27 ft bgs. Analytical data from these sample intervals will allow calibration of the in-situ sensors.

Additional samples will be collected at the completion of the SVE operation for confirmation. Boreholes will be drilled near the vapor extraction wells and the monitoring wells, and confirmatory soil samples will be collected at 5-ft intervals. At a minimum, samples from 10 ft, 20 ft, and 30 ft will be submitted to a fixed analytical laboratory for TPH-DRO, TPH-GRO, SVOC, and VOC analyses. The analytical results will be compared to the baseline analytical data collected before the start of the SVE. This comparison will be used to determine how well the SVE system worked and if it should be used for other PRSs with the same type of contaminants. Figure E-3.2-1 shows the proposed sampling locations of both the pre-SVE samples and the post-SVE samples.

Figure E-3.2-1. PRS 0-027, proposed sample locations for pre-SVE and post-SVE samples

E-3.2.2 PRS 0-004

PRS 0-004 is a former indoor container storage area that has had two documented incidences of spills in which the area was washed down with water. Previous samples were collected from a drainage ditch on the east side of the parking lot and from a drainage outfall from the west side of the parking lot. Before additional samples are collected, a geomorphologist will map the sediment catchment areas most likely to have received contamination. This sediment mapping will be documented and used for subsequent human health and ecological evaluations and for data assessments. At least two sediment catchments will be identified in each drainage, and samples will be collected from each location at 0–6 in. and 6–12 in. Each sample will be analyzed for TAL metals, VOCs (subsurface samples only), SVOCs, PCBs/pesticides, and radionuclides. Table E-3.2-2 summarizes the intended sampling. The nature and extent of contamination, if there is any contamination, will be defined with these extra samples.

Because PRS 0-004 and PRS 0-033(b) share a drainage system, and because PRS 0-030(l) is spatially located with the drainage system, these PRSs may be aggregated. The vertical and lateral extent of potential contamination will be defined spatially.

An additional location will be sampled upgradient from PRS 0-004; this sample will serve as a local background sample. The analytical results from the background sample will indicate what is coming onto the site from unrelated sources.

Table E-3.2-2
PRS 0-004 Sampling Design

Location Description	Depth (in.)	Analytical Suites	Objective
Sediment catchment east of the parking lot	0–6	TAL metals, SVOCs, PCBs/pesticides, rad	Assess nature and extent
	6–12	TAL metals, SVOCs, VOCs, PCBs/pesticides, rad	
Sediment catchment east of the parking lot, south of previous location	0–6	TAL metals, SVOCs, PCBs/pesticides, rad	Assess nature and extent
	6–12	TAL metals, SVOCs, VOCs, PCBs/pesticides, rad	
Sediment catchment west of the parking lot	0–6	TAL metals, SVOCs, PCBs/pesticides, rad	Assess nature and extent
	6–12	TAL metals, SVOCs, VOCs, PCBs/pesticides, rad	
Sediment catchment west of the parking lot, south of previous location	0–6	TAL metals, SVOCs, PCBs/pesticides, rad	Assess nature and extent
	6–12	TAL metals, SVOCs, VOCs, PCBs/pesticides, rad	
Upgradient location	0–6	TAL metals, SVOCs, PCBs/pesticides, rad	Location chosen to identify local background sample location
	6–12	TAL metals, SVOCs, VOCs, PCBs/pesticides, rad	

E-3.2.3 PRS 0-030(l)

PRS 0-030(l) is a former concrete septic tank and associated drain lines. The tank and 40 ft of inlet piping were removed in 1995. Based on the data gaps described in this document, additional samples will be collected. The data gaps consisted of composite samples collected from the soil outside of the tank and analytical results from the MCAL.

Table E-3.2-3 presents the additional samples that will be collected from this site. Three samples will be collected below the former location of the septic tank, from a depth of at least 5.5–6.0 ft, and one sample will be collected from each side of the former tank (east, west, and south), from 4.5–5.5 ft. In addition, the outfall will be resampled. Previous remedial activities at PRS 0-030(l) did not remove the outlet pipe. Although this outlet pipe is inactive and the source removed, the outlet pipe will be removed to prevent exposure to any residual concentrations of COPCs within the pipe and to remove legacy subsurface features wherever possible. When the outlet pipe is removed, the soil in the trench can be visually inspected for staining as evidence of leaks from the pipe. Only pipes located in areas that are readily accessible for removal will be handled in this manner, which is consistent with applying cost-effective remediation approaches to minimize potential risks from legacy contamination. Soil samples will be collected from below pipe joints to determine if the pipe leaked, but not every joint will be sampled. Each sample will be analyzed for TAL metals, VOCs (subsurface samples only), SVOCs, PCBs/pesticides, and radiological constituents. These samples are being collected to define the nature and extent of contamination, both vertically and laterally, at the site.

Because PRS 0-004 and PRS 0-033(b) share a drainage system and PRS 0-030(l) is spatially located with the drainage system, these PRSs may be aggregated.

Table E-3.2-3
PRS 0-030(l) Sampling Design

Location Description	Depth (ft)	Analytical Suites	Objective
Below former bottom of tank: 3 samples	5.5–6.0	TAL metals, SVOCs, VOCs, PCBs/pesticides, rad	Define nature and extent
Outside tank: one sample from each side (east, west, and south)	4.5–5.5	TAL metals, SVOCs, VOCs, PCBs/pesticides, rad	Define nature and extent
Outfall (below pipe): two samples	0–0.5	TAL metals, SVOCs, PCBs/pesticides, rad	Define nature and extent
Outlet pipe: one sample	TBD*	TAL metals, SVOCs, VOCs, PCBs/pesticides, rad	Define nature and extent
Below outlet pipe joints: two samples	TBD	TAL metals, SVOCs, VOCs, PCBs/pesticides, rad	Define nature and extent
Below inlet pipe joints: two samples	TBD	TAL metals, SVOCs, VOCs, PCBs/pesticides, rad	Define nature and extent

*TBD = to be determined based on field conditions.

E-3.2.4 PRS 0-030(m)

PRS 0-030(m) was a wooden septic tank that served the former incinerator building. PRS 0-030(m) also included a VCP outlet, which was found to join the outlet pipe from PRS 0-030(b). Because of the data gaps described in the this document, additional samples will be collected. The two confirmatory samples were analyzed for VOCs and metals by the MCAL. The metals analysis was conducted by XRF; but XRF

cannot be used to characterize sites. Therefore, the lack of inorganic data at this site presents a data gap. No samples were collected from the outside of the tank, which represents a data gap because it is not known if the wooden tank leaked from its sides. In addition, trenching was not conducted south of the tank to ensure that the tank did not discharge to the south.

Table E-3.2-4 presents the additional samples that will be collected from this site. Three samples will be collected below the former location of the septic tank from a depth of 11–11.5 ft. One sample will be collected from each side of the tank (east, west, and south) from a depth of 10–11 ft. In addition, the area to the south will be trenched to ensure that no outlet pipe drained to the south. If a drain line is found, samples will be collected from the interior of the pipe, if possible, as well as from below the joints and within the outfall. Additional trenching will be conducted to expose the 400 ft of pipeline leading to PRS 0-030(b), and it will be removed before the land transfer. The soil beneath the pipe joints will also be sampled. It is assumed that the pipe lengths are 20 ft long; two soil samples (from depths of 0–6 in. and 12–18 in. beneath the pipe) will be collected every 40 to 60 ft, for a minimum of 7 samples per depth. Each sample will be analyzed for TAL metals, VOCs (subsurface samples only), SVOCs, PCBs/pesticides, and radiological constituents.

Table E-3.2-4
PRS 0-030(m) Sampling Design

Location Description	Depth (ft)	Analytical Suites	Objective
Below former bottom of tank: three samples	11–11.5	TAL metals, SVOCs, VOCs, PCBs/pesticides, rad	Assess nature and extent
Outside tank: one sample from each side (east, west, and south)	10–11	TAL metals, SVOCs, VOCs, PCBs/pesticides, rad	Assess nature and extent
Outlet pipe: one sample	TBD*	TAL metals, SVOCs, VOCs, PCBs/pesticides, rad	Assess nature and extent
Below outlet pipe joints: fourteen samples	TBD	TAL metals, SVOCs, VOCs, PCBs/pesticides, rad	Assess nature and extent

* TBD = to be determined based on field conditions.

E-3.2.5 PRS 0-033(b)

PRS 0-033(b) consists of (1) potential soil contamination at the outlet piping from the materials testing laboratory located south of 6th Street Warehouses 3/4, and (2) potential contamination associated with drain lines and outfalls. Although a VCA was conducted at the site, review of the sampling shows a data gap for inorganic and VOC data. Soil samples collected downgradient of the VCP and cast iron drain lines were not analyzed for TAL metals. Table E-3.2-5 provides the sampling design for this PRS.

Because PRS 0-004 and PRS 0-033(b) share a drainage system, and because PRS 0-030(l) is spatially located with the drainage system, these PRSs may be aggregated.

Table E-3.2-5
PRS 0-033(b) Sampling Design

Location Description	Depth (ft)	Analytical Suites	Objective
Northwest side of VCP outfall: one sample	TBD*	TAL metals, VOCs	Assess nature and extent
Downgradient of VCP drain line: two samples	TBD	TAL metals, VOCs	Assess nature and extent
Northeast side of cast-iron drain line outfall: one sample	TBD	TAL metals, VOCs	Assess nature and extent
Downgradient of cast-iron drain line: two samples	TBD	TAL metals, VOCs	Assess nature and extent

* TBD = to be determined based on field conditions.

E-3.2.6 PRS 0-030(b)

PRS 0-030(b) is a septic system that consists of two diversion boxes which directed sewage flow to four septic tanks. The septic tanks are connected to a former leach field and a drainage line. The leach field associated with PRS 0-030(b) is approximately 325 ft long by 150 ft wide, but only two soil samples were collected from it, and both of these were from the northwest corner. This lack of spatial data represents a data gap. The two samples were analyzed for SVOCs, PCBs, pesticides, and radiological constituents by a fixed analytical laboratory, and for VOCs and metals by the MCAL. XRF data for metals cannot be used to characterize sites, and the lack of inorganic data at this site presents another data gap.

Table E-3.2-6 identifies the proposed samples to be collected. The unpaved area of PRS 0-030(b) has had many uses over the past 55 years, one as a storage area for coal and another as a trailer park. To distinguish constituents associated with PRS 0-030(b) from those associated with other activities, background samples are proposed for collection from areas not affected by the PRS. A total of nine samples should be collected from north and east of the leach field.

Table E-3.2-6
PRS 0-030(b) Sampling Design

Location Description	Depth (ft)	Analytical Suites	Objective
Background samples: nine samples Samples will be collected from north and east of the leach field. Additional depth samples may be collected.	0–0.5	TAL metals, SVOCs, PCBs/pesticides, rad	Identify background analytical data
Leach field: seven samples	0–0.5	TAL metals, SVOCs, PCBs/pesticides, rad	Determine nature and extent
Pipe joints and stained locations beneath pipes: at least seventeen samples per depth	TBD*	TAL metals, SVOCs, VOCs, PCBs/pesticides, rad	Determine nature and extent

* TBD = to be determined based on field conditions.

From within the former leach field, seven surface soil samples will be collected (see Figure E-3.2-2). Trenching will be conducted to expose the pipeline to the leach field and from the septic tanks to the outfall, and to remove the pipes before the land transfer. Samples will be collected under joints (0 to 6 in. and 12 to 18 in. beneath the pipe) every 40 to 60 ft, and if staining is detected. At least 1050 ft of piping is believed to remain in place. Assuming that the pipes are 20 ft long, a minimum of 17 soil samples per depth will be collected underneath each joint. Each sample will be analyzed for TAL metals, VOCs (subsurface samples only), SVOCs, PCBs/pesticides, and radionuclides.

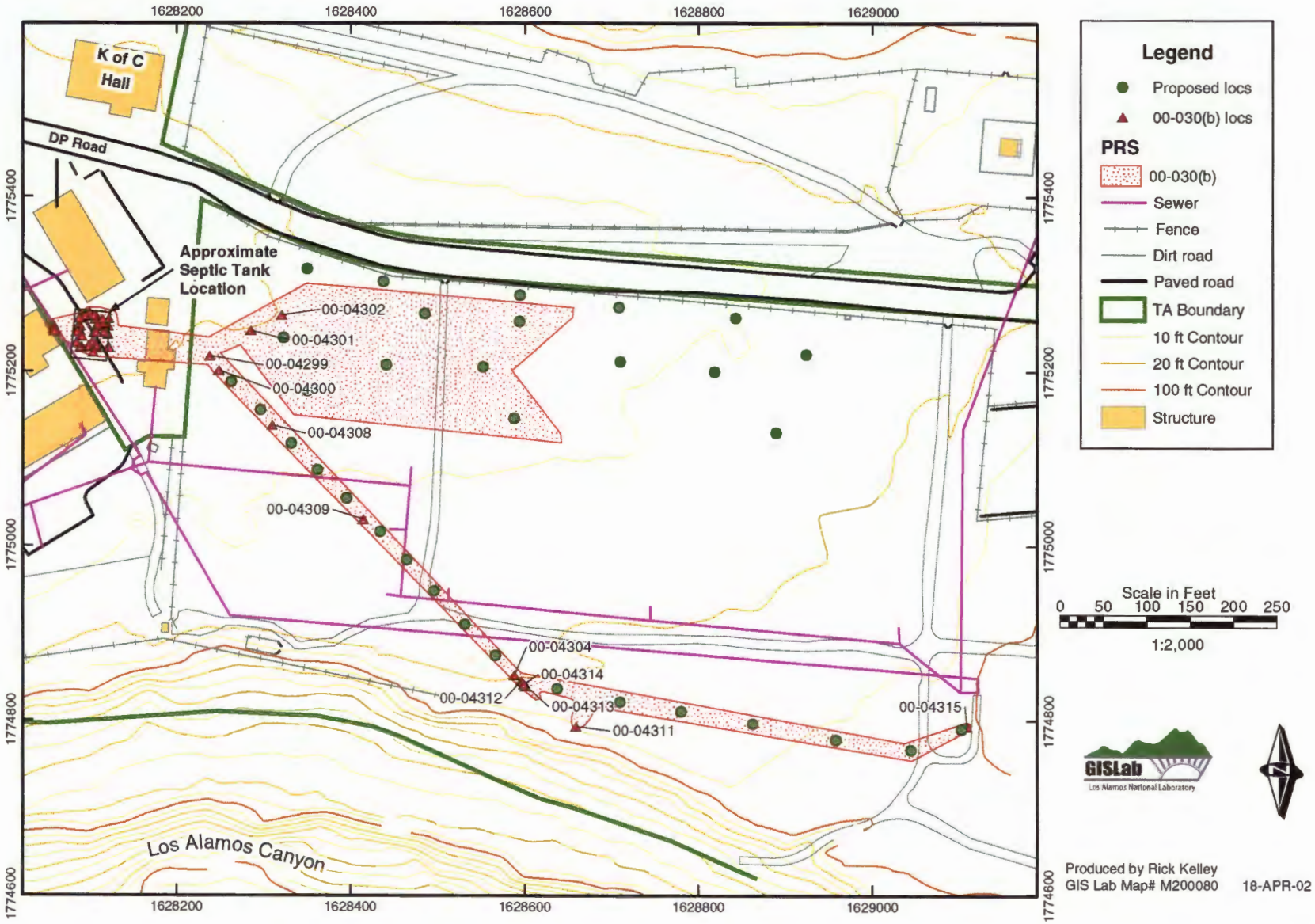


Figure E-3.2-2. PRS 0-030(b), proposed sample locations in the leach field

This sampling will define the nature and extent of the contamination, if any, within the leach field. In addition, the vertical and lateral extent of any contamination associated with the piping will be defined.

E-3.2.7 PRS 0-029(a,b,c)

PRS 0-029(a) is the location of potential soil contamination due to releases from two PCB-containing transformers located on a power pole for a groundwater production well (Well #5) in Los Alamos Canyon. Approximately 20 yd^3 of soil that was stained was removed from this site. There is no record of the area being regraded; therefore, the samples will be collected from 0–6 in. and 12-18 in. (Table E-3.2-7). The original sampling plan that was implemented in 1993 (LANL 1993, 26972) will be followed, with a few exceptions. The previous plan did not call for collecting any samples from the rill. The new grid will have nine sample locations instead of fifteen. In addition, samples will be collected from the area around the base of the power pole and inside the well house (see Figure E-3.2-3).

Table E-3.2-7
PRS 0-029(a,b,c) Sampling Design

Location Description	Depth (ft)	Analytical Suites	Objective
PRS 0-029(a): 9 grid samples (grid is 50 ft by 100 ft) 1 sample from base of power pole 4 samples from area around power pole 3 samples along rill on eastern perimeter 3 samples from inside well house	0–0.5 1–1.5	PCBs	Resample to determine if PCBs exist at the site
PRS 0-029(b): 15 grid samples (grid is 65 ft by 75 ft) 5 samples from base of power pole	0–0.5 1–1.5	PCBs	Resample to determine if PCBs exist at the site
PRS 0-029(c): 16 grid samples (grid is 65 ft by 75 ft) 5 samples from area around power pole	0–0.5 1–1.5	PCBs	Resample to determine if PCBs exist at the site

PRS 0-029(b) is the location of potential soil contamination due to releases from three transformers located on a power pole that was used to supply electrical power to a groundwater production well (Well #4) in Los Alamos Canyon. A grid similar to the one used in 1992 will be used to collect the soil samples (LANL 1993, 26972).

Fifteen grid samples will be collected, and another five samples will be collected from the area around the base of the former power pole (see Figure E-3.2-4).

PRS 0-029(c) is the location of potential soil contamination due to leakage from a PCB-containing transformer. This transformer was located on a power pole that was used to supply electrical power to a groundwater production well (Well #1) in Guaje Canyon (see Figure E-3.2-5). The original sampling plan (LANL 1993, 26972) that was implemented in 1993 will be followed. Briefly, this plan involved collecting the soil samples from a grid system. Each sample will be submitted to a fixed analytical laboratory for PCB analysis (see Table E-3.2-7).

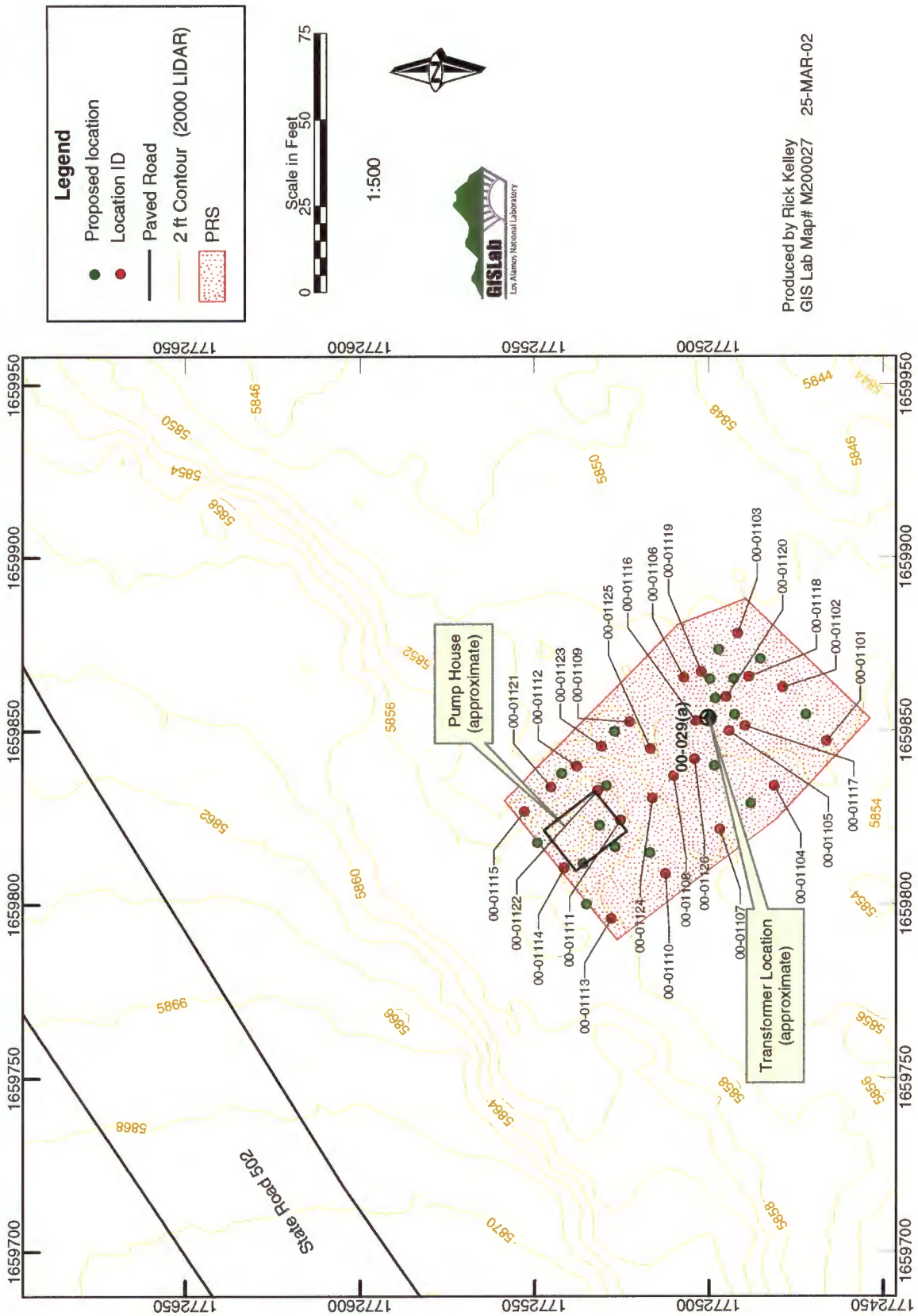


Figure E-3.2-3. PRS 0-029(a), proposed sample locations

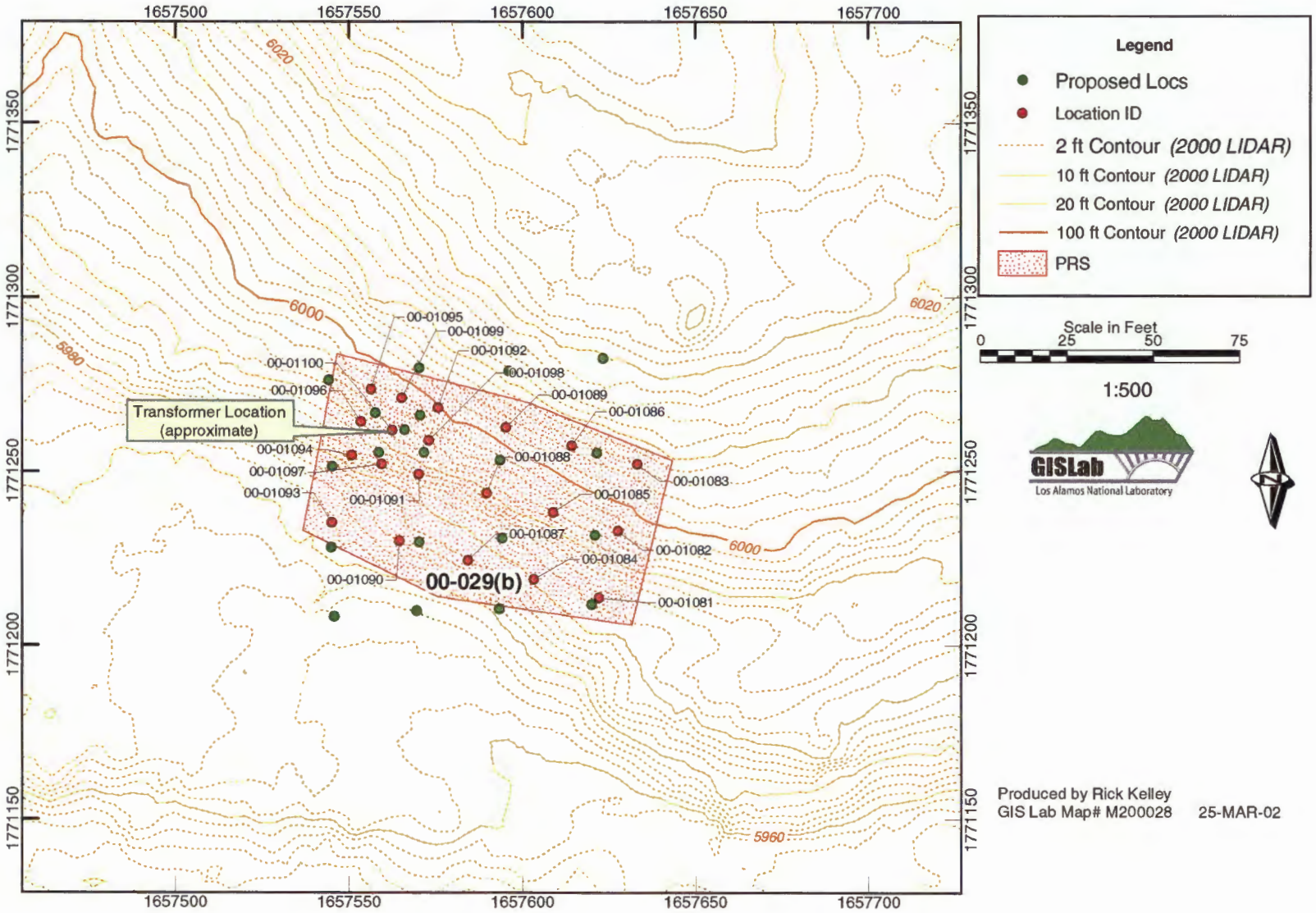


Figure E-3.2-4. PRS 0-029(b), proposed sample locations

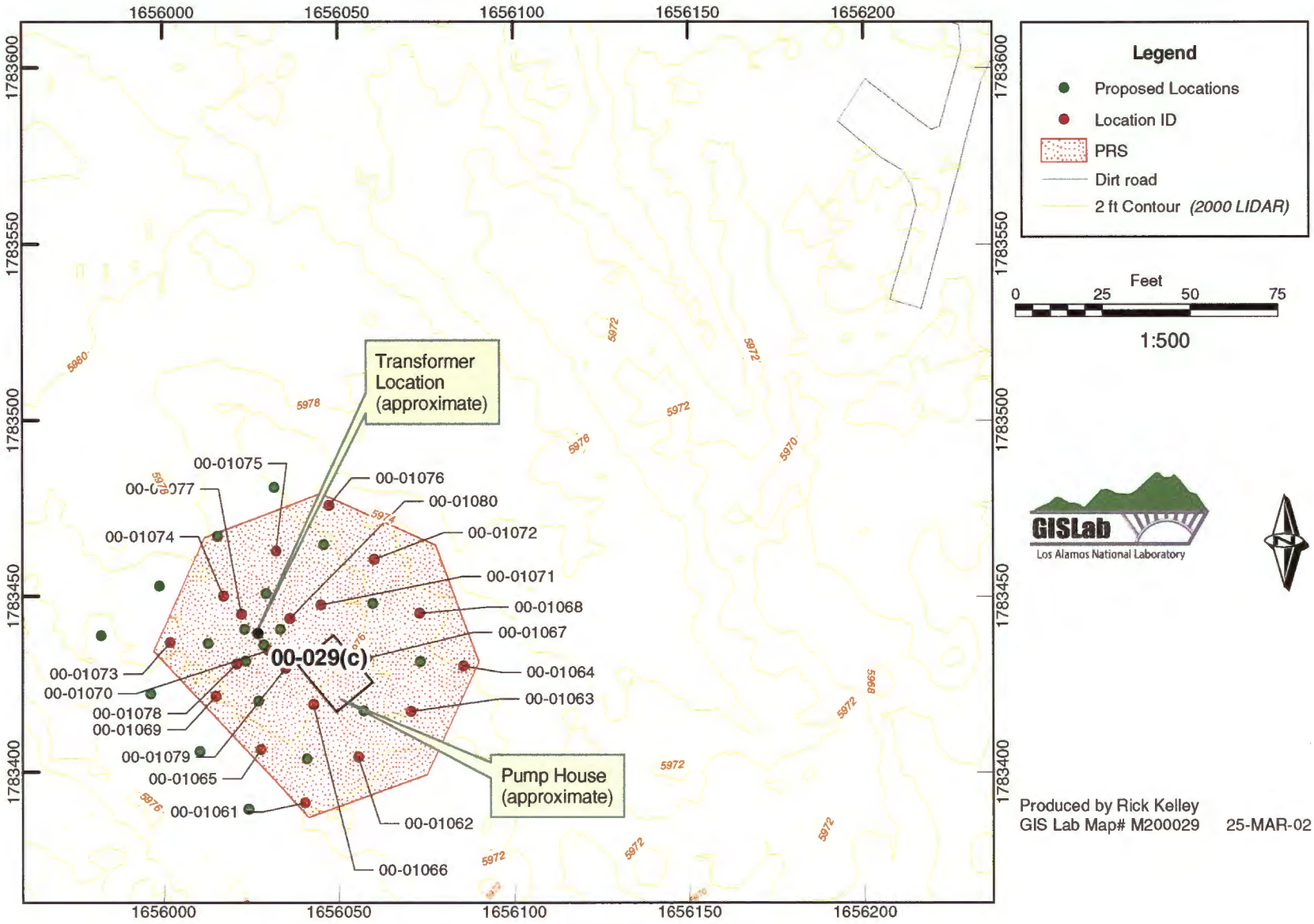


Figure E-3.2-5. PRS 0-029(c), proposed sample locations

E-3.2.8 TA-21 Sampling

Additional surface samples will be collected in the field at TA-0 to ensure that low-level airborne emissions from TA-21 are not present. These samples will be collected in the vicinity of the grid sampling that was conducted in 1992 (LANL 1994, 26073). Based on the analytical results from the previous grid sampling at TA-21 (LANL 1994, 26073), the new samples will be analyzed for radionuclides (gamma spectroscopy, plutonium-239, strontium-90, and tritium) and inorganics, and will not be analyzed for SVOCs because they were not found previously.

Sampling for the TA-21 contaminants will be based on a grid system similar to one that was used for the 1992 sampling (LANL 1994, 26073). Sixty soil samples will be collected from the 0 to 1 in. depth, and 20 soil samples will be collected from the 0 to 6 in. depth. The grid will be set up before the field work begins, and it will be surveyed.

The analytical data will be used to determine if contaminants from the TA-21 stack emissions are present in the soil within the PRS 0-030(b) leach field.

E-3.3 Field Quality Control and Assessment

Field blanks and trip blanks are designed to help protect data users from incorrectly concluding that a site is contaminated. Results from these blanks are an indicator of possible sample contamination during field and laboratory operations. Field and trip blanks will be collected and submitted with every 20 samples or one per day, whichever is more frequent, following ER-SOP-1.05. Routine laboratory blanks will be evaluated to assess the possibility of laboratory contamination. When duplicate field samples exhibit analyte concentrations lower than detection limits, the duplicate results are not useful because the control parameter related to those samples (relative percent difference) cannot be computed.

E-3.4 Waste Characterization Sampling

All waste streams will be sampled following the Waste Characterization Strategy Form for proper disposal.

Before removing the pipe from PRS 0-030(b), waste characterization samples will be collected. The field team will collect one sample from the east end of the pipe, one from each elbow joint (two samples), one from south of the manhole, and one from any remaining pipe north of the manhole. Additional waste characterization samples will be collected from beneath the PRS 0-030(m) pipes. One sample will be collected from the joint where the pipe from PRS 0-030(m) joins the pipe from PRS 0-030(b), one from the elbow, and one from southeast of the septic tank. The waste characterization samples will be analyzed for TCLP metals, SVOCs, VOCs, PCBs/pesticides, and radionuclides.

E-3.5 Laboratory Communications

Several special requirements are placed on the analytical laboratories by this sampling and analysis plan. The special requirements are detailed in the "Special Sample Handling Instructions" and "Special Analytical Requirements" sections below. These requirements must be discussed with the analytical laboratory manager before shipment of any samples.

The analytical laboratory shall contact the SMO immediately if a problem arises in any phase of the sample analysis and reporting process, so that possible corrective measures may be discussed and implemented. Any instructions to analytical laboratory managers or analysts must be approved by the SMO to maintain contract compliance.

LANL contacts and areas of responsibility are provided in Table E-3.5-1.

Table E-3.5-1
LANL Contacts

Title	Name	Phone/Fax/Email	Responsibilities
SMO	Joylene Valdez	(505) 665-9968 (505) 665-9972 joylenev@lanl.gov	Sample shipping, chain-of-custody (COC) issues including lost or broken containers, lost holding times, analysis delays
	Keith Greene	(505) 665-9966 kgreene@lanl.gov	
DP Land Transfer project chemists	Cliff Deiner	(505) 662-1744 cdeiner@lata.com	Analytical chemistry method selection, preliminary data review and sample analysis decisions, laboratory problem resolution, final focused data validation.
	Dave Gratson	(505) 662-0707 x 29 dgratson@neptuneandco.com	
Field Project Leader (FPL)	Terry Rust	(505) 665-8843 trust@lanl.gov	SMO and project chemists shall brief the FPL on all significant laboratory communications.

E-3.6 Special Sample Handling Instructions

The analytical laboratory will contact the SMO upon receipt and check-in of the DP land transfer samples, both to verify the condition of the samples and to ensure that special instructions included with the COC are clear and consistent with the laboratory's expectations.

E-3.7 Special Analytical Requirements

Special analytical requirements are necessary to avoid data quality problems. The following special requirements must be clearly communicated to the analytical laboratory.

Inorganic Analysis

A majority of inorganic analysis requests include antimony, cadmium, mercury, and silver. See the "Quality Indicators" section below for specific requirements on matrix spike recoveries.

1. Detection Limits

   Contract-required EDLs (determined in soil matrix extracts) are listed in the current LANL ER Project analytical SOW (LANL 2000, 71233). The SOW-specific detection limits are closely linked to the EPA contract laboratory program's contract-required detection limits. The complete TAL metals list, with comparisons to BVs and SOW EDLs, is shown in Table E-3.7-1. Special detection limits are required for this project when ER analytical SOW EDLs are greater than BVs. The last column in Table E-3.7-1 shows the detection limits for the required method (note the values in bold type). They are lower than the standard SOW-specific detection limits.)

Table E-3.7-1
Comparison of BVs, SOW-Required EDLS, and Project-Specific EDL Requirements

TAL Metals	BV[a], Soil	BV[a], Qbt 2,3,4	SOW EDL[a]	Special EDL Request[a,b]
Aluminum (Al)	29200	7340	10	40
Antimony (Sb)	0.83	0.5	0.2	**0.4**
Arsenic (As)	8.17	2.79	0.2	2
Barium (Ba)	295	46	10	40
Beryllium (Be)	1.83	1.21	10.1	1
Cadmium (Cd)	0.4	1.63	0.25	**0.2**
Calcium (Ca)	6120	2200	250	1000
Chromium (Cr)	19.3	7.14	0.5	2
Cobalt (Co)	8.64	3.14	0.5	**1.5**
Copper (Cu)	14.7	4.66	0.5	**4**
Iron (Fe)	21500	14500	300	20
Lead (Pb)	22.3	11.2	2	0.6
Magnesium (Mg)	4610	1690	250	1000
Manganese (Mn)	671	482	20	3
Mercury (Hg)	0.1	0.1	0.05	**0.08**
Nickel (Ni)	15.4	6.58	0.2	**6**
Potassium (K)	3460	43700	250	1000
Selenium (Se)	1.52	0.3	0.2	**0.3**
Silver (Ag)	1	1	0.2	**0.5**
Sodium (Na)	915	2770	250	**450**
Thallium (Tl)	0.73	1.1	0.1	**0.4**
Vanadium (V)	39.6	17	0.5	10
Zinc (Zn)	48.8	63.5	5	4

[a] BVs and EDL are given in mg/kg.
[b] The special EDL must be met by the laboratory. The EDL must be established on a soil matrix.

At least two contract analytical laboratories have provided documentation showing they can meet these special detection limits. Samples shall not be sent to a laboratory that does not commit to providing detection limits at least as low as those shown in Table E-3.7-1 for LANL soil and tuff.

2. Quality Indicators

In addition to the normal reporting of quality indicators, special corrective action is required in the event that matrix spike or solid laboratory control sample (LCS) analyte recoveries fall outside the following criteria shown below.

Matrix Spike Criteria	Solid LCS Acceptance Criteria
75–125%	60–120%

Criteria are in percent recovery. Any matrix spike recovery below 30% will be redone. But, if the matrix spike subsequently fails then, according to the method, the analytical laboratory only has to do a post-digestion spike.

3. Methods

Methods comparable to SW-846, Update III or Draft Update IVA, are required. The following SW-846 method combinations are satisfactory.

Analyte	Prep Method Options	Determinative Method Options
Antimony (Sb), silver (Ag), cadmium (Cd), barium (Ba), and target analyte list	3050B 3051(3051A)	6010B 6020
Mercury (Hg)	7471A	7471A

Methods in parentheses pertain to Draft Update IVA. Any method combination may be used that meets the detection limit requirements and quality indicator goals. Deviations from these methods must be discussed with the SMO. The hard copy data package delivered to LANL must specify the standard method (e.g., SW-846 series) employed by the laboratory.

Organic Analysis

1. Detection Limits

No special detection limits are required for organic analytes. The standard detection limits given in the ER Project analytical SOW are satisfactory and are consistent with the current LANL ER Project QAPP.

2. Quality Indicators

Report data quality indicators normally. No special corrective action response is required.

3. Methods

Use methods comparable to SW-846 protocols. The following method (or equivalent) combinations are satisfactory.

Analyte	Prep Method Options	Determinative Method Options
SVOC Suite	3550	8270C
VOC Suite	5035	8260B
Pesticides and PCBs	3550	8081/8082

Deviations from these methods must be discussed with the SMO. The hard copy data package delivered to LANL must specify the standard method (e.g., SW-846 series) employed by the laboratory.

Radiochemical Analysis

1. Detection Limits

No special detection limits are required for radionuclides. The standard detection limits given in the ER Analytical SOW are satisfactory, and are consistent with the current LANL ER QAPP.

2. Quality Indicators

Report data quality indicators normally. No special corrective-action response is required.

3. Methods

Use methods comparable to EPA 900 series protocols. The following method (or equivalent) combinations are satisfactory.

Analyte	Determinative Method Options
Isotopic plutonium, uranium	Alpha spectrometry
Standard gamma spectrometry analytes (should include americium-241)	901.1 (Modified)
Gross alpha/beta	900.0 gas proportional counting
Gross gamma	901.1
Strontium-90	905.0

Deviations from these methods must be discussed with a project chemist. The hard copy data package delivered to LANL must specify the standard method employed by the laboratory.

E-4.0 DATA VALIDATION

Analytical data will be validated according to current versions of the following ER Project SOPs: SOP-15.01, SOP-15.02, SOP-15.03, SOP-15.05, SOP-15.06, SOP-15.12, and SOP-15.13. This includes a routine validation of all inorganic, organic, and radiochemistry data. Following the routine data validation, a focused data validation will be performed, if necessary, to ensure that any analytical problems experienced with the first sampling effort are not encountered again. The validations will be summarized in the VCA completion report.

Appendix F

Photos–Aerial and Ground

Photos are provided on the attached CD as a PowerPoint presentation and as JPG files.

PRS 0-004 parking lot

PRS 0-004 west drainage

PRS 0-027 parking lot

PRS 0-027 parking lot 2 with location of PRS 0-030(a) at top center of photo

PRS 0-030(b) line location

PRS 0-030(b) septic tank location

PRS 0-030(l) looking south

PRS 0-030(m) looking south

PRS 0-030(b) cobbles

PRS 0-030(b) east outfall

PRS 0-030(b) leach field

PRS 0-030(b) septic tank location

PRS 0-030(b) VCP on ground

PRS 0-030(b) VCP

PRS 0-030(l) looking west

PRS 0-033(b) looking south

PRS 0-033(b) looking south, 2

PRS 0-033(b) looking southeast

PRS 0-027 animal hole

Ant mound outside Knights of Columbus building

Ant mound outside Knights of Columbus building, 2

Ant mound in PRS 0-030(b) field

Ant mound in PRS 0-030(b) field, 2

Close-up of PRS 0-030(l) outfall

Coal

End of PRS 0-030(b) line

Knights of Columbus parking lot with location of PRS 0-030(a) at top center of photo

Knights of Columbus parking lot, 2

PRS 0-004 asphalt drainage

PRS 0-029(a) looking north

PRS 0-029(a) looking south

PRS 0-029(b) looking southeast

PRS 0-029(c) cap

PRS 0-029(c) looking west

PRS 0-029(c)

PRS 0-030(b) leach field

PRS 0-030(l) outfall

VCP in PRS 0-030(b) field

View north toward former MTL

2-P-0002

Life Abortion?
The Natural Choice is Life

Life
Abortion?
The Natural Choice is Life.

Appendix G

Diffusion Screening and
Contaminant Mass Removal—Relation to Risk Reduction

Diffusion in the vapor phase is the primary mechanism by which the volatile chemicals migrate in the subsurface. When considering diffusion-driven contaminant transport in the vapor phase, there is a question of what is a realistic estimate of the mass of contaminant that would exit the ground surface in a given area, thereby potentially entering a building structure and resulting in an exposure to building occupants. A gross mass balance calculation, conducted by assuming that the total inferred mass of contaminant in the subsurface exits the ground surface through a given area over a given time, provides a starting point for evaluation. However, this approach is likely to substantially overestimate the amount of mass that would or could migrate through a given area over a given period via diffusion alone. A reasonable approach to considering vapor migration via diffusion in the subsurface is to use the basic premises of Fick's first law (Appelo and Postma, 1993), which allows prediction of both flux rates and cumulative mass losses over time that will result from diffusion.

For consideration of flux rates and mass losses due to diffusion as they pertain to PRS 0-027, the following inputs and assumptions were used.

Inputs:

VOC COPCs: Benzene is the primary carcinogenic risk-based driver at the site, with risk-based air concentration screening levels are considerably lower than that of other BTEX compounds. Therefore, the fate of benzene is of primary interest. Average and 95% UCL benzene concentrations within the estimated 465 m^2 zone of elevated BTEX concentrations at the site are 0.9 mg/kg and 2.0 mg/kg, respectively.

Volume of contaminated soil: An area of 100 ft by 50 ft (5000 ft^2) is used in these screening calculations. This area corresponds to the zone where BTEX concentrations exceed 50 mg/kg, based on concentration contour plots.

Bulk concentrations of benzene: The average and 95% UCL benzene mass concentrations can be used to estimate the bulk volumetric concentration of benzene in the contaminated soil.

Assumptions:

initial bulk concentration of benzene in soil: 95% UCL value = 0.003 kg/m^3; average value = 0.00135 kg/m^3

effective soil-diffusion coefficient of benzene: 1×10^{-5} m^2/d (reasonable order of magnitude without detailed calculation for benzene specifically in Bandelier Tuff)

bulk density of tuff: a bulk density of 1500 kg/m^3 is assumed (LANL 2002, draft)

exposure duration: 30 yr (NMED UST Guidelines for Corrective Action, Table 4-5)

building height: 2 m (NMED UST Guidelines for Corrective Action, Table 4-6)

building area: 200 m^2 (best judgment; corresponds to 2150 ft^2)

building air exchange rate: 12/day (NMED UST Guidelines for Corrective Action, Table 4-6)

Calculations:

Benzene flux: The flux, or rate, of a contaminant migrating via diffusion decreases with time, roughly as a function of $t^{-1/2}$. The flux can be determined by:

$$\text{Flux} = \text{initial bulk concentration} \times \sqrt{effective_diffusion_coefficient \div \pi \div time}$$

The table below presents resulting flux rates calculated using various combinations of time and initial bulk concentrations.

Bulk Concentration (kg/m^3)	Time (days)	Flux (kg per m^2/d)
0.003 (95 UCL)	365 (1 yr)	2.80E-07
0.003 (95 UCL)	10,950 (30 yr)	5.11E-08
0.003 (95 UCL)	18,250 (50 yr)	3.96E-08
0.00135 (average)	365 (1 yr)	1.26E-07
0.00135 (average)	10,950 (30 yr)	2.30E-08
0.00135 (average)	18,250 (50 yr)	1.78E-08

Cumulative benzene loss: The cumulative loss of a volatile compound via diffusion roughly increases with time as a function of $t^{1/2}$. The cumulative volatile compound loss is determined by:

Cumulative benzene loss =
initial bulk concentration x $\sqrt{4 \times effective_diffusion_coefficient \times time \div \pi}$

The table below presents predicted cumulative losses calculated using various combinations of time and initial bulk concentrations.

Bulk Concentration (kg/m^3)	Time (days)	Cumulative Loss (kg/m^2)
0.003 (95 UCL)	365 (1 yr)	2.05E-04
0.003 (95 UCL)	10,950 (30 yr)	1.12E-03
0.003 (95 UCL)	18,250 (50 yr)	1.45E-03
0.00135 (average)	365 (1 yr)	9.21E-05
0.00135 (average)	10,950 (30 yr)	5.04E-04
0.00135 (average)	18,250 (50 yr)	6.51E-04

These flux and cumulative loss values discussed above can be used to estimate the amount of contaminant mass that may exit the ground surface and move into a building over time.

Time-averaged exposure = cumulative loss over time (t) [$\mu g/m^2$] x building area [m^2]
cumulative air exchange over time (t) [m^3]

Using the 95% UCL benzene concentration of 2 mg/kg; for a 200 m^2 building area, a total mass of 0.22 kg could enter the footprint of the building over the course of 30 years. This corresponds to less than 3% of the total contaminant mass estimated to be present in the subsurface, based on the 2 mg/kg concentration. Using the assumptions regarding building size and air exchange, this results in a time-averaged air exposure concentration of 4.26 $\mu g/m^3$.

Using the average benzene concentration of 0.9 mg/kg for a 200 m^2 building area, a total mass of 0.101 kg could enter the footprint of the building over the course of 30 years. This also corresponds to less than 3% of the total contaminant mass estimated to be present in the subsurface, based on the 0.9 mg/kg concentration. Using the assumptions regarding building size and air exchange, this results in a time-averaged air concentration of 1.92 $\mu g/m^3$.

Risk Reduction Evaluation

For a residential scenario, the NMED UST Tier 1 risk-based screening level for benzene in indoor air is 2.66 $\mu g/m^3$. Therefore, the estimated time-averaged air concentration for the upper benzene concentration is slightly more than 1.5 times higher than the screening level whereas the air concentration using the average benzene concentration is less than the screening level. Comparing the estimated exposure levels with the residential risk-based screening level supports consideration of a limited remedial action.

Removing benzene mass from the subsurface will help reduce the potential for vapor phase migration of benzene that could result in human exposures. It is possible that a sufficient amount of the benzene mass in the subsurface could be removed to achieve air exposure levels below applicable residential screening levels. Once the remediation system is operational, the amount of contaminant mass being removed from the subsurface can be measured and an evaluation of the system's effectiveness and expected contribution to risk reduction can be better quantified.

One of the primary limitations of the above calculations and risk reduction evaluation is the lack of site-specific data to allow determination of the effective soil diffusion coefficient for the site soils/tuff. Site-specific coefficients are calculated using information on porosity: the fraction of pore space occupied by air, water, and NAPL; compound-specific molecular diffusion coefficients; tortuosity of connected pore space; bulk partitioning of the contaminant between the different phases; etc. Very few of these parameters are available for this site. Therefore, an order of magnitude value of 10^{-5} was selected as a conservative number for BTEX-type compounds in a basic soil. The unique characteristics of the Bandelier Tuff could result in a unit-specific effective diffusion coefficient that is several orders of magnitude different. However, it was felt that, in spite of potentially atypical diffusion patterns within the tuff unit itself, more standard diffusion properties would dominate in the layer of sandy silt fill material overlying the tuff. Therefore, the standard Fickian diffusion application is most likely a reasonable approach. The specific diffusion rates resulting from contaminant mass and distribution, and the specific properties of the subsurface materials at the PRS 0-027 site, will ultimately dictate actual contaminant migration via diffusion in the system.

There are components of the risk evaluation that are potentially overly conservative. For instance, general consideration of Fickian diffusion reveals that, even at higher effective soil diffusion rates, only a relatively small percentage of contaminant migrates out of a system via diffusion. If an effective diffusion rate of 10^{-3} m^2/day is assumed (two orders of magnitude higher than the 10^{-5} that was used), after 30 years only roughly 25% of the total mass is expected to have diffused out of the subsurface. Although that amount of contaminant migration may still exceed the applicable regulatory benchmarks, it does demonstrate that use of a diffusion-driven gross mass balance evaluation may overestimate potential exposures. The limited effectiveness of diffusion as a bulk contaminant mass transport method is supported by the fact that contamination persists in the subsurface at the site 40+ years after the source was removed.

Another potentially overly conservative assumption used in this evaluation approach is the extrapolation of contaminant concentrations across bulk soil volumes. The predicted diffusion rates and cumulative volumes are based on the assumption of a uniform distribution of benzene at a given concentration throughout every cubic meter of soil. This is obviously an inaccurate model, and the reality of pockets of soil with much higher concentrations and/or free-phase NAPL interspersed with pockets of uncontaminated soil will affect the actual diffusion rates that occur in the subsurface.

Finally, there is the assumption that, although a given amount of mass may migrate through a given area over a given time when driven by diffusion, all of the mass may not necessarily enter a building. If any

portion of a given total mass flux did not physically enter a structure, that would contribute to lowering the indoor exposure concentrations.

Conclusion

Based on implementation of contaminant mass removal via active remediation at PRS 0-027, it is felt that a reduction in potential human-health risk associated with this site will be achievable. Using conservative evaluations of possible indoor air exposure levels, risk-based screening criteria have already almost been met at the site. Removal of contaminant mass from the system will enhance the reduction in risk.

Appendix H

Human Health Screening Assessment for PRS 0-027

A human health screening assessment was used to determine if COPC concentrations resulted in potential unacceptable risk to receptors. The screening assessment was performed according to the approach outlined in Chapter 3 of the "Installation Work Plan for Environmental Restoration Program" (LANL 1998, 62060).

H-1.0 Scoping

PRS 0-027 was used historically for oil and fuel storage. COPCs associated with the site include such VOCs as BTEXand such SVOCs as PAHs. Currently, land use at PRS 0-027 is commercial and it is expected to remain so in the future. The potential for human exposure to contaminants is currently limited to inhalation because either a building or concrete pavement covers the site, precluding dermal absorption and soil ingestion as pathways. Data were screened to a depth of 15 ft to address potential exposure that could be associated with future construction and/or renovations for the existing building (Knights of Columbus Hall) onsite. The exposure risks to volatile contaminants found in the subsurface will be reduced by the implementation of an SVE system (see section 4 of the VCA plan).

H-2.0 Screening Evaluation

A human health screening assessment was used to determine if COPC concentrations resulted in potential unacceptable risk. The SALs were based on a residential exposure scenario as described in LANL's human health risk-based screening methodology (LANL 2002, 72639) and on the guidance provided by the NMED (NMED 2000, 68554). The exposure pathways considered in the calculation of SALs include direct ingestion of soil, dermal contact with soil, inhalation of volatiles outdoors, and inhalation of fugitive dusts outdoors. The SALs are compared to maximum site concentrations from 0 to 15 ft, which is the depth of a building foundation; this comparison is done separately for noncarcinogens and carcinogens. The SALs are based on a hazard quotient of 1.0 for noncarcinogens and a target cancer risk of 10^{-6} for carcinogens. A value equal to one-tenth of the SAL is used for noncarcinogens, and a value equal to the SAL is used for carcinogens. The results of the screening assessment are presented in Tables H-2.0-1 and H-2.0-2. Because the SALs do not address indoor air inhalation, this pathway is addressed for VOCs and SVOCs by using EPA Region 6 soil screening levels for subsurface vapor intrusion in a variety of soil types and composition (EPA 2001, 68410) (Table H-2.0-3). The subsurface vapor intrusion values used are for silty clay soil, which is the representative soil type assumed for PRS 0-027. In the Tables H-2.0-1 through H-2.0-3, the COPCs with maximum concentrations above the SALs or the EPA values are shaded.

Table H-2.0-1 shows that antimony and several VOCs had maximum concentrations higher than their respective SALs. Antimony had maximum concentrations greater than one-tenth of its SAL but less than the SAL (30 mg/kg). The organic noncarcinogens naphthalene; butylbenzene[n-], butylbenzene[sec-], isopropylbenzene, isopropyltoluene[4-], propylbenzene[1-], and xylene[1,2-] all had maximum concentrations greater than one-tench of their respective SALs, but less than their respective SALs. Methylnaphthalene[2-], ethylbenzene, toluene, trimethylbenzene[1,2,4-], trimethylbenzene[1,2,5-], and xylene all had maximum concentrations greater than their SALs.

Table H-2.0-2 shows that the maximum concentration of benzene in the depth interval of 0 to 15 ft is 2.9 mg/kg, which is greater than its SAL. The extent to which benzene exceeds its SAL is still less than NMED's target risk level of 10^{-5} (NMED 2000, 68554). The maximum concentration of benzene in the 0- to 15-ft interval represents a potential cancer risk of $5x10^{-6}$ (an excess cancer risk of about 5 per million exposed). However, benzene concentrations increase by more than an order of magnitude (40 mg/kg) below 15 ft. The potential human health risks associated with inhalation of volatile benzene from depths beyond 15 ft are being addressed through remediation of subsurface organics.

Table H-2.0-1
Screening Evaluation for Noncarcinogenic COPCs at PRS 0-027

COPC	Maximum Value (0–15 ft) (mg/kg)	SAL (mg/kg)	0.1 SAL (mg/kg)
Antimony	10.2	30	3
Barium	317	5200	520
Beryllium	0.79	150	15
Cadmium	0.77	70	7
Chromium, total	10	210	21
Cobalt	6.7	4500	450
Copper	11.7	2800	280
Lead	38.7	400	40
Manganese	405	7800	780
Mercury	0.05	23	2.3
Nickel	7.9	1500	150
Vanadium	26.3	530	53
Zinc	121	23000	2300
Fluoranthene	0.049	2300	230
Methylnaphthalene[2-][a]	58	53	5.3
Naphthalene	27	53	5.3
Pyrene	0.053	1800	180
Arochlor 1260	0.076	1	0.1
Benzoic Acid	0.059	100000	10000
Acetone	2.2	1600	160
Butanone	0.025	37000	3700
Butylbenzene[n-]	42	140	14
Butylbenzene[sec-]	26	110	11
Butylbenzene[tert-]	0.012	130	13
Chlorotoluene[4-]	0.041	160	16
Ethylbenzene	290	68	6.8
Isopropylbenzene	54	160	
Isopropyltoluene[4-][b]	43	160	
Methylene Chloride	0.59	8.9	0.89
Propylbenzene[1-][b]	81	160	
Toluene	210	180	18
Trimethylbenzene[1,2,4-]	160	52	5.2
Trimethylbenzene[1,2,5-]	38	21	2.1
Xylene[1,2-][c]	9.7	63	6.3
Xylene, total	440	63	6.3

a. Surrogate value based on naphthalene
b. Surrogate value based on isopropylene
c. Surrogate value based on total xylene

Table H-2.0-2
Screening Evaluation for Carcinogenic COPCs for PRS 0-027

COPC	Maximum Value (0–15 ft) (mg/kg)	SAL (mg/kg)
DDD[4,4'-]	0.006	2.4
DDE[4,4'-]	0.003	1.7
DDT[4,4'-]	0.025	1.7
Benzene	[redacted]	0.64

Table H-2.0-3 shows the maximum concentration of volatile and semivolatile COPCs for which EPA Region 6 screening benchmarks were available for subsurface vapor intrusion. Several of these COPCs have higher maximum concentrations than their indoor air inhalation screening value.

Table H-2.0-3
VOC and SVOC COPC Screening Evaluation for Indoor Air Inhalation

COPC	Maximum Value (0–15 ft) (mg/kg)	Subsurface Vapor Intrusion Values (mg/kg)
Benzene	2.9	
Toluene	210	
Ethylbenzene	290	
Xylene[1,2-]	9	168
Xylene, total[1]	440	
Naphthalene	27	63.4

[a] Surrogate value based on most conservative EPA Region 6 xylene screening value (xylene[1,3-]) (EPA 2001, 68410).

H-3.0 Uncertainty Analysis

The analysis presented in this human health screening assessment is subject to varying degrees and types of uncertainty. The uncertainties associated with data evaluation, exposure assessment, toxicity assessment, and the additive approach may affect results.

Data Evaluation and COPC Identification Process

Uncertainties associated with the data can include sampling errors, laboratory analysis errors, and data analysis errors. For this PRS, these uncertainties are expected to have little effect on the results because most chemicals that were higher than screening benchmarks were above detection limits.

Exposure Assessment

Uncertainties were identified in three areas of the exposure assessment process:

- Identification of receptors—Land-use and activity patterns for PRS 0-027 are not represented by those activities assumed under the residential land-use scenario. Therefore, biases towards overestimating risk are introduced. Because the individuals visiting building facilities would spend much less time onsite relative to a resident, the screening assessment overestimates exposure and the potential site hazards. Consequently, these uncertainties are addressed through highly protective estimates of risk.

- Exposure pathway assumptions—For each exposure pathway, assumptions are made concerning the parameters, routes of exposure, the amount of contaminated material to which an individual can be exposed, and intake rates for different routes of exposure. As previously stated, dermal contact and soil ingestion exposure pathways are incomplete.

- Derivation of exposure point concentrations—Maximum detected concentrations are used for comparison to SALs. This practice leads to an overestimate of the concentration that represents exposure over the entire site. It also results in an overestimate of the potential risk to human health.

Toxicity Values

The primary uncertainty associated with the SALs is related to the derivation of toxicity values used in the calculation. EPA toxicity values (reference doses [RfDs] and slope factors [SFs]) were used to derive the SALs used in this assessment. Uncertainties were identified in three areas with respect to the toxicity values: (1) extrapolation from animals to humans, (2) extrapolation from one route of exposure to another route of exposure, and (3) interindividual variability in the human population.

- Extrapolation from animals to humans—The SFs and RfDs are often determined based on extrapolation from animal data to humans, which may result in uncertainties in toxicity values because differences exist in chemical absorption, metabolism, excretion, and toxic responses between animals and humans. The EPA accounts for differences in body weight, surface area, and pharmacokinetic relationships between animals and humans to minimize the potential to underestimate the dose-response relationship. However, this typically results in more conservatism being incorporated into the toxicity value.

- Extrapolation from one route of exposure to another route of exposure—The SFs and RfDs can often contain extrapolations from one route of exposure to another. This extrapolation from the oral route to the inhalation and/or dermal route is used based on the EPA's Integrated Risk Information System database (EPA 2001, 70109). Differences between the exposure pathways could result in an overestimation of the risk.

- Interindividual variability in the human population—Regarding noncarcinogenic effects, the amount of human variability in physical characteristics is important to determining expected risks that can be expected at low exposures and in determining the no observed adverse effect level (NOAEL). The NOAEL/uncertainty factor approach incorporates a ten-fold conservatism factor (i.e., divide toxicity reference value by 10) to reflect the possible interindividual variability in the human population.

Additive Approach

For noncarcinogens, the effects of a mixture of chemicals are generally unknown, and possible interactions could be synergistic or antagonistic, thereby causing an over- or underestimation of the risk. Additionally, the RfDs for different chemicals are not based on the same severity, effect, or target organ. Therefore, the potential for occurrence of noncarcinogenic effects can be overestimated for chemicals that act by different mechanisms and on different target organs but are addressed additively.

H-4.0 Interpretation

Considering the screening results (Tables H-2.0-1 and H-2.0-2), the only inorganic with a maximum concentration greater than the one-tenth SAL is antimony. However, antimony was detected in only 2 of 33 samples (Table 2.1-1 of the VCA plan), and use of the maximum value as the representative screening concentration yields a highly conservative, and most likely unrealistic, estimate of risk. In addition, the estimated (J-qualified) maximum concentration of antimony is less than its SAL. The assumption of additive effects underlies the use of a hazard index of 1.0 when estimating risk from multiple COPCs. For this assumption to be valid, antimony must share the same toxicological mode of action with inhalation of VOCs and SVOCs. Antimony affects blood glucose levels, whereas exposure through inhalation of the other COPCs largely affects the liver and kidney (http://www.epa.gov/iris); thus, comparison to one-tenth of SAL is not representative. Finally, pathways for exposure (dermal contact or ingestion) are incomplete due to the concrete cover over the site. Thus, antimony is not expected to be a risk driver.

The COPCs with the potential to adversely affect human health at PRS 0-027 are volatile or semivolatile organics in the subsurface (Tables H-2.0-1 and H-2.0-2). Table H-2.0-3 shows the maximum concentration of volatile and semivolatile COPCs for which EPA Region 6 screening benchmarks were available for subsurface vapor intrusion. Although empirical measures in the indoor air exposure pathway showed that most volatilized chemicals were below detection limits, several analytes (toluene and xylene[1,3-]) were detectable in the vapor phase (<1.00 ppbv; Table 2.1-5 of the VCA plan). These results indicate that there may be a potential for unacceptable human health risk. Consequently, an SVE system will be employed at the site to reduce potential risks associated with these COPCs.