RFI Work Plan for Operable Unit 1071

Environmental Restoration Program

May 1992

A Department of Energy Environmental Cleanup Program

Los Alamos
NATIONAL LABORATORY

LA-UR-92-810

RFI WORK PLAN FOR OPERABLE UNIT 1071
ENVIRONMENTAL RESTORATION PROGRAM

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EXECUTIVE SUMMARY

Purpose

The primary purpose of this Resource Conservation and Recovery Act (RCRA) facility investigation (RFI) work plan is to determine the nature and extent of releases of hazardous waste or hazardous constituents from solid waste management units (SWMUs) in Operable Unit (OU) 1071 and to determine the need for corrective measures studies (CMSs) of the SWMUs. Secondarily, this document satisfies part of the regulatory requirements contained in Los Alamos National Laboratory's (the Laboratory's) permit to operate under RCRA. OU 1071 includes Technical Areas (TAs) -0 (which is outside Laboratory boundaries), -19 (East Gate Laboratory), -26 (D Site), -73 (Los Alamos Airport), and -74 (Otowi Section buffer zone). These TAs are largely located in Los Alamos County north of the Laboratory proper. Within these TAs are 69 SWMUs and 6 areas of concern (AOCs), which are located on residential and commercial private property and on lands owned by the San Ildefonso Pueblo, the US Forest Service, Los Alamos County, Santa Fe County, the General Services Administration, and the Department of Energy (DOE).

Module VIII of the permit, known as the HSWA Module [the portion of the permit that responds to the requirements of the Hazardous and Solid Waste Amendments (HSWA)], was issued by the Environmental Protection Agency (EPA). At the Laboratory, these permit requirements are addressed by the DOE's Environmental Restoration (ER) Program. This document provides field sampling plans to implement the RFI. In conjunction with seven other RFI work plans for OUs at the Laboratory, it meets the requirements set forth in the HSWA Module to address a cumulative percentage of the Laboratory's SWMUs in RFI work plans by May 23, 1992.

Installation Work Plan

The HSWA Module required the Laboratory to prepare an installation work plan (IWP) to describe the Laboratory-wide system for accomplishing the RFI, CMS, and the corrective measures, a requirement satisfied by the Installation Work Plan for Environmental Restoration submitted to the EPA in November 1990. Revision 1 of the document, which is updated annually, was published in November 1991. The IWP identifies the Laboratory's SWMUs, describes their aggregation into 24 OUs, and presents the Laboratory's overall management plan and technical approach for meeting the requirements of the HSWA Module. When information relevant to this work plan has already been provided in the IWP, the reader is referred to the most recent version of that document.

Both the IWP and this work plan address radioactive materials and other hazardous substances not subject to RCRA. It is understood that the language in this work plan pertaining to subjects outside the scope of RCRA is not enforceable under the Laboratory's operating permit.

Background

The nature of past Laboratory activities in OU 1071 varied considerably, and, therefore, the SWMUs identified at the Laboratory differ widely. The SWMUs include, but are not limited to, container storage areas, surface disposal areas, landfills, small-arms firing ranges, mortar impact areas, waste lines, wastewater treatment plants, septic systems, and contaminated soil beneath service stations.

Contaminants and Pathways of Concern

Known contaminants include lead, unexploded ordnance, waste oils, polychlorinated biphenyls, and depleted uranium. Potential contaminants include, but are not limited to, various radionuclides (primarily ^{235}U, ^{233}U, tritium, and plutonium associated with TA-26), fuel oils, solvents, greases, detergents, descaling chemicals, algicides, and high explosives (HE). The principal exposure pathways of concern are direct contact with unexploded ordnance, ingestion of soil, and inhalation of soil. Neither transport in the unsaturated (vadose) zone nor the groundwater pathway is of direct concern, given the considerable depth to the main aquifer (about 1,080 ft) over much of the OU and the absence of any known pathway to the main aquifer.

Technical Approach

To successfully complete the RFI in the face of continuing uncertainty, this work plan applies the data quality objectives process, phasing of the proposed investigations, the observational approach, voluntary corrective actions (remediation), bias for action, health-based risk assessments, and the decision analysis process. The investigations and sampling plans for the SWMUs make use of various aspects of Laboratory-wide framework studies of contaminant background levels, geology, and hydrology. When appropriate, SWMUs and AOCs are grouped in sampling plans, with specific studies at individual SWMUs, as necessary. The groupings take into consideration the geographic proximity of the SWMUs and the conceptual pathway models for the individual SWMUs.

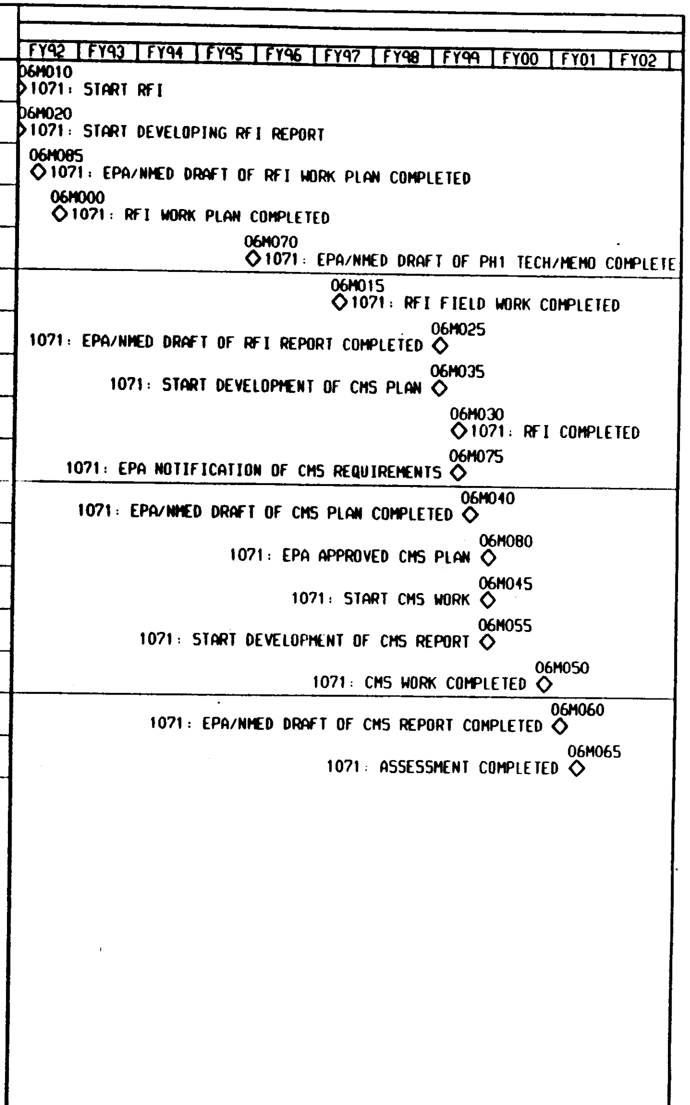
Schedule, Costs, and Reports

The RFI field work described in this document requires 5 years to complete. Figure ES-1 shows the baseline schedule, which reflects a time template applied across the program. The activities in this plan will require a DOE change control to the OU 1071 schedule. If extensive Phase II studies are required, the field work will not be completed within the 5-year period.

Table ES-1 shows the OU 1071 in the baseline cost/schedule. The costs are based upon assumptions that are generic to the program and are, therefore, only approximate.

Reports generated in the implementation of this work plan will be made available for public review at the ER Program's public reading room at 2101 Trinity Drive in Los Alamos.

ACTIVITY ID	ACTIVITY DESCRIPTION	EARLY START	EARLY FINISH
06M010	1071: START RFI	1OCT91	
06M020	1071: START DEVELOPING RFI REPORT	1OCT91	
06M085	1071: EPA/NMED DRAFT OF RFI WORK PLAN COMPLETED	4FEB92	
06M000	1071: RFI WORK PLAN COMPLETED	17JUN92	16JUN92
06M070	1071: EPA/NMED DRAFT OF PH1 TECH/MEMO COMPLETED		26SEP95
06M015	1071: RFI FIELD WORK COMPLETED		21MAR97
06M025	1071: EPA/NMED DRAFT OF RFI REPORT COMPLETED		2DEC98
06M035	1071: START DEVELOPMENT OF CMS PLAN	3DEC98	
06M030	1071: RFI COMPLETED		6APR99
06M075	1071: EPA NOTIFICATION OF CMS REQUIREMENTS		6APR99
06M040	1071: EPA/NMED DRAFT OF CMS PLAN COMPLETED		21JUN99
06M080	1071: EPA APPROVED CMS PLAN		13OCT99
06M045	1071: START CMS WORK	14OCT99	
06M055	1071: START DEVELOPMENT OF CMS REPORT	14OCT99	
06M050	1071: CMS WORK COMPLETED		5OCT00
06M060	1071: EPA/NMED DRAFT OF CMS REPORT COMPLETED		12JAN01
06M065	1071: ASSESSMENT COMPLETED		30APR01



LOS ALAMOS NATIONAL LABORATORY
OU-1071
MILESTONE CHART

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ENVIRONMENTAL RESTORATION

Figure ES-1. RFI schedule for OU 1071.

TABLE ES-1

BASELINE COSTS OF MAJOR ACTIVITIES AT OU 1071

Activity	Duration (man-hours)	Budget	Scheduled Start	Scheduled Finish
Assessment—RFI Work Plan	392	649,925.00	10/01/91	4/29/93
Assessment—RFI	1,380	44,998,129.97	10/01/91	4/18/97
Assessment—RFI Report	1,868	2,068,455.35	10/1/91	4/06/99
Assessment—CMS Plan	245	68,586.16	12/03/98	11/24/99
Assessment—CMS	245	1,346,320.00	10/14/99	10/05/00
Assessment—CMS Report	515	344,797.08	4/07/99	4/30/01
Assessment—ADS Management	2,125	1,313,561.34	10/01/91	4/17/00
Assessment—Voluntary Corrective Action	1,489	629,917.00	10/01/92	9/24/98
		51,419,691.90*		

***Summary of Total Costs (X $1,000)**

Estimate to Completion	51,420
Escalation	459
Prior Years	1,028
Total at Completion	52,907

RFI phase reports will be submitted at the end of each fiscal year and at the completion of each of the 17 sampling plans. The RFI phase reports will serve as

- a partial summary of the results of initial site characterization activities;
- modifications to the sampling plans suggested by the initial findings;
- work plans that describe Phase II sampling when such sampling is required;
- a vehicle for recommending voluntary corrective action or no further action as mechanisms for delisting SWMUs shown by the RFI to have acceptable health-based risk levels; and
- summary reports of the sampling plans.

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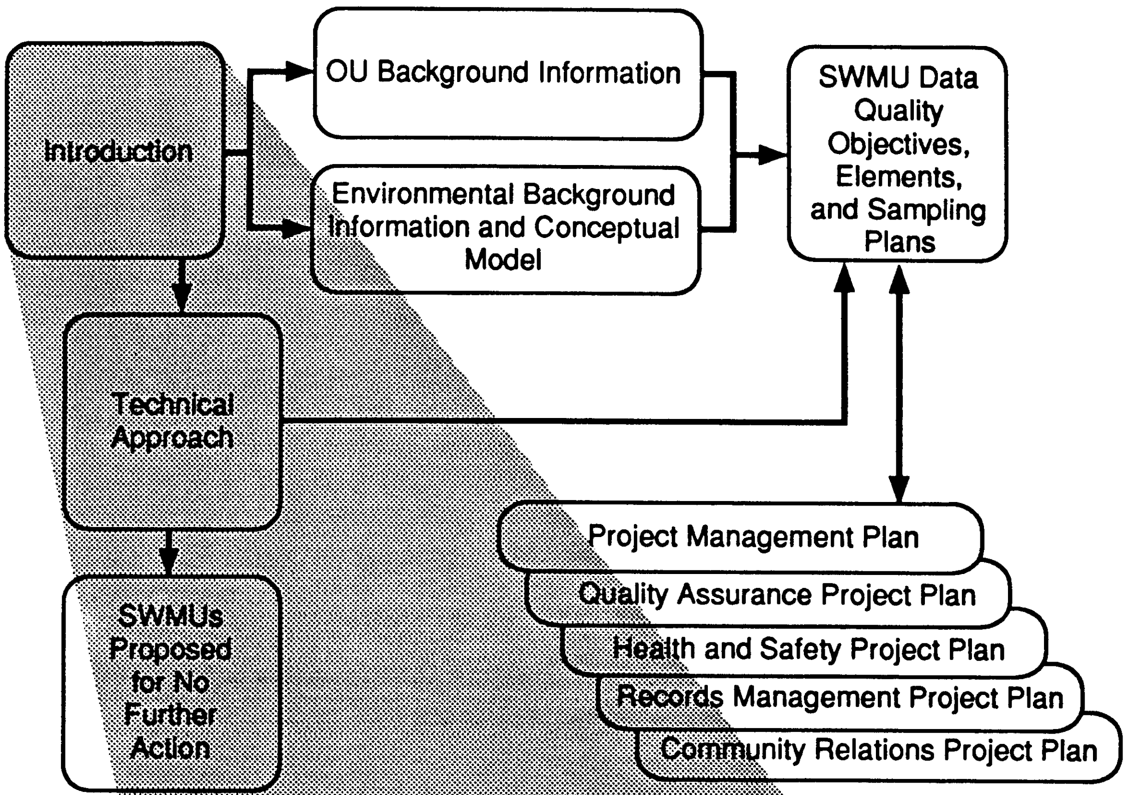
LIST OF TABLES

ACGIH	American Conference of Governmental Industrial Hygienists
AEC	US Atomic Energy Commission
ALARA	As low as reasonably achievable
AOC	Area of concern
ASME	American Society of Mechanical Engineers
CEARP	Comprehensive Environmental Assessment and Response Program
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CLS	Chemical and Laser Sciences (Division)
CMI	Corrective measures implementation
CMR	Chemistry and Metallurgical Research (Division)
CMS	Corrective measures study
D&D	Decontamination and decommissioning
DOE	US Department of Energy
DQO	Data quality objective
EES	Earth and Environmental Sciences (Division)
EIS	Environmental impact statement
EMC	Electromagnetic conductivity
ENG	Facilities Engineering (Division)
EPA	US Environmental Protection Agency
ER	Environmental restoration
ERPG	Emergency response planning guideline
ES&H	Environment, safety, and health
FIMAD	Facility for Information Management, Analysis, and Display
H&S	Health and safety
H&SPL	Health and safety project leader
HE	High explosive(s)
HSE	Health, Safety, and Environment (Division)
HSWA	Hazardous and Solid Waste Amendments
INC	Isotope and Nuclear Chemistry (Division)
IWP	Installation work plan
LAAO	Los Alamos Area Office (a branch of the Department of Energy)
LANL	Los Alamos National Laboratory
LASL	Los Alamos Scientific Laboratory (LANL before January 1, 1981)
MDA	Material disposal area
MEKP	Methyl ethyl ketone peroxide
MSDS	Material safety data sheet
MWSDF	Mixed-waste storage and disposal facility
NEPA	National Environmental Policy Act
NFA	No further action
NIOSH	National Institute of Occupational Health and Safety
NMED	New Mexico Environment Department
NPDES	National pollutant discharge elimination system

NRC	US Nuclear Regulatory Commission
OSHA	Occupational Safety and Health Administration
OU	Operable unit
OUPL	Operable unit project leader
PCB	Polychlorinated biphenyl
PCM	Potential contact medium
PL	Project leader
PPE	Personal protective equipment
QA	Quality assurance
QAPjP	Quality assurance project plan
QC	Quality control
RCRA	Resource Conservation and Recovery Act
RFI	RCRA facility investigation
RPF	Records-Processing Facility
SOP	Standard operating procedure
SWMU	Solid waste management unit
TA	Technical area
TAL	Target analyte list
TRU	Transuranic (waste)
TSD	Treatment, storage, disposal
UC	University of California
USGS	US Geological Survey
UST	Underground storage tank
VCP	Vitrified clay pipe
WBS	Work breakdown structure

CHAPTER 1



Introduction

- Purpose
- HSWA Requirements
- Installation Work Plan
- Operable Unit Description
- Permit Modifications
- Document Organization

1.0 INTRODUCTION

1.1 Purpose

In 1976, Congress enacted the Resource Conservation and Recovery Act (RCRA), which governs the day-to-day operations of hazardous waste treatment, storage, and disposal (TSD) facilities. Sections 3004(u) and (v) of RCRA established a permitting system, which is implemented by the Environmental Protection Agency (EPA), and set standards for all hazardous-waste-producing operations at a TSD facility. Under this law, Los Alamos National Laboratory (the Laboratory) qualifies as a treatment and storage facility and must have a permit to operate.

In 1984, Congress amended RCRA by passing the Hazardous and Solid Waste Amendments (HSWA), which modified the permitting requirements of RCRA. In accordance with this statute, the Laboratory's permit to operate (EPA 1990, 0306) includes a section, referred to as the HSWA Module, that prescribes a specific corrective action program for the Laboratory. The HSWA Module includes provisions for mitigating releases from facilities currently in operation and for cleaning up inactive sites and sets a schedule for completing this work. The primary purpose of this RCRA field investigation (RFI) work plan is to determine the nature and extent of releases of hazardous waste or hazardous constituents from solid waste management units (SWMUs). The plan meets the requirements of the HSWA Module and is consistent with the scope of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).

1.2 Requirements of the Hazardous and Solid Waste Amendments

Any discernible unit in which a TSD facility has placed solid wastes is identified as a SWMU. Table A of the HSWA Module identifies 603 SWMUs at the Laboratory, and Table B lists those (priority) SWMUs that must be investigated first.

For purposes of implementing the cleanup process, the Laboratory has aggregated SWMUs that are geographically related in groupings called operable units (OUs). The Laboratory has established 24 OUs, and an RFI work plan is to be prepared for each. This work plan for OU 1071 addresses SWMUs located in five of the Laboratory's technical areas (TAs): TAs -0, -19, -26, -73, and -74, four of which contain SWMUs. This plan and the seven other OU work plans due on May 23, 1992, meet the schedule requirement of the HSWA Module, which is to address a cumulative total of 35% of the SWMUs in Table A and a cumulative total of 55% of the 182 priority SWMUs listed in Table B of the HSWA Module.

The HSWA Module outlines five tasks to be addressed in an RFI work plan. Table 1-1 lists these tasks and indicates the sections of this work plan in which they are described. Table 1-2 identifies the HSWA Module SWMUs addressed in this work plan. Table 1-3 identifies the 69 SWMUs and 6 areas of concern [AOCs (potential release sites that do not meet the definition of a SWMU)] that are addressed in OU 1071. For clarity, it also identifies the RFI work plans that address those SWMUs previously listed in TAs no longer part of OU 1071.

TABLE 1-1

LOCATION OF DISCUSSIONS OF HSWA MODULE REQUIREMENTS IN THIS WORK PLAN

HSWA Module Requirements	Location in RFI Work Plan
RFI Task I, Description of Current Conditions	
Facility Background	Chapter 3
Nature and Extent of Contamination of SWMUs	Chapter 5, Subsections 5._.2*
RFI Task II, RFI Work Plan Requirements	
Data Collection Quality Assurance Plan	Annex II Quality Assurance Project Plan
Data Management Plan	Annex IV Records Management Project Plan
Health and Safety Plan	Annex III Health and Safety Project Plan
Community Relations Plan	Annex V Community Relations Project Plan
Project Management Plan	Annex I Project Management Plan
RFI Task III, Facility Investigation	
Environmental Setting	Chapter 4; Chapter 5, Subsections 5._.5.2
Source Characterization	Chapter 5, Subsections 5._.1 and 5._.2.1
Contaminant Characteristics	Chapter 5, Subsections 5._.5.1
Potential Receptors	Chapter 5, Subsections 5._.3 and 5._.5.3
RFI Task IV, Investigative Analysis	To be addressed in RFI report.
RFI Task V, Reports	Annex I, Project Management Plan

*Blanks indicate Sections 1–17 in Chapter 5.

TABLE 1-2

HSWA MODULE SWMUs ADDRESSED IN THIS WORK PLAN

SWMUs in Table A of the HSWA Module	SWMUs to Be Addressed in This RFI Work Plan	Renumbered SWMUs (New Number)	OU RFI Work Plan Addressing SWMU
TA-0			
0-001	No		1049
0-002	No	61-006	1114[a]
0-003	Yes		1071
0-005[b]	Yes		1071
0-006	No	61-005	1114[a]
0-007[b]	Yes	73-001(a, b)	1071
0-009[b]	No	9-013	1157[a]
0-012	Yes		1071
0-014	Yes	73-002	1071
0-017	Yes		1071
0-023	No	61-007	1114
TA-19			
19-001	Yes		1071

a. SWMUs moved into different operable units to put them with other SWMUs and/or geologic systems to which they are related.

b. Also in Table B, priority SWMUs.

TABLE 1-3

CURRENT LIST OF SWMUs AND AREAS OF CONCERN LOCATED IN TECHNICAL AREAS OF OU 1071

Technical Area and SWMU	Title	SWMU, SWMU Aggregate, or SWMU Group	Location of Discussion
TA-0[a]			
0-003	Decommissioned Container Storage Area	0-A	5.1
0-004	Active Container Storage Area	0-1	5.2
0-005	Mortandad Canyon "Landfill"[b]	0-005	6.1
0-008	North Mesa Surface Disposal	0-008	6.2
0-010(a)	Surface Disposal	0-010	6.3
0-010(b)	"Landfill"[b]	0-C	5.2
0-011(a)	Mortar Impact Area	0-D	5.3
0-011(c)	Mortar Impact Area	0-D	5.3
0-011(d)	Mortar Impact Area	0-D	5.3
0-011(e)[c]	Mortar Impact Area	0-D	5.3
0-012	Western Steam Plant	0-A	5.1
0-015	Active Firing Range	0-015	6.4
0-016	Inactive Firing Range	0-016	5.4
0-017	Waste Lines	0-017	5.5
0-018(a)	Active Wastewater Treatment Plant	0-2	5.6
0-018(b)	Active Wastewater Treatment Plant	0-2	5.6
0-019	Decommissioned WastewaterTreatment Plant	0-2	5.6
0-024	Cistern	0-024	6.5
0-025	Tank Mesa "Landfill"[b]	0-025	6.6
0-026	Gun Mount "Landfill"	0-026	6.7
0-027	DP Road Storage Area	0-F	5.7
0-028(a)	Los Alamos County Recreation Area	O-3	5.8
0-028(b)	Los Alamos County Recreation Area	0-E	5.8
0-029(a)	Leakage from PCB Transformers	0-G	5.9
0-029(b)	Leakage from PCB Transformers	0-G	5.9
0-029(c)	Leakage from PCB Transformers	0-G	5.9
0-030(a)	Septic System	0-F	5.7
0-030(b)	Septic System	0-1	5.2
0-030(c)	Septic System	0-3	5.10
0-030(d)	Septic System	0-3	5.10
0-030(e)	Septic System	0-3	5.10
0-030(f)	Septic System	0-3	5.10
0-030(g)	Septic System	0-3	5.10

TABLE 1-3 (continued)

CURRENT LIST OF SWMUs AND AREAS OF CONCERN LOCATED IN TECHNICAL AREAS OF OU 1071

Technical Area and SWMU	Title	SWMU, SWMU Aggregate, or SWMU Group	Location of Discussion
0-030(h)	Septic System	0-3	5.10
0-030(i)	Septic System	0-3	5.10
0-030(j)	Septic System	0-3	5.10
0-030(k)	Septic System	0-3	5.10
0-030(l)	Septic System	0-1	5.2
0-030(m)	Septic System	0-1	5.2
0-030(n)	Septic System	0-3	5.10
0-030(o)	Septic System	0-3	5.10
0-030(p)	Septic System	0-3	5.10
0-030(q)	Septic System	0-3	5.10
0-031(a)	Soil Contamination Beneath Former Service Station	0-031(a)	5.11
0-031(b)	Soil Contamination Beneath Former Service Station	0-4	5.12
0-032	Soil Contamination Under Former Motorpool Facility	0-4	5.12
0-033	Soil Contamination Beneath Former Zia Warehouses	0-1	5.2
0-034(a)	"Landfill"	0-5	5.13
0-034(b)	"Landfill"	0-5	5.13
0-035(a)	"Surface Disposal"	0-035(a)	6.8
C-0-020[c]	Area of Concern—Mortar Impact Area	0-D	5.3
TA-19			
19-001	Septic System	19-1	5.14
19-002	Surface Disposal	19-1	5.14
19-003	Drainline and Outfall	19-1	5.14
C-19-001[c]	Area of Concern--Potential Soil Contamination Beneath Former Structures	19-1	5.14
TA-26			
26-001	Canyonside Disposal Area	26-1	5.15
26-002(a)	Sump System	26-1	5.15
26-002(b)	Sump System	26-1	5.15
26-003	Septic System	26-1	5.15
TA-73			
73-001(a)	Landfill	73-1	5.16
73-001(b)	Waste Oil Pit	73-1	5.16
73-001(c)	Landfill	73-2	5.17

TABLE 1-3 (concluded)

CURRENT LIST OF SWMUs AND AREAS OF CONCERN LOCATED IN TECHNICAL AREAS OF OU 1071

Technical Area and SWMU	Title	SWMU, SWMU Aggregate, or SWMU Group	Location of Discussion
73-001(d)	Landfill	73-1	5.16
73-002	Airport Incinerator/Surface Disposal	73-2	5.17
73-003	Garbage Truck and Can Cleaning	73-2	5.17
73-004(a)	Inactive Septic System	73-2	5.17
73-004(b)	Inactive Septic System	73-2	5.17
73-004(c)	Inactive Septic System	73-2	5.17
73-004(d)	Inactive Septic System	73-1	5.16
73-005	Surface Disposal	73-2	5.17
73-005	Surface Disposal	73-2	5.17
73-006	Airport Building Outfalls	73-2	5.17
C-73-001[c]	Area of Concern—Fuel Tank	C-73-001	6.9
C-73-002[c]	Area of Concern—Fuel Tank	C-73-002	6.9
C-73-003[c]	Area of Concern—Fuel Tank	C-73-003	6.9
C-73-004[c]	Area of Concern—Fuel Tank	C-73-004	6.9

a. SWMU 0-001, Surface Impoundments in Mortandad Canyon, will be addressed as part of the Canyons Study (OU 1049). SWMUs 0-007, 0-014, 0-020, and 0-021 have been renumbered and are addressed in this work plan as part of TA-73. (Table 1-2 gives new SWMU numbers). The following SWMUs have been renumbered and are no longer part of OU 1071: 0-002, 0-006, 0-009, 0-013, 0-022, and 0-023.

b. Quotation marks are used in a SWMU title when the title contains a misnomer.

c. SWMU 0-11(e) is the same site as SWMU 0-011(b); therefore, 0-011(b) has been eliminated as a SWMU number.

d. Areas of concern are identified in Appendix C of the SWMU report (LANL 1990, 0145).

1.3 Installation Work Plan

The HSWA Module requires that the Laboratory prepare a master plan, called the Installation Work Plan (IWP), to describe the Laboratory-wide system for accomplishing all RFIs and corrective measures studies (CMSs). The IWP (LANL 1990, 0144; 1991, 0553) has been prepared in accordance with the HSWA Module and is consistent with EPA's interim final RFI guidance (EPA 1989, 0088) and proposed Subpart S of 40 CFR 264 (EPA 1990, 0432), which, when adopted, will implement the cleanup program mandated in Section 3004(u) of RCRA.

The IWP (LANL 1990, 0145; 1991, 0553) identifies the Laboratory's SWMUs (Appendix G) and describes their aggregation into 24 OUs (Subsection 3.4.1). It presents a facilities description in Chapter 2 and a description of the Laboratory's Environmental Restoration (ER) Program in Chapter 3. Annexes I-V contain the Program Management Plan, Quality Program Plan, Health and Safety Program Plan, Records Management Program Plan, and the Community Relations Program Plan, respectively. The document also contains a proposal to integrate RCRA closure and corrective action and a strategy for identifying and implementing interim remedial measures. When information relevant to this work plan has already been provided in the IWP, the reader is referred to the most recent version of the IWP.

1.4 Description of OU 1071

OU 1071 (TAs -0, -19, -26, -73, and -74) is located in Los Alamos and Santa Fe counties in north-central New Mexico (Figure 1-1). TA-0 consists of a series of small, geographically separated structures, most of which are located off Laboratory land (Figure 1-2). A few of these structures are located in other TAs. TAs-19, -26, -73, and -74 are single, discrete areas of land (Figure 1-3), each of which contains SWMUs, except TA-74 (Section 3.5). The SWMUs in TA-0 reflect the manner in which the Laboratory dealt with geographically isolated structures during its early years. The SWMUs of TAs-0, -19, -26, and -73 were placed in a single OU, largely because of their management history and geographic proximity. The elevations of the SWMUs in OU 1071, which are located on Los Alamos, North, and Barranca mesas and in Mortandad, Los Alamos, Pueblo, Bayo, Rendija, Cabra, and Guaje canyons (Figure 1-2), range from approximately 5,840 to 7,500 ft above sea level. Table 1-3 lists the SWMUs in the OU.

The SWMUs and AOCs (Appendix C, LANL 1990, 0145) in OU 1071 are located on property owned by Los Alamos County, the US Forest Service, the Department of Energy (DOE), the General Services Administration, commercial organizations, private individuals, and the San Ildefonso Pueblo (Figure 1-4 and Table 1-4). DOE does not currently use TAs-19, -26, or -74 for Laboratory operations. Johnson Controls, Inc., operates the Los Alamos Airport, located at TA-73, for the DOE. Ongoing Laboratory and commercial operations at TA-0 include a firing range, wastewater treatment, and drum storage. The DOE currently uses TA-74 as a safety buffer zone.

Section 3.5 of the IWP states that each OU work plan may contain an application for a Class III permit to modify Table A of the HSWA Module when it is determined that a SWMU needs no further investigation or when it is necessary to add SWMUs. Table 1-4 includes the Table A SWMUs to be addressed in this work plan (Table 1-2), as well as all additional SWMUs that the Laboratory has identified in OU 1071. Table 1-5 (a subset of Table 1-3) lists the SWMUs proposed for no further action.

Chapter 6 of this work plan provides a brief description of each SWMU proposed for no further action and the basis for that recommendation.

1.5 Organization of This Work Plan

Tables 3-2 and 3-3 of the IWP (LANL 1991, 0553) provide two possible outlines for work plans. This work plan includes all of the elements of the outline presented in Table 3-3, although it does not adhere strictly to its structure. Table 1-5 identifies the section in this work plan in which each element of the outline given in Table 3-3 of the IWP (LANL 1991, 0553) is discussed.

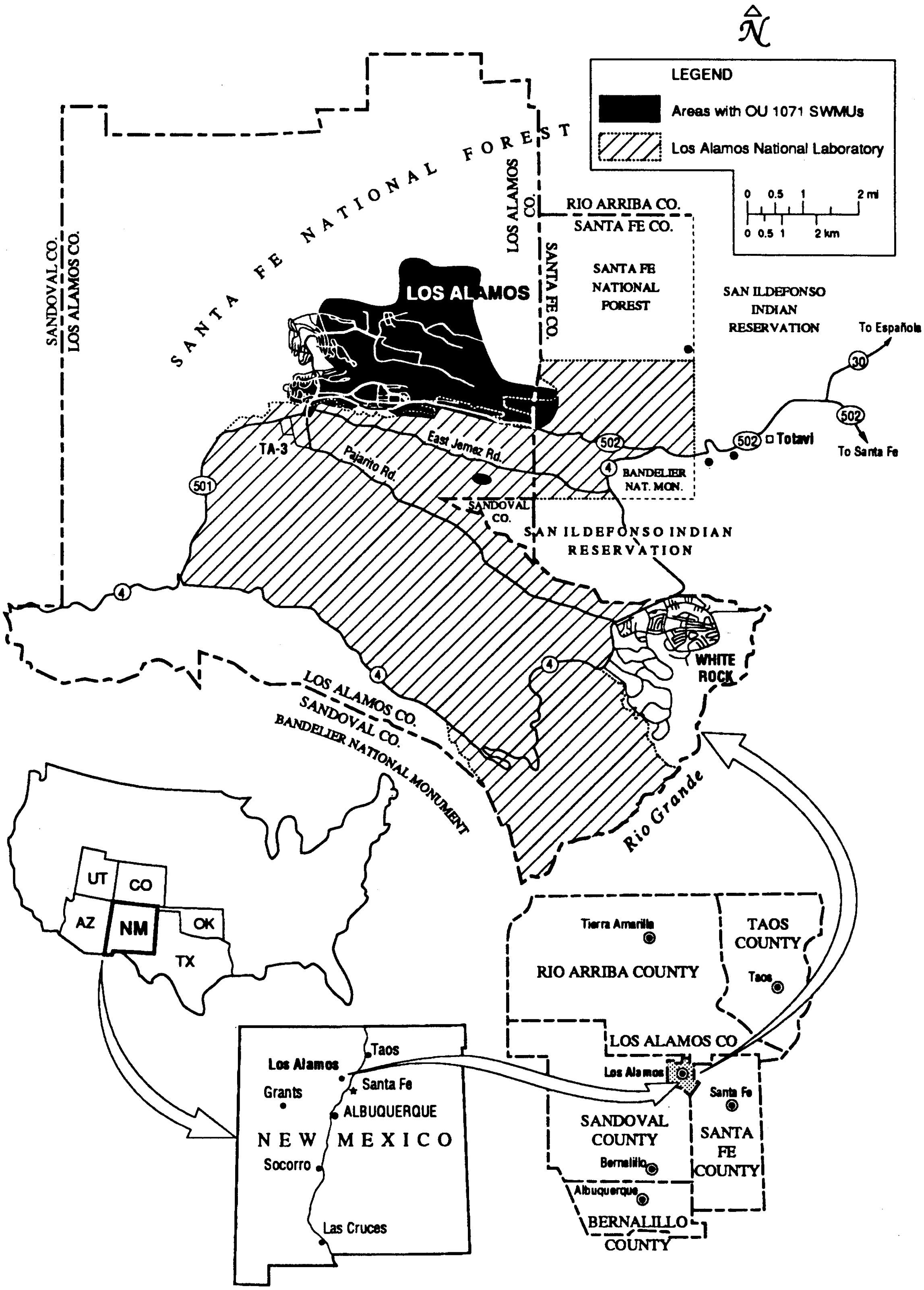


Figure 1-1. Location of technical areas that contain OU 1071 SWMUs.

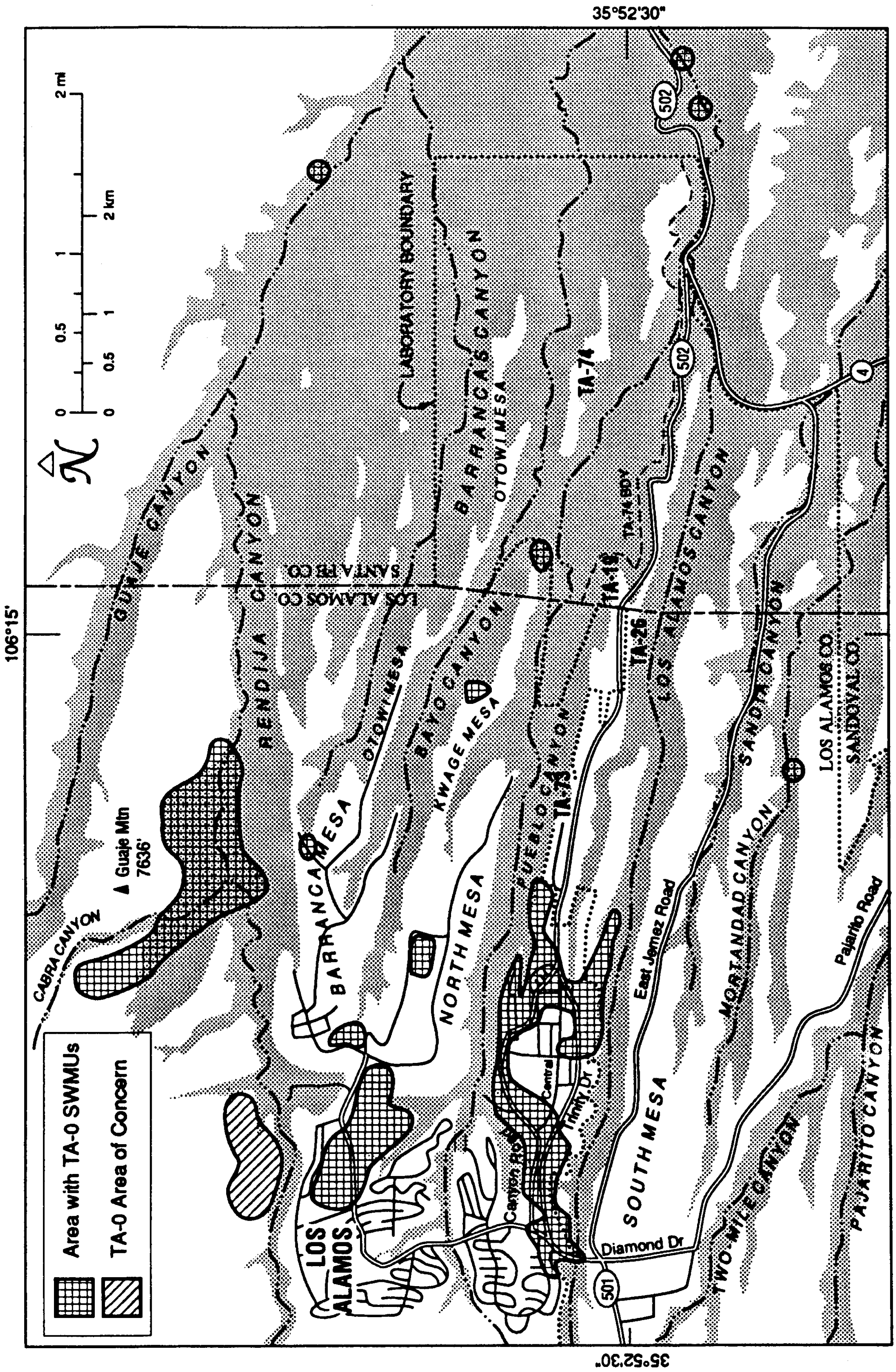


Figure 1-2. Location of SWMUs in TA-0. Light shading denotes canyon bottoms.

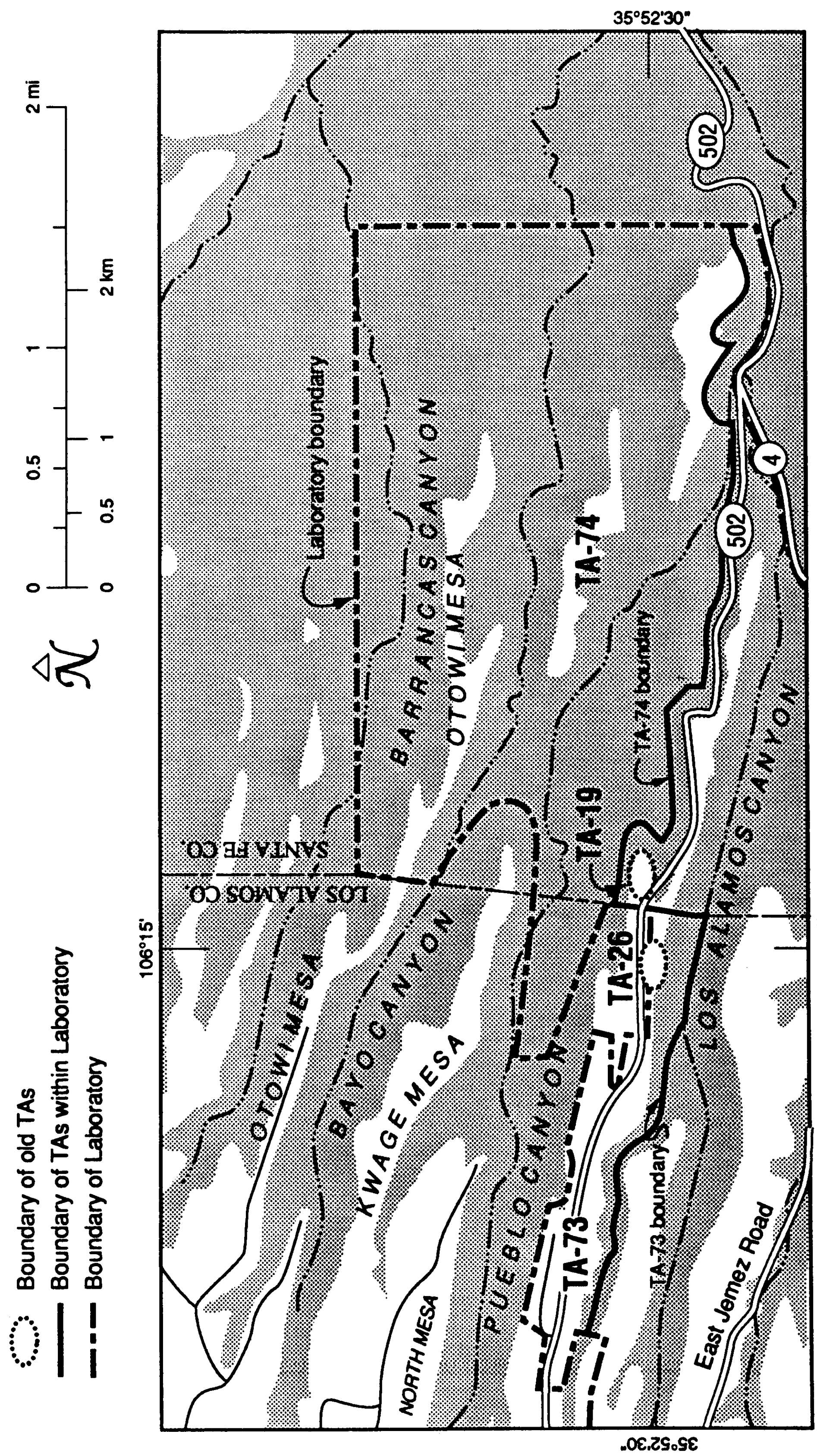


Figure 1-3. Location of TAs-19, -26, -73, and -74 in OU 1071. Light shading denotes canyon bottoms.

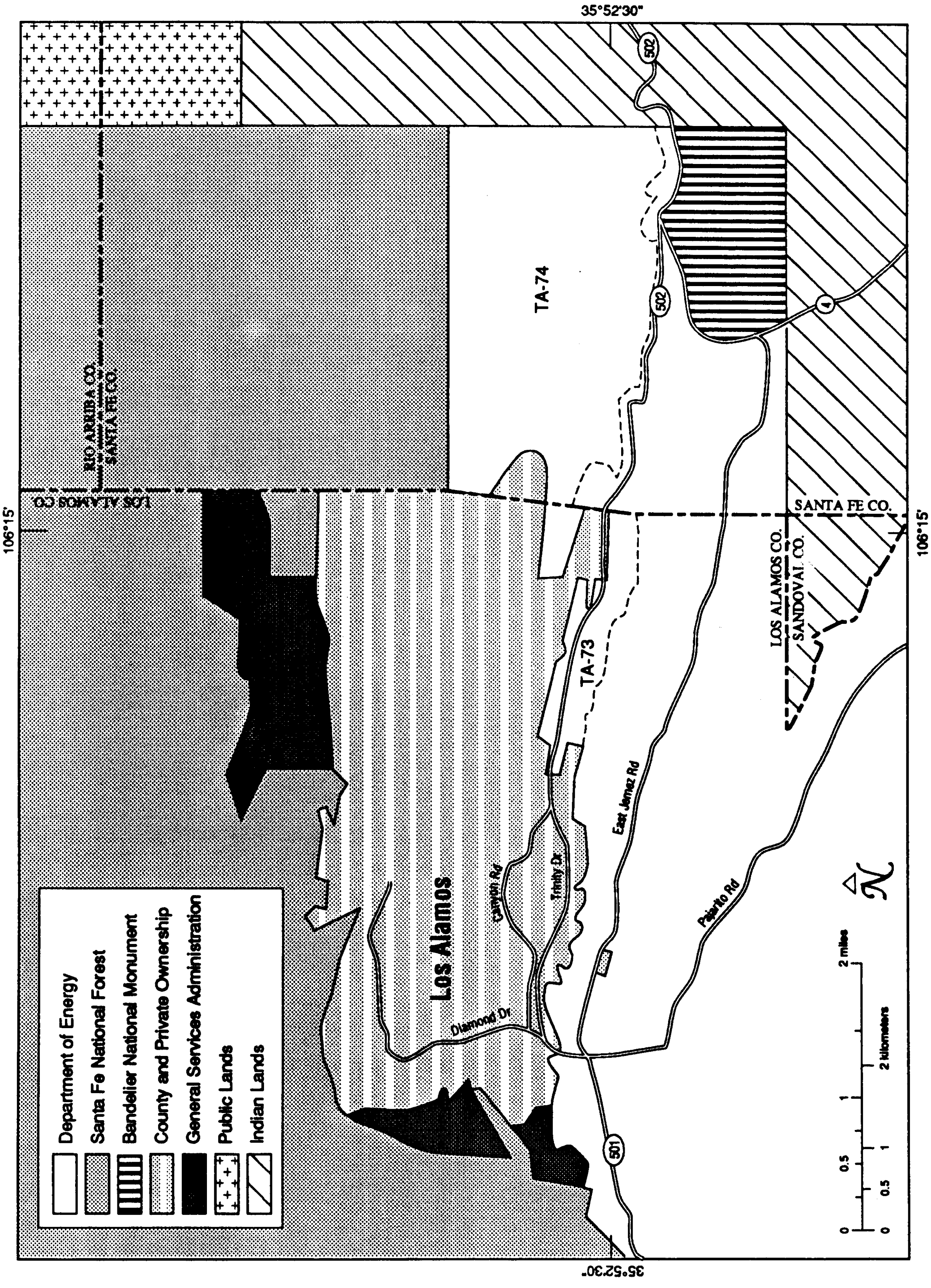


Figure 1-4. Land ownership map that includes areas with OU 1071 SWMUs.

TABLE 1-4

SWMUS IN OU 1071 PROPOSED FOR NO FURTHER ACTION

Where Addressed (Section)	SWMU Number	Title
6.1	0-005	Mortandad Canyon "Landfill" *
6.2	0-008	North Mesa Surface Disposal
6.3	0-010(a)	Surface Disposal
6.4	0-015	Active Firing Range
6.5	0-024	Cistern
6.6	0-025	Tank Mesa "Landfill"
6.7	0-026	Gun Mount "Landfill"
6.8	0-035	"Surface Disposal"
6.9	C-73-001 through C-73-004	Areas of Concern—Fuel Tanks

*Quotation marks are used in a SWMU title when the title contains a misnomer.

TABLE 1-5

LOCATION IN THIS WORK PLAN OF ELEMENTS REQUIRED BY TABLE 3-3 OF THE INSTALLATION WORK PLAN

Outline of Work Plan for OU 1071		Outline of Table 3-3 of IWP	
1.0	Introduction	1.0	Introduction
1.1	Purpose	1.1	Overview of Environmental Restoration Program
1.2	Requirements of the Hazardous and Solid Waste Amendments	1.2	Hazardous and Solid Waste Amendments Requirements
1.3	Installation Work Plan	1.3	Description of Operable Units and Solid Waste Management Units
1.4	Description of OU 1071		
1.5	Organization of This Work Plan	1.4	Organization of This Work Plan
2.0	Technical Approach	4.0	Remediation Alternatives and Evaluation Criteria
3.0	Background Information for OU 1071	2.0	Background Information for Operable Unit
3.-.1	Physical Description (of each TA)	2.1	Description
3.-.2	History (of each TA)	2.2	History
		2.3	Past Waste Management Practices
		2.4	Current Conditions at Technical Areas in Operable Unit
4.1	Environmental Setting	3.0	Environmental Setting
4.1.1	Topographic Setting	3.1	Topography

TABLE 1-5 (concluded)

LOCATION IN THIS WORK PLAN OF ELEMENTS REQUIRED BY TABLE 3-3 OF THE INSTALLATION WORK PLAN

Outline of Work Plan for OU 1071		Outline of Table 3-3 of IWP	
4.1.2	Climatic Setting	3.2	Climate
4.1.3	Geologic Setting	3.5	Geology
4.1.3.3	Surficial Deposits	3.3	Soils
4.1.4	Hydrogeological Setting	3.4	Hydrology
4.2	Conceptual Model of OU 1071	3.6	Three-Dimensional Geologic/ Hydrologic Model
5.0	SWMU DQOs, Elements, and	5.0	Evaluation of Solid Waste Management Units
5.-	First SWMU/Aggregate/Group Sampling Plan	5.-	First SWMU or SWMU Aggregate
5.-.1	Description and History	5.-.1.1	Description and History of Solid Waste Management Unit
5.-.2	Nature and Extent of Contamination	5.-.1.2.1	Existing Information on Nature and Extent of Contamination
5.-.2.1	Description and Contamination Levels		
5.-.2.2	Potential Migration Pathways	5.-.1.2.2	Potential Pathways of Contaminant Migration
5.-.2.3	Potential Public Health and Environmental Impacts	5.-.1.2.3	Potential Public Health and Environmental Impacts
5.-.3	Conceptual Model	5.-.1.1.2	Conceptual Exposure Model
5.-.4	Decisions, Domain, and Approach	5.-.2	Remediation Alternatives and Evaluation Criteria
5.-.5	Data Required	5.-.3	Data Needs and Data Quality Objectives
5.-.5.1	Source Characterization	5.-.3.1	Source Characterization
5.-.5.2	Environmental Setting	5.-.3.2	Environmental Setting
5.-.5.3	Potential Receptors	5.-.3.3	Potential Receptors
5.2	Second SWMU/Aggregate Group Sampling Plan	5.2	Second SWMU or SWMU Aggregate, etc.
6.0	Solid Waste Management Units	6.0	Proposed No-Investigation SWMUs
6.-	SWMU ____________	6.-	SWMU ____________
6.-.1	Description and History	6.-.1	Description
		6.-.2	History
6.-.2	Basis for Recommendation of No Further Action	6.-.3	Rationale for Recommendation
Annex I	Project Management Plan	Annex I	Project Management Plan
Annex II	Quality Assurance Project Plan	Annex II	Quality Assurance Project Plan

References for Chapter 1

EPA (US Environmental Protection Agency), May 1989. "Interim Final RCRA Facility Investigation (RFI) Guidance, Volume I of IV, Development of an RFI Work Plan and General Considerations for RCRA Facility Investigations," EPA/530-SW-89-031, OSWER Directive 9502.00-6D, Office of Solid Waste, Washington, DC. (EPA 1989, 0088)

EPA (US Environmental Protection Agency), April 10, 1990. RCRA Permit No. NM0890010515, EPA Region VI, issued to Los Alamos National Laboratory, Los Alamos, New Mexico, effective May 23, 1990, EPA Region VI, Hazardous Waste Management Division, Dallas, Texas. (EPA 1990, 0306)

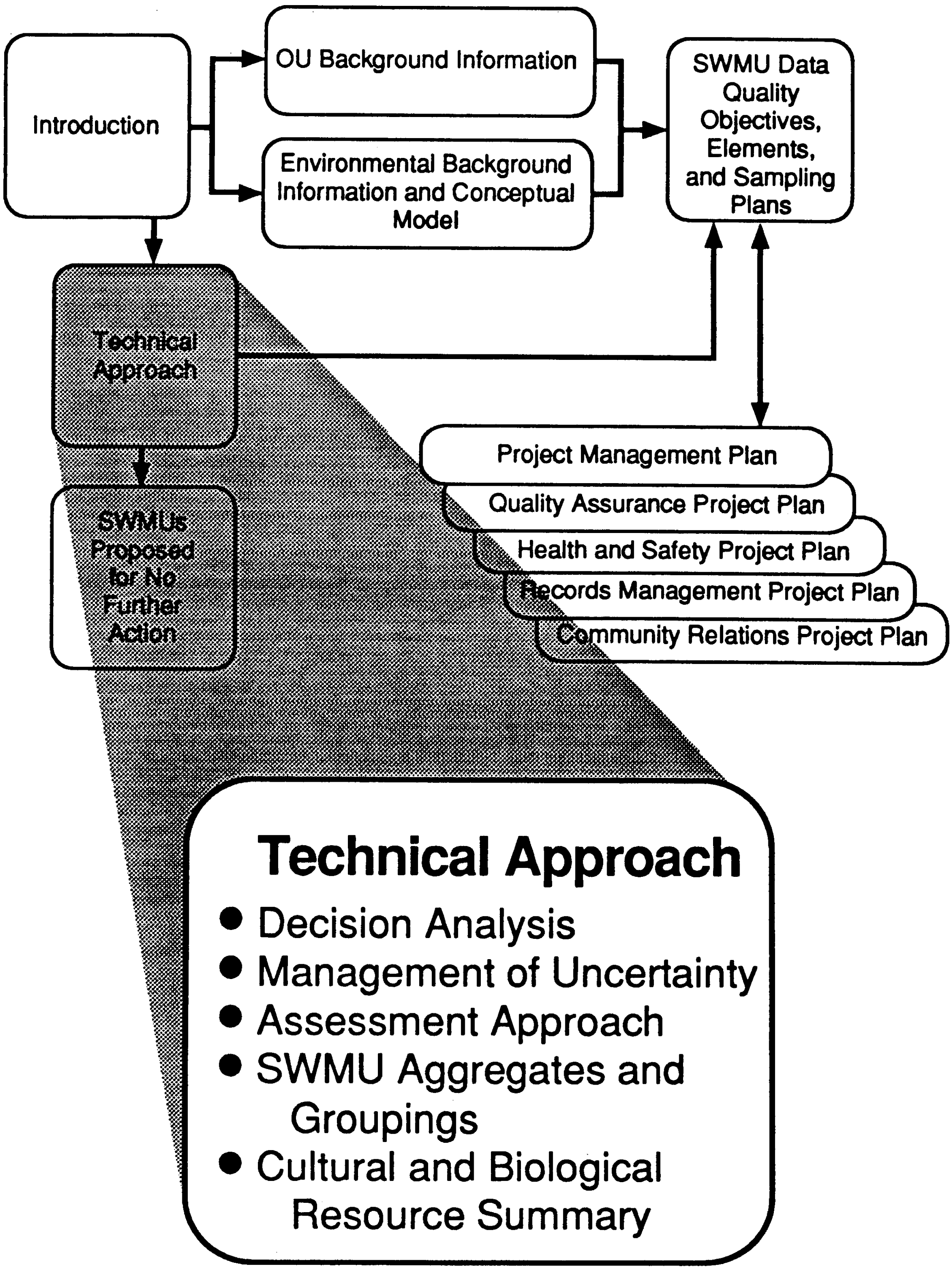
EPA (US Environmental Protection Agency), July 27, 1990. "Corrective Action for Solid Waste Management Units (SWMUs) at Hazardous Waste Management Facilities," proposed rule, Title 40 Parts 264, 265, 270, and 271, Federal Register, Vol. 55. (EPA 1990, 0432)

LANL (Los Alamos National Laboratory), November 1990. "Installation Work Plan for Environmental Restoration," Los Alamos National Laboratory Report LA-UR-90-3825, Los Alamos, New Mexico. (LANL 1990, 0144)

LANL (Los Alamos National Laboratory), November 1990. "Solid Waste Management Units Report," Volumes I through IV, Los Alamos National Laboratory Report No. LA-UR-90-3400, prepared by IT Corporation under Contract 9-XS8-0062R-1, Los Alamos, New Mexico. (LANL 1990, 0145)

LANL (Los Alamos National Laboratory), November 1991. "Installation Work Plan for Environmental Restoration," Revision 1, Los Alamos National Laboratory Report LA-UR-91-3310, Los Alamos, New Mexico. (LANL 1991, 0553)

CHAPTER 2


Introduction
OU Background Information
Environmental Background Information and Conceptual Model
SWMU Data Quality Objectives, Elements, and Sampling Plans
Technical Approach
SWMUs Proposed for No Further Action
Project Management Plan
Quality Assurance Project Plan
Health and Safety Project Plan
Records Management Project Plan
Community Relations Project Plan
Technical Approach
Decision Analysis
Management of Uncertainty
Assessment Approach
SWMU Aggregates and Groupings
Cultural and Biological Resource Summary

2.0 TECHNICAL APPROACH

2.1 Decision Analysis

The decision analysis approach, which provides for efficient identification and evaluation of corrective measures alternatives, is described in Appendix I of the Installation Work Plan (IWP) (LANL 1991, 0553). This appendix describes how decision analysis will be used in the Environmental Restoration (ER) Program. Because the decision analysis process is being developed concurrently with this work plan, the process will be applied to this operable unit (OU) during the first year of field work, reflecting the decision-making framework described in the IWP. Future documents describing work at the OU will also reflect this approach.

2.2 Management of Uncertainty

Characterization and remediation of hazardous waste sites, more than most engineering activities, are dominated by uncertainty. The Resource Conservation and Recovery Act (RCRA) facility investigations (RFIs) must deal not only with variations in the complex, heterogeneous subsurface environment, which play a large role in geotechnical engineering, but also with uncertainties about waste characteristics, fate of chemicals and transport of contaminants, exposure risks, health effects, and the effectiveness of the available remedial alternatives.

Some of the approaches and tools that can be used to deal with these uncertainties in this work plan are outlined in Appendix H of the IWP:

- the observational approach, which, in the RFI phase, provides guidelines for determining the level of detail appropriate for site characterization before engineering a corrective measure;
- phasing the proposed investigations so that data needs can be re-evaluated after each phase, as required to develop the site conceptual model sufficiently for baseline risk assessment and corrective measures studies (CMSs); and
- the data quality objectives (DQO) process, a formal procedure for ensuring that proposed data collection activities are carefully developed from and tied back to decision criteria and strategies.

The following subsections discuss the application of these ideas in the RFI work plan for OU 1071.

2.2.1 The Observational Approach

Application of the observational approach has implications for all phases [RFI, CMS, and corrective measures implementation (CMI)] of the RCRA process, as discussed by Brown et al. (1990, 0503). For the RFI phase, the goal is to establish the most probable site conditions with sufficient precision to permit the remaining uncertainties to be handled by contingency plans in the remedial design and implementation phases; that is, site characterization beyond a certain level of detail is more efficiently continued in parallel with CMI, provided that appropriate observational programs are incorporated in the two latter phases.

In the RFI work plan for OU 1071, this philosophy has been adopted explicitly in the generic approach to SWMUs that consist of inactive septic systems or underground storage tanks (Subsection 2.3.4). It is implicit in the proposed Stage II investigations, such as the approach to the former Zia motorpool area (Section 5.12), in which detailed characterization of the distribution of contaminants is postponed until remedial action, if required, although the RFI will provide sufficient data to bound the extent of the problem.

2.2.2 Phased Investigation

It is seldom possible to identify all of the data needed to complete a facility investigation at the outset of the RFI process. This problem is recognized by the Environmental Protection Agency (EPA) in its proposed Subpart S, Corrective Action for Solid Waste Management Units (SWMUs) at Hazardous Waste Management Facilities, which recommends that investigations be "conducted in a step-wise fashion, with early screens to determine whether further investigation is necessary" (EPA 1990, 0432, p. 30803).

In this work plan, the Phase I investigation of each site, for which a detailed sampling plan is provided, addresses the most obvious gaps in the existing information about the site. The sampling plans call for one of two basic types of Phase I investigation: (1) Stage I investigations are designed to determine whether contamination is present at a site. This type of investigation is proposed for those cases in OU 1071 in which the site's history and existing data provide no evidence of a source of contamination (either primary or secondary). Additional investigations may be required if contamination is present above the action levels given in proposed Subpart S and/or above acceptable dose levels to be listed in the 1992 revision of the IWP. Action levels for inorganic analytes are the highest of either background levels or health-risk-based levels. (2) Stage II investigations assume that a source is present or probable, based either on existing data or professional judgment. Stage II investigations are therefore designed to provide sufficient data for a baseline risk assessment for the site, which may require determining the extent of contamination or investigating the adequacy of its containment. Detection limits specified for analyzing samples will follow detection limits to be presented in the 1992 revision of the IWP. The risk assessment methodologies in the IWP will include the detection limits required to perform the assessments.

Few or no data exist for the majority of SWMUs in OU 1071, nor is there evidence that the sites present any problem apart from their historical associations with former Los Alamos National Laboratory (Laboratory) operations. For such sites, extensive investigation is not warranted until the presence of contamination has been established. At these sites, Phase I of the sampling plan consists of a Stage I investigation with sampling of areas most likely to be contaminated, both in the immediate vicinity of existing or former structures and, frequently, also along channels carrying surface run-off away from the site. The decisions defining the end of Phase I for investigations of this type will generally be based on the highest contaminant concentration (Subsection 2.2.3). When Stage I data show that contaminants are present above action levels, Phase II investigations may be proposed (Subsection 2.3.2).

For the few SWMUs in OU 1071 in which contamination is known or likely to be present, Phase I will consist of Stage II investigations. These investigations will be designed to define the extent of the release of contamination to the environment. The details of these Phase I, Stage II, investigations vary, depending on the nature of the site. However, in keeping with the philosophy of the observational approach, these investigations are tightly focused on the questions that must be answered to develop the conceptual exposure model to the point at which it can be used for baseline risk assessment and design of remedial action.

This phased approach is intended to produce streamlined investigation, "biased for action," in agreement with the philosophy underlying proposed Subpart S.

2.2.3 The Data Quality Objectives Process

Formulating questions critical for the current stage of the investigation and tailoring data collection activities to answer these questions are formalized by the DQO process (EPA 1987, 0086). In this work plan, the steps of this process are reflected in Chapter 5, Subsections 5.-.1 through 5.-.5.

The organization of the individual sections in Chapter 5 is based on the seven-step DQO process described by Neptune et al. (1950, 0511) and Hull and Neptune (1991, 0587). Within the discussion of each SWMU or SWMU group in Chapter 5, the first three subsections review the available information about the site and formulate the initial conceptual model underlying the proposed investigations. This description composes the first step of the DQO process, the "statement of the problem."

The fourth subsection outlines Steps 2 through 6 of the DQO process. A specific Phase I decision is proposed in the form of a question to be answered or a hypothesis to be tested during the Phase I investigation. (For example, for a Stage I investigation, this question is always "Is contamination present at this site?") The "inputs affecting the (Phase I) decision" (DQO Step 3, Phase I data needs) and the "domain of the (Phase I) decision" (DQO Step 4), which is a more explicit statement of the spatial (and temporal) boundaries to be sampled, are outlined. The "logic statement" (DQO Step 5), which is a brief statement of the criteria/decision rule by which the data will be evaluated, is presented.

"Constraints on uncertainty" (DQO Step 6) are not well quantified for the Phase I investigations because too little information is available at this point about what to expect at any of the sites. For Stage I investigations, the decision logic generally calls for comparing the observations with conservative risk-based action levels. A nonparametric approach to determining an appropriate sample size, N, for a test of this type is based on the inequality,

$$P_r\{X_{[N]} \geq q_\beta\} = 1 - \beta^N , \qquad \text{(2-1)}$$

where $X_{[N]}$ denotes the sample maximum (that is, the N^{th} order statistic), and q_b is the b^{th} quantile of the sampled population. (Equation 2-1 assumes that the observations are independent; empirical corrections are available for the correlated case, but, unless the correlations are strong, they are not very significant.) For example, a sample of size N = 7 gives an 80% probability of obtaining an observation at least as large as the 80th quantile of the underlying population; that is, if all seven observations at a site are below a prespecified action level, it can be said with 80% confidence that not more than 20% of the site exceeds the level. This result is considered satisfactory for many of the Stage I investigations of SWMUs for which no historical evidence or data exists to indicate the presence of contamination.

Attention in Stage I designs is frequently restricted to subsets of the area or media surrounding a SWMU that are selected, on the basis of expert judgment, as most likely to be contaminated. [For example, one strategy used in a number of sampling plans is to sample sediments in the catchments ("traps") in run-off channels, where it is likely that surface soil contamination has collected over the years.] Although these data cannot in themselves provide a complete test of the hypothesis that no source exists, most of the Stage I sampling plans that use this strategy also collect some data from nearby surface media. Thus, it will be possible to perform an OU-wide test of the hypothesis that it is reasonable to bias the Phase I sample by pooling data from several SWMUs or aggregates.

The decision at the end of Stage II investigations in Phase I will generally be based on the results of a preliminary baseline risk assessment that has been adapted to the site (with respect to land use scenarios, economic issues, legal agreements, etc.). The corresponding characterization decisions and data needs are much more variable and site-specific than they are for Stage I investigations. The decision logic might involve estimating mean contaminant levels over an exposure unit that depends on the land use scenario and other factors (e.g., when the problem is surface or near-surface contamination in an area that might be used for residences in the future), or it might require estimating the probability and consequences of future containment failure (e.g., in the case of a large landfill). Without existing data, it is impossible to design a sampling plan that provides the required estimates with a specified degree of precision.

Phase I, Stage II, investigations therefore attempt to provide good coverage of the site and to develop the estimates of contaminant variability that would be needed to optimize a Phase II sampling plan, if one is required, rather than to guarantee precision in the resulting estimate (which, in most cases, could not be planned at this stage without excessive sampling). Both random and "biased" sampling are used in these Phase I plans. A random sample is often spatially stratified to ensure coverage of a site. Depending on the preference of the field team, spatial stratification can be accomplished by sampling at the nodes of a regular, random-start grid (in one, two, or three dimensions, as appropriate) or by spatial stratification of the entire sample. The random sample may be supplemented by biased sampling of areas that are identified by field surveys or visual inspection; specimens selected in this way are so noted in the field log kept by the field team.

Field duplicates (samples collected as close as practicable to other samples) and "neighbors" (occasional samples collected closer to other samples than occurs using average sample spacing) will be included in the sample design to provide complete information for estimating spatial variability in the underlying population. As suggested in the Quality Assurance Project Plan (QAQjP, Annex II), field duplicates are provided in the sampling plans in Chapter 5 at about the rate of one per ten samples in all sampling plans. Additional neighbors are obtained only when the variability may have an important spatial dependence. Other quality assurance (QA) samples will not be used directly to estimate population characteristics and are not specifically mentioned in the sampling plans in Chapter 5, but they will be included as specified by the QAQjP.

The fifth subsection reviews proposed data collection for Phase I investigations in more detail and outlines potential Phase II data needs. The sixth subsection describes the proposed data collection activities. These two subsections implement the final step, Step 7, of the DQO process, the "design for obtaining data."

2.3 Assessment Approach

This section amplifies various aspects of Section 2.2. The format for presenting conceptual exposure models is described in Subsection 2.3.1. The selection of decision criteria is outlined in Subsection 2.3.2. Analytical requirements appropriate to the different phases and stages are discussed in Subsection 2.3.3. Finally, a generic approach used for the SWMUs that consist of inactive septic systems and fuel tanks is outlined in Subsection 2.3.4.

Several installation-wide surveys and investigations, which will provide additional information needed for the RFI decisions outlined in Chapter 5, are either under way or are planned for the near future. Among these are on-going cultural and biological surveys of various parts of the Laboratory, which have been largely completed for OU 1071 (Section 2.5). Other supporting installation-wide studies include the stratigraphy and structure of the Pajarito Plateau; surface processes; vadose zone processes; background concentrations of chemical or elemental constituents in the rocks, soils, and sediments of the plateau; and rates of erosion (cliff retreat). The installation-wide investigations will provide critical information for analyzing data collected in OU 1071 SWMUs, including the data needed for assessing risk and carrying out CMSs for these sites. In particular, background ranges of naturally occurring elements (including radionuclides deposited by worldwide fallout) in local soils and tuffs will be available in the IWP before completion of Phase I work for OU 1071. Risk assessment (including ecological risk assessment methodologies), which will be incorporated in the 1992 IWP, will be followed in the RFI for OU 1071.

2.3.1 Conceptual Exposure Models

Integral to the RFI decision process is the development of a conceptual exposure model. Each conceptual exposure model describes the potential sources of contamination, potential pathways for contaminant migration, and potential pathways to human and biotic receptors. When SWMUs have sources, contaminants, or receptors in common, the same or very similar conceptual models are applied. The conceptual models then serve as the basis for the proposed field investigations.

Figure 2-1 presents an example of a conceptual exposure model for potential contaminant releases from an underground fuel tank and subsequent exposure of various potential receptors. The conceptual exposure models presented in this work plan are not meant to delineate every possible release mechanism, migration pathway, or potential receptor but are designed to illustrate those considered to be the most relevant to Phase I investigations based on current understanding of the site and its immediate environment. Aquatic biota have been excluded from the exposure assessments because the drainages in the domains of OU 1071 contain water only during periods of high run-off. A brief description of each column presented in Figure 2-1 is provided in Table 2-1. The conceptual exposure models for each SWMU or SWMU group are presented in Subsections 5.-.2 and 5.-.3.

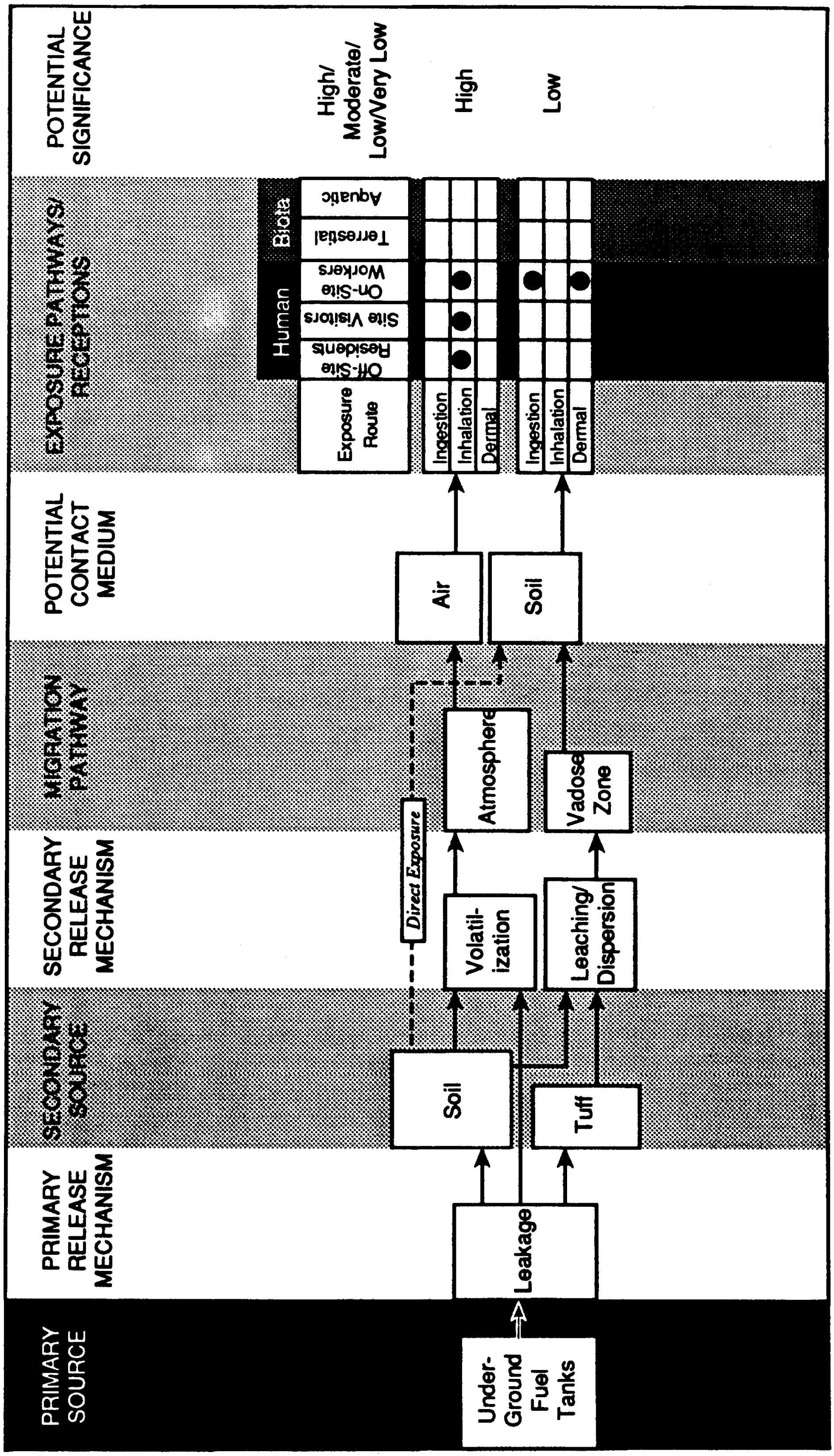


Figure 2-1. Example of a conceptual model.

TABLE 2-1

EXPLANATION OF FIGURE 2-1

Column In Figure 2-1	Description
Primary Source	SWMU, e.g., underground storage tank (UST).
Primary Release Mechanism	Mechanism for the release of contaminants from the SWMU the environment, e.g., leakage from a UST.
Secondary Source	Environmental medium potentially contaminated by the primary or secondary sources to receptors, e.g., leached contaminants may move through the vadose zone.
Secondary Release Mechanism	Potential mode for release of contamination from a secondary source, e.g., contaminants leaching from soil around a UST.
Migration Pathway	Environmental pathway by which contaminants may move from primary or secondary sources to receptors, e.g., leached contaminants may move through the vadose zone.
Potential Contact Medium (PCM)	Environmental medium with which a potential receptor may come in contact, e.g., groundwater beneath a UST used as a drinking water source. Air would become a PCM as a result of soil disturbance, although undisturbed soil is also a PCM.
Exposure Pathways/Receptors	Human and other receptors that may come in contact with a contaminated environmental medium, e.g., off-site residents who ingest groundwater contaminated by a UST.
Potential Significance	The expected importance of the identified exposure pathway relative to other exposure pathways in the OU, e.g., the potential significance of exposure to contaminates oil at a UST may be lower than that at another SWMU in which the soil is exposed at the surface or is more likely to be disturbed. The terms "low," "moderate," and "high," in a relative sense only.

2.3.2 Decision Logic

The culmination of the DQO process is a focused sampling plan that enables collection of the data needed to make and support the identified decision. In order to allow re-evaluation of data needs and refocusing of the sampling plan, field investigations will be implemented in a phased approach (Figure 2-2). Implicit in the logic of Figure 2-2 is that investigations will continue until the nature and extent of contamination has been adequately defined; i.e., if Phase II investigations do not provide the required information, additional investigations may be necessary.

The purpose of a Stage I investigation (Subsection 2.2.2) is to confirm the presence or absence of a significant source of contamination. Concentrations of chemical contaminants will be compared with the action level criteria presented in the preamble to proposed Subpart S [Subsection 3.5.2.2 and Appendix F of the IWP (LANL 1991, 0553)] or computed according to the methods used in proposed Subpart S. The action level for an inorganic analyte is defined by the health-risk-based action level unless it is exceeded by the background level, in which case, the background level becomes the action level. Concentrations of radionuclides will be compared with action level criteria developed by the RESRAD Program (DOE 1990, 0277). These action levels are media-specific concentrations corresponding to risk

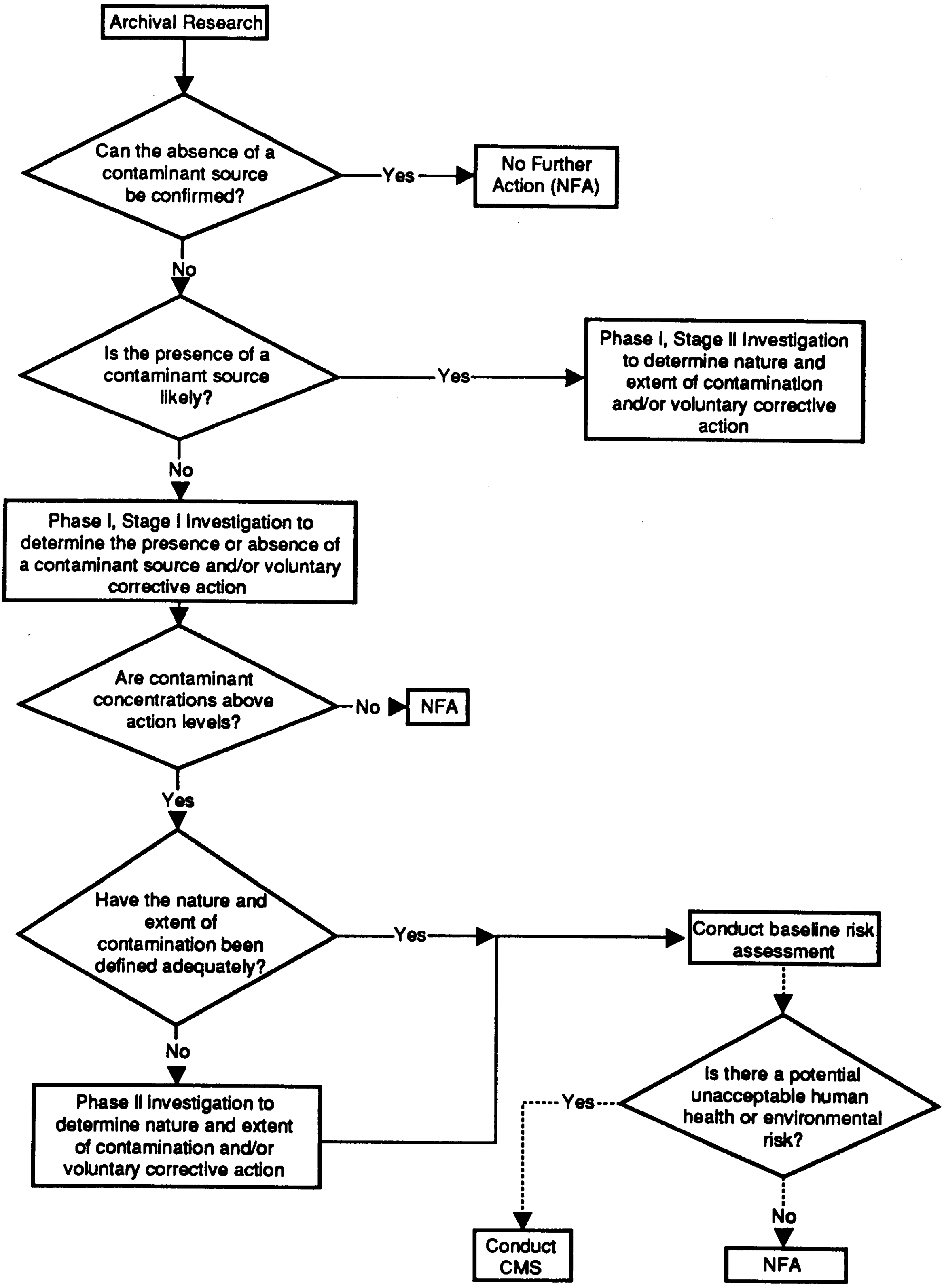


Figure 2-2. Phased approach to assessment.

levels of 10^{-4} to 10^{-6}, based on conservative assumptions regarding human behavior and land use.

In general, the presence of contaminants at concentrations above action levels will trigger a Phase II investigation to determine the extent of contamination. However, the detection of contaminants at a site in concentrations exceeding action level criteria does not always indicate the need for corrective action. The purpose of a Stage II investigation in Phase I or of a Phase II investigation is to characterize the nature and extent of existing contamination and to collect information on other parameters required for a site-specific baseline risk assessment. The results of the site-specific baseline risk assessment may indicate that no action is appropriate, for example, when there is no health risk to the receptors.

Not all SWMUs will necessarily progress through the complete process described above. As shown in Figure 2-2, voluntary corrective action may be undertaken instead of continuing through the investigative process. Information collected during Phase I may be deemed adequate to select and design a corrective alternative, particularly when the choice of a remedy is obvious. In such cases, a Phase II investigation will not be implemented. This flexibility in this generalized approach should allow for the best allocation of time and resources during the RFI.

2.3.3 Analytical Considerations

The level of analysis required for field data depends in part on the proposed uses of the results. Appropriate analytical levels for various data uses are outlined in the EPA's guidelines for the DQO process (EPA 1987, 0086). Table 2-2 summarizes these recommendations. The Phase I sampling plans in Chapter 5 involve Levels I through IV data collection.

Data collection in the field survey mode produces Level I or Level II data. Specific activities include soil gas surveys and areawide scans for gross radiation. The results are generally qualitative to semiquantitative. Such data, including nonanalytical activities (e.g., geophysical surveys to locate features of interest), provide information to guide sample selection to obtain higher-quality data.

Field screening data are also generally of Level I or Level II quality and are used to detect contamination and to provide initial estimates of contaminant levels and/or extent in various media. Specific activities include sample screening by hand-held instruments such as an organic vapor analyzer or radiation detector. The results can be semiquantitative and can provide indications of gross sample contamination or can aid in selecting samples for subsequent laboratory analysis. Direct-reading devices can be used to guide the interactive approach during drilling so that the vertical or lateral extent of contamination can be determined.

Field laboratory data are generally of Level III caliber, and Level III analyses can be obtained from the Environmental Chemistry Group (EM-9) at the Laboratory or from commercial laboratories that have good QA programs. In the field sampling plans for OU 1071, field laboratories will provide rapid results and will be used along with real-time Level II field screening data to guide the interactive approach to determining the vertical and lateral extent of contamination. Specific compounds to be analyzed in field laboratories include total petroleum hydrocarbons and PCBs. The results can be quantitative, and their detection limits can approach those specified for Level IV data.

TABLE 2-2

SUMMARY OF ANALYTICAL METHODS APPROPRIATE TO DATA USES[a]

Data Uses	Analytical Level	Type of Analyses	Limitations	Data Quality
Site characterization Monitoring during implementation	Level I	Field screening for organic vapor and radiological detection using portable instruments Field tests kits	Instruments respond to naturally occurring compounds	If instruments calibrated and data interpreted correctly, can provide indication of contamination
Site characterization Evaluation of alternatives Engineering design Monitoring during implementation	Level II	Variety of organics by GC[b]; inorganics by AA[c], XRF[d]	Tentative identification analyte-specific Techniques/instruments limited mostly to volatiles, metals, some radionuclides	Dependent on QA[e]/QC[f] steps used Data typically reported in concentration ranges Detection limits vary from low parts per million to low parts per billion
Site characterization Risk assessment Evaluation of alternatives Engineering design Monitoring during implementation	Level III	Organics/inorganics using EPA procedures; can be analyte-specific RCRA characteristic tests Radiological constituents	Specific identification; tentative identification in some cases Can provide data of same quality as Level IV	Detection limits between Levels III and IV
Risk assessment Evaluation of alternatives Engineering design	Level IV	TCL[g]/TAL organics/inorganics by GC/MS[h], AA, ICP[i] Radiological constituents	Tentative identification of non-TCL parameters Some time may be required for validating packages	Goal is data of known quality Rigorous QA/QC Low parts per billion detection limit
Risk assessment	Level V	Nonconventional parameters Appendix 8[j] parameters	May require method development/ modification Mechanism to obtain services requires special lead time	Quality is method-specific Method-specific detection limits

a. Source: EPA 1987, 0086.
b. GC = gas chromatography.
c. AA = atomic absorption.
d. XRF = x-ray fluorescence.
e. QA = quality assurance.
f. QC = quality control.
g. TCL = target compound test.
h. MS = mass spectrometry.
i. ICP = inductively coupled plasma.
j. Appendix 8, 40 CRF 261 (EPA 1989, 0092).

Level IV data consist of data that are used when accuracy, precision, and especially defensibility are of prime concern. Level III and Level IV data may be used for site characterization and risk assessment and to evaluate and design remedial alternatives. Detection limits are expected to be consistent with EPA's standard methods.

More than half the sites in OU 1071 are being addressed by Stage I investigations to determine whether a source of contamination is present. This determination will be based on analytical laboratory measurements and, in the case of naturally occurring or widely distributed contaminants, will require comparing sample data with action levels as outlined above. Recommendations of no further action will be supported by Level III/IV analytical data.

To perform the baseline risk assessments called for in most of the Phase I, Stage II, investigations, data of Level III quality or higher will be required.

2.3.4 Approach to Septic and Fuel Tanks

The November 1992 version of the IWP will describe the process for determining whether a voluntary corrective action will be conducted. In OU 1071, the RFI and remediation of inactive septic tanks and their associated drainlines and inactive fuel oil tanks will, whenever feasible, follow a corrective action approach in which the tanks are removed and residual contamination is cleaned up.

2.3.4.1 Septic Tanks

Septic tanks will be located and sufficiently excavated to expose the top of the tank and drainline. The contents will be sampled using a sludge or residual wipe sample and will be field-screened for gross alpha, beta, and gamma. Samples will be collected using the procedures described in LANL-ER-SOP-06.10, Hand Auger and Thin-Wall Tube Sampler, and LANL-ER-SOP-06.19, Weighted Bottle Sampler for Liquids and Slurries in Tanks. The samples will then undergo a Level III/IV laboratory analysis of various radionuclides and metals on the EPA's target analyte list, and a base neutral fraction procedure (EPA Method SW-8270) will be used to screen for semivolatile organics. Tanks containing sanitary waste will be excavated and removed. Voluntary corrective actions for tanks with hazardous, radioactive, or mixed waste on Department of Energy (DOE) property will be cleaned and removed only if a suitable site for storing the waste is available. The decision to remove a tank will be made on a case-by-case basis during the field investigation. A tank with mixed waste, for example, may need to remain in the ground until the Mixed-Waste Storage and Disposal Facility at Los Alamos comes on line.

Each tank and associated drainline will be inspected for integrity before removal. The excavation will be inspected for stains to determine whether contaminants have leaked from the tank and will be field-screened. If an area is stained or if samples reveal the presence of contaminants, a minimum of two samples of material will be collected directly below the tank. If visual inspection and the results of field analyses indicate that no leakage is present, samples will be taken at two points equidistant between the center and the ends of the tank. Additionally, at least one sample of material will be collected from directly below any joint or crack in the drainline and/or location with a positive field screen response, and two samples will be taken from sediment catchments immediately below the tank's outfall. All samples will be screened for organic vapors and gross alpha, beta, and gamma radiation to determine whether organic or radionuclide contamination is present. Samples that have contamination levels above action levels will be submitted for additional Level III/IV laboratory analyses. The Level III/IV data for each septic site will be compared with action levels. If the concentrations are below action levels, no further field investigations will be conducted at that site, and the excavation will be backfilled with clean imported material.

Phase II field sampling may be required at septic tank sites whose contaminant levels are above action levels; however, available information indicates that the septic tanks should not contain any contaminants at levels that pose a health-based risk; therefore, no Phase II, Stage II, sampling plans have been developed for the septic tanks.

2.3.4.2 Fuel Tanks

Inactive fuel USTs will be located by visual inspection and geophysical surveys, primarily by using ground-penetrating radar. The UST site will be prepared by disconnecting and removing all piping, removing any fluid and/or vapors in the tanks, monitoring for hazardous vapor levels, and carefully excavating around each tank to expose it for removal. The USTs and associated pipes will be inspected for evidence of leakage and corrosion, and the subsurface material surrounding and underlying the tanks will be field-screened for organic vapors, using headspace analysis of spot samples. Two soil samples will be collected from beneath each tank, from sites at which soil staining is observed, and/or at sites, if any, where a positive field screening response for organic vapors is obtained; otherwise, the samples will be collected randomly following the procedures described in LANL-ER-SOP-06.09, Spade and Scoop Method for Collection of Soil Samples, and LANL-ER-SOP-06.10, Hand Auger and Thin-Wall Tube Sampler. If the extent of soil staining or positive field screening response is limited, the excavation will continue as far as practicable, depending on structural and cost constraints, until apparently clean soils are encountered, at which point two confirmatory samples will be collected and submitted for laboratory analysis. The closure of the SWMU will then proceed in accordance with New Mexico Environment Department regulations, unless the extent of soil contamination is not adequately defined based on the analytical results, in which case additional assessment work may be required.

2.4 Solid Waste Management Unit Aggregates and Groups

In order to streamline this RFI work plan, selected SWMUs have been combined as "aggregates" and "groups." A SWMU aggregate consists of two or more geographically related SWMUs that have the same conceptual model (Section 2.3) and receptors. Combining geographically and conceptually comparable SWMUs, when appropriate, avoids repetitive modeling and evaluation of migration pathways. A summary of SWMU aggregates in OU 1071 is presented in Table 2-3. A SWMU group consists of two or more SWMUs and/or SWMU aggregates that can be investigated under a single sampling plan. Combining SWMUs in this manner simplifies preparing, presenting, and implementing sampling plans. A summary of SWMU groups is presented in Table 2-4.

TABLE 2-3

LISTING AND DESCRIPTION OF SWMU AGGREGATES

SWMU Aggregate	Where Addressed (Section Number)	Description
0-A	5.1	Western Steam Plant Includes SWMUs 0-003 and 0-012.
0-B	5.2	6th Street Warehouse Includes SWMUs 0-004, 0-030(b, l, and m), and 0-033 (except UST).
0-C	5.2	6th Street Warehouse Includes SWMU 0-010(b) and UST of SWMU 0-033.
0-D	5.3	Mortar Impact Areas Includes SWMUs 0-011(a-e) and Area of Concern C-0-020.
0-E	5.8	Los Alamos County Recreation Areas Includes SWMUs 0-028(a and b).
0-F	5.7	DP Road Storage Area Includes SWMUs 0-027 and 0-030(a).
0-G	5.9	PCB Transformers Includes SWMUs 0-029(a-c).
19-A	5.14	East Gate Laboratory Includes SWMUs 19-001 and 19-003.
26-A	5.15	D Site Includes SWMUs 26-002(a and b) and 26-003
73-A	5.16	Los Alamos Airport (East) Includes SWMUs 73-001(a) and 73-004(d).
73-B	5.17	Los Alamos Airport (West) Includes SWMUs 73-004(a-c) and 73-006.

TABLE 2-4

LISTING AND DESCRIPTION OF SWMU GROUPS

SWMU Group	Where Addressed (Section Number)	Description
0-1	5.2	6th Street Warehouse Area Includes SWMU Aggregates 0-B and 0-C.
0-2	5.6	Wastewater Treatment Plants Includes SWMUs 0-018(a and b) and 0-019.
0-3	5.10	Septic Systems Includes SWMUs 0-030(c-k and n-q).
0-4	5.12	Former Motor Pool Facility Includes SWMUs 0-031(b) and 0-032.
0-5	5.13	Potential Landfills Includes SWMUs 0-034(a and b).
19-1	5.14	East Gate Laboratory Includes SWMU 19-002, SWMU Aggregate 19-A , and Area of Concern C-19-001.
26-1	5.15	D-Site Includes SWMU 26-001 and SWMU Aggregate 26-A.
73-1	5.16	Los Alamos Airport Includes SWMUs 73-001(b and d) and SWMU Aggregate 73-A
73-2	5.17	Los Alamos Airport Includes SWMUs 73-001(c), 73-002, 73-003, 73-005, and SWMU Aggregate 73-B.

2.5 Cultural and Biological Resources

This section addresses the cultural resource requirements of the National Historic Preservation Act and biological resource requirements of the National Environmental Policy Act (NEPA), which must be met before RFI field work can proceed. It discusses the archaeological sites in the OU and actions being taken to obtain approval for field work to be conducted. It also presents the animal and plant species of concern and describes how field activities will be managed to mitigate any impacts on them.

2.5.1 Cultural Resources

As required by the National Historic Preservation Act of 1966 (as amended), a cultural resource survey was conducted at OU 1071 during the summer of 1991 (McGehee et al., in preparation, 0611). The methods and techniques used for this survey conform to those specified in the Secretary of the Interior's standards and guidelines for archaeology and historic preservation.

Twenty-six archaeological sites eligible for inclusion in the National Register of Historic Places under Criterion D are located in the survey area: Laboratory of Anthropology (LA) site numbers LA 12658, LA 15166, LA 21492, LA 24902, LA 85403, LA85404, LA 86532 through LA 86543, and LA 86548 through LA 86555.

The attributes of these sites that make them eligible for inclusion in the national register will not be affected by any sampling activities proposed at OU 1071. A report documenting the survey area, methods, results, and monitoring recommendations, if any, will be transmitted to the New Mexico State Historic Preservation Officer for his concurrence in a "Determination of No Effect" for sites located on Los Alamos County land, DOE land, and General Services Administration land administered by the DOE. A copy of the report will also be sent to the governor of the San Ildefonso Pueblo and to the Santa Fe National Forest archaeologist with recommendations to seek the State Historic Preservation Officer's concurrence in a "Determination of No Effect" for the sites located within their jurisdiction. Following the intent of the American Indian Religious Freedom Act, the copy sent to the San Ildefonso Pueblo will also serve as notification of a proposed action with the potential to affect sacred and traditional places. All monitoring and avoidance recommendations contained in this report must be followed by all personnel involved in ER sampling activities.

2.5.2 Biological Resources

2.5.2.1 Background

During 1991, the Biological Resource Evaluations Team of the Environmental Protection Group (EM-8) conducted field surveys of OU 1071 (TAs-0, -19, -26, -73, and -74). Further information concerning the biological surveys for OU 1071, including the survey methodology, results, and mitigation measures, will be provided in the full report, Biological Assessment for Environmental Restoration Program, Operable Unit 1071 (Foxx, in preparation, 0612). This report will also contain information that may aid in defining contaminant migration pathways and in determining appropriate methods for restoring vegetation, if needed.

2.5.2.2 Relevant Statutes, Orders, and Regulations

Field surveys were conducted in 1991 pursuant to the Federal Endangered Species Act of 1973, New Mexico's Wildlife Conservation Act, the New Mexico Endangered Plant Species Act, Executive Order 11990, Protection of Wetlands (The White House 1977, 0635), Executive Order 11988, Floodplain Management (The White House 1977, 0634), 10 CFR 1022 (DOE 1979, 0633), and DOE Order 5400.1 (DOE 1988, 0075).

TABLE 2-5

SPECIES OF CONCERN IN OU 1071

Species	Endangered Federal	Endangered State	Sensitive Federal	Sensitive State
Black hawk (*Buteogallus anthracinus*)		X		
Bald eagle (*Haliaeetus luecocephalus*)	X	X		
Mississippi kite (*Ictinia mississippiensis*)		X		
Peregrine falcon (*Falco peregrinus*)	X	X		
Broad-billed hummingbird (*Cynanthus latirostris*)		X		
Willow flycatcher (*Empidonax trailii*)	Candidate	X		
Spotted bat (*Euderma maculatum*)		X		
Meadow jumping mouse (*Zapus hudsonicus*)	Candidate	X		
Wright's fishhook cactus (*Mammillaria wrightii*)		X		
Santa Fe cholla (*Opuntia viridiflora*)	Candidate	X		
Grama grass cactus (*Pediocactus papyracanthus*)	Candidate	X		
Sessile-flowered false carrot (*Aletes sessiliflorus*)				X
Threadleaf horsebrush (*Tetradymia filifolia*)				X
Plank's catchfly (*Silene plankii*)				X
Santa Fe milkvetch (*Astragalus mollissimus*)				X
Mathew's wooly milkvetch (*Astragalus mollissimus*)				X
Taos milkvetch (*Astragalus puniceus*)				X
Cyanic milkvetch (*Astragalus cyaneus*)				X
Tufted sand verbena (*Abronia bigelovii*)				X
Pagosa phlox (*Phlox caryophylla*)				X

2.5.2.3 Methodology

The purpose of the surveys was threefold. The first purpose was to determine the presence or absence within OU boundaries of critical habitat for any sensitive, threatened, or endangered plant or animal species identified by the state or federal government. Second, these surveys were conducted to identify the presence of any sensitive areas, such as floodplains or wetlands, the areas to be sampled, and the extent and general characteristics of such areas. The third purpose was to provide additional data pertaining to habitat types in OU 1071. These data will supplement existing baseline information for the purposes of characterizing the site and determining presampling conditions. This information is also necessary to provide documentation required by NEPA.

EM-8 maintains a data base that contains the habitat requirements of all sensitive, threatened, or endangered species identified by the state and federal governments. After searching this data base, EM-8 personnel conducted a Level 2 habitat evaluation survey to determine whether areas relatively undisturbed by Laboratory activities could support threatened and/or endangered species. The techniques used in a Level 2 survey area are designed to gather data on the percent cover, density, and frequency of both the understory and overstory.

The habitat information gathered through the field surveys was then compared with the habitat requirements for species of concern identified in the data base search. If a site did not meet habitat requirements for a species of concern, no further surveys were conducted and the site was cleared for impact on state and federally listed species. If habitat requirements were met, then specific surveys for the species of concern (i.e., Level 3 surveys) were conducted in accordance with pre-established survey protocols.

In each location, investigators noted all wetlands and floodplains in the survey area using national wetlands inventory maps and field checks. Characteristics of wetlands, floodplains, and riparian areas were noted using criteria outlined in the Federal Manual for Identifying and Delineating Jurisdictional Wetlands (Army Corps of Engineers et al. 1989, 0237)

2.5.2.4 Species Identified

Table 2-5 lists the species of concern in OU 1071.

2.5.2.5 Results and Mitigation

Baseline data and the results of the habitat evaluation survey indicate that only two of the above species appear to have potential for occurrence in the area: the meadow jumping mouse and the peregrine falcon.

2.5.2.5.1 Meadow Jumping Mouse

The meadow jumping mouse inhabits meadows along streams or other water sources. A Level 3 survey was conducted in August 1991 along a portion of the stream channel in Rendija Canyon (TA-0). No meadow jumping mice were found. Although water was flowing through the canyon at the time of the survey, it was caused by recent, heavy rainfall. Based on the results of this survey and the lack of a perennial stream and associated habitat, this species is not expected to occur in OU 1071.

2.5.2.5.2 Peregrine Falcon

The peregrine falcon occupies steep cliffs, and a nest site has been recorded in TA-73 in Pueblo Canyon. This area is considered to be a critical habitat for this species. All activities in the critical habitat should be scheduled from October 16 through February 28 to ensure no adverse impact on the peregrine falcon or its critical habitat. If sampling in Pueblo Canyon is required outside of this period, additional monitoring of the critical habitat will be required. The ER Program Office must contact EM-8 to schedule the necessary monitoring.

Monitoring will occur between March 1 and May 15 of the year field work begins at the Los Alamos Airport (SWMU Groups 73-1 and 73-2). The monitoring results may allow for some adjustments of the time restrictions without resulting in adverse impact on the falcon. EM-8 will consult with the Fish and Wildlife Service about any proposed adjustments in time restrictions. Sampling surface soils for the purpose of site characterization should have minimal or no impact on sensitive species.

2.5.2.5.3 Wetlands and Floodplains

The field survey showed that no wetlands are located in OU 1071; however, floodplains are found in the canyons. The proposed action will not adversely impact these floodplains, and therefore no mitigation measures are necessary.

2.5.2.6 Best Management Practices

Impacts on nonsensitive plant species should be avoided whenever possible. Off-road driving is especially harmful to plants and soil crust. Vehicular traffic should be restricted to existing roads whenever possible. If off-road travel is required, EM-8 should be contacted to monitor the activity. Revegetation may be required at some sites. A list of native plants suitable for revegetating OU 1071 is contained in the final report, Biological Assessment for Environmental Restoration Program, Operable Unit 1071 (Foxx, in preparation, 0612).

References for Chapter 2

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The White House, May 24, 1977, "Protection of Wetlands," Executive Order 11990, in Environment Reporter, The Bureau of National Affairs, Inc., Washington, DC. (The White House 1977, 0635)

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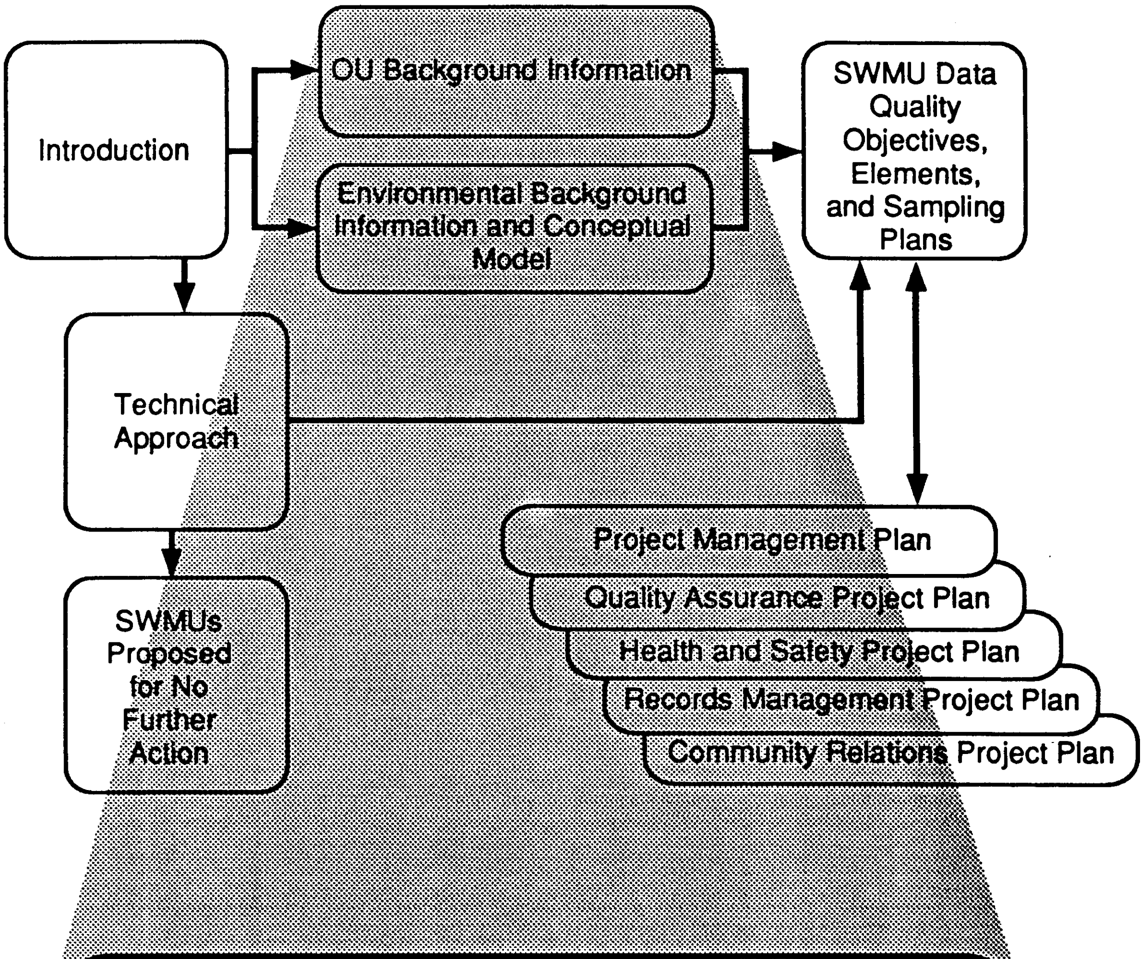
CHAPTER 3



OU Background Information

- TA-0 Outside and Inside Laboratory Boundaries
- TA-19, East Gate Laboratory
- TA-26, D-Site
- TA-73, Los Alamos Airport
- TA-74, Otowi Section

3.0 OPERABLE UNIT BACKGROUND INFORMATION

Los Alamos National Laboratory (the Laboratory) began operations in OU 1071 in 1943 and had largely ceased using this area by 1986. Historical operations at OU 1071 involved disposal areas, landfills, wastewater treatment and septic systems, indoor and outdoor drum storage areas, aboveground and underground storage tanks (USTs), motor pool facilities, industrial waste effluent systems, production of sanitary waste effluent that was used to water recreation areas, polychlorinated biphenyl (PCB) transformers, firing ranges and impact areas, storage of radioactive materials and high explosives (HE), incineration, steam cleaning, and disposal of waste oil.

The following sections provide a brief discussion of site location and a physical description of the technical areas in OU 1071. Detailed information on individual solid waste management units (SWMUs) appears in Chapters 5 and 6 (Table 1-3); however, very few data exist on the contaminants at the SWMUs. The data that do exist are limited and were obtained without adequate quality control procedures.

3.1 Technical Area 0

3.1.1 Physical Description

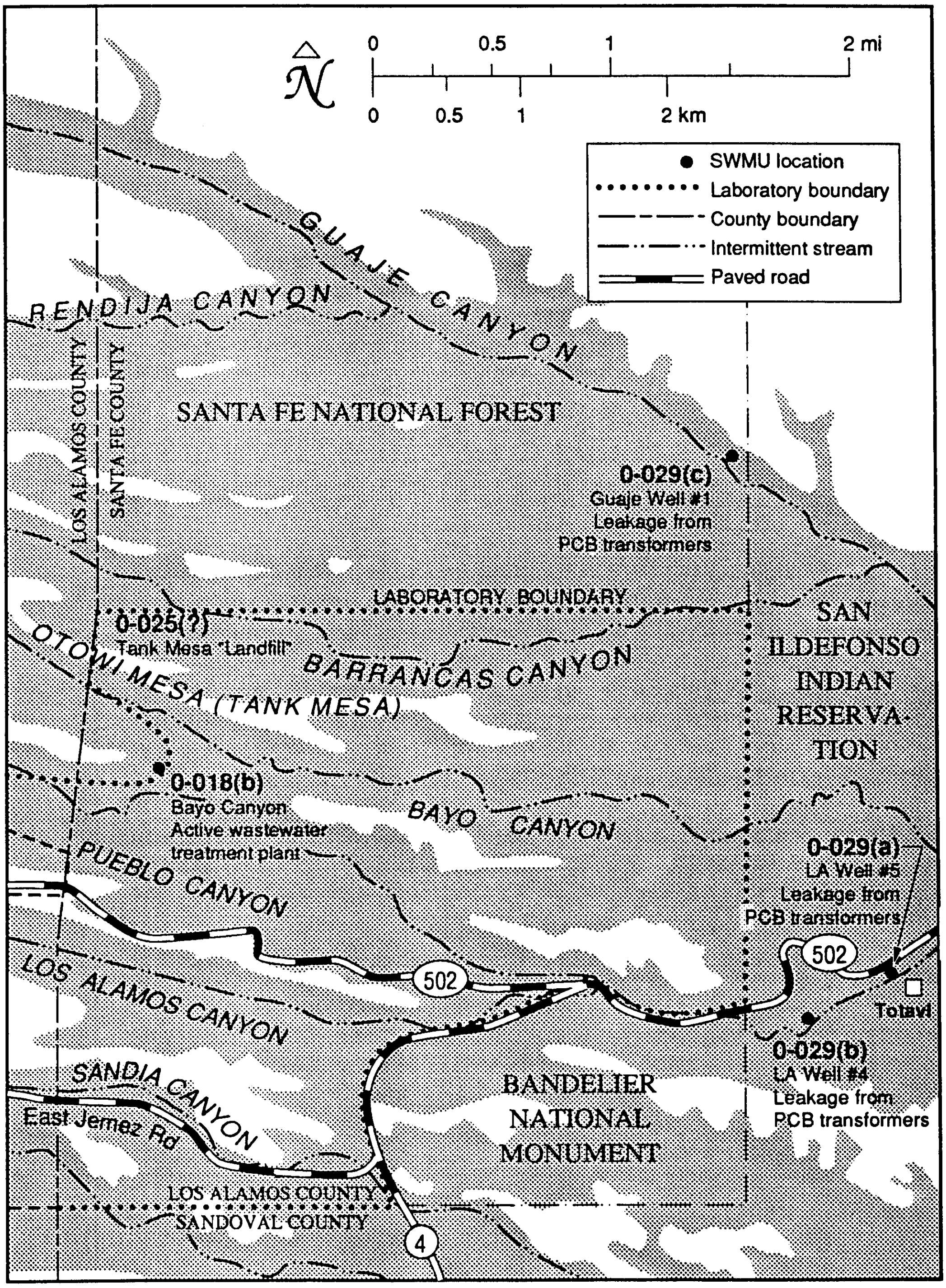
Technical Area (TA) 0 sites consist of a series of geographically separated structures and areas scattered across the Pajarito Plateau in the northern part of Los Alamos County and in adjacent Santa Fe County (Figure 1-2). Most of the SWMUs in TA-0 are located outside the boundaries of active technical areas. A few are located in other technical areas. TA-0 sites occur as far south as Mortandad Canyon, as far north as Cabra Canyon, and from the western part of Los Alamos County to Totavi on the east. The elevations of SWMUs in TA-0 range from approximately 5,840 ft at SWMU 0-029(a) to approximately 7,400 ft at SWMUs 0-011(b, c, and e).

The SWMUs are located on the tops of Los Alamos, North, Barranca, Kwage, and Otowi mesas and in Mortandad, Los Alamos, Pueblo, Bayo, Cabra, and Rendija canyons. Table 1-3 provides a list of the SWMUs, and Figures 3-1 through 3-6 show the approximate locations of SWMUs in TA-0.

A wide variety of SWMUs exist in TA-0. They include or are related to (1) disposal areas and landfills, (2) active and inactive wastewater treatment plants and septic systems, (3) recreation areas watered with sanitary waste effluent, (4) indoor and outdoor drum storage areas, (5) above- and underground storage tanks and motor pool facilities, (6) industrial waste effluent lines, (7) PCB transformers, and (8) firing ranges and impact areas.

3.1.2 History

A total of 50 SWMUs and one area of concern (AOC) are located in TA-0 on land owned by Los Alamos County, the US Forest Service (Santa Fe National Forest), the Department of Energy (DOE), the General Services Administration, the San Ildefonso Pueblo, commercial organizations, and private residences. Some of the SWMUs have been decommissioned and decontaminated, and others remain



Sources: 1952, U.S. Geological Survey, Puye, NM Quadrangle, scale: 1:24,000
1984, U.S. Geological Survey, White Rock, NM Quadrangle, scale: 1:24,000

Figure 3-1. SWMU locations in TA-0, East. Areas in white are mesatops. Shaded areas are canyon bottoms.

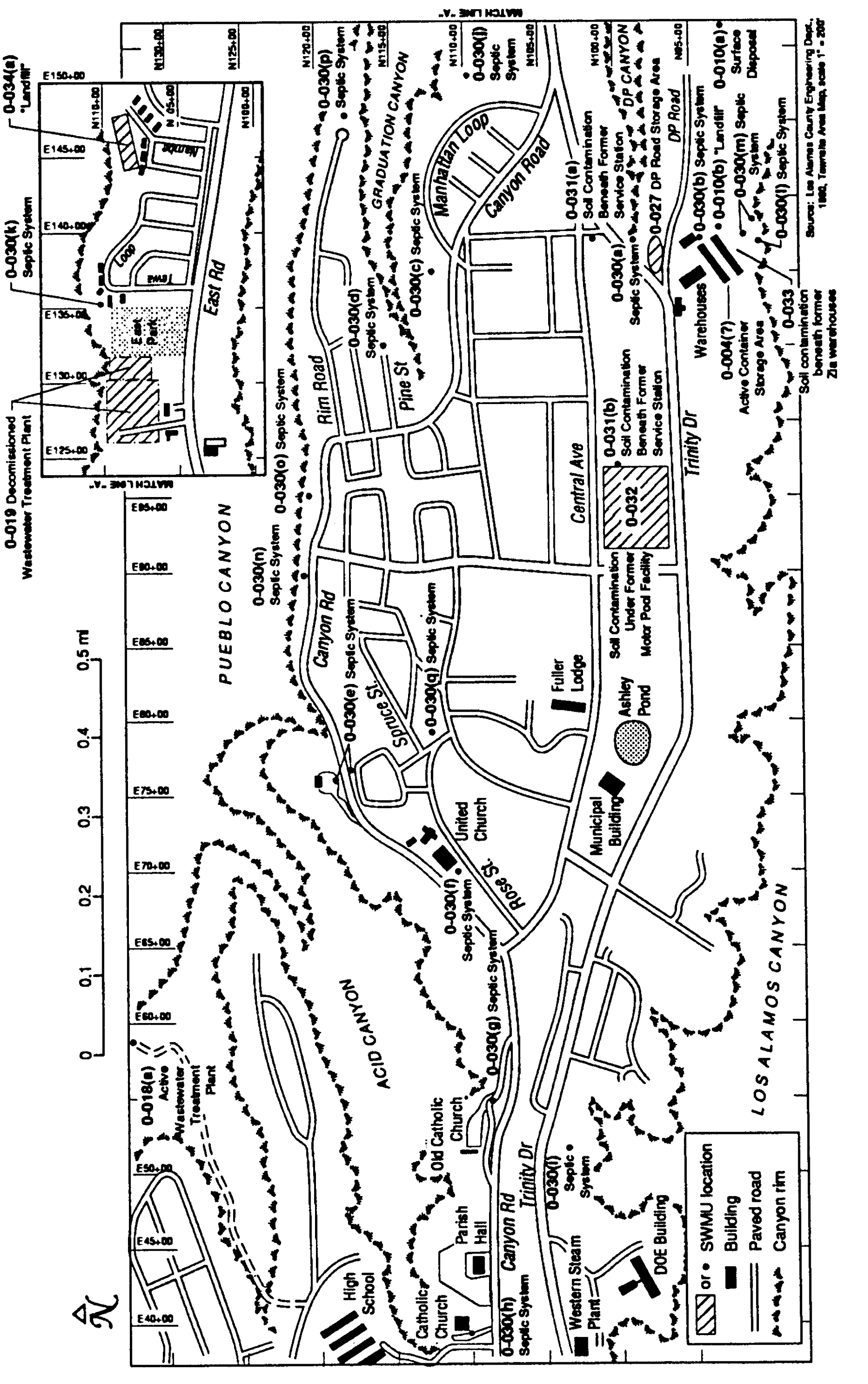


Figure 3-2. SWMU locations in TA-0, Townsite.

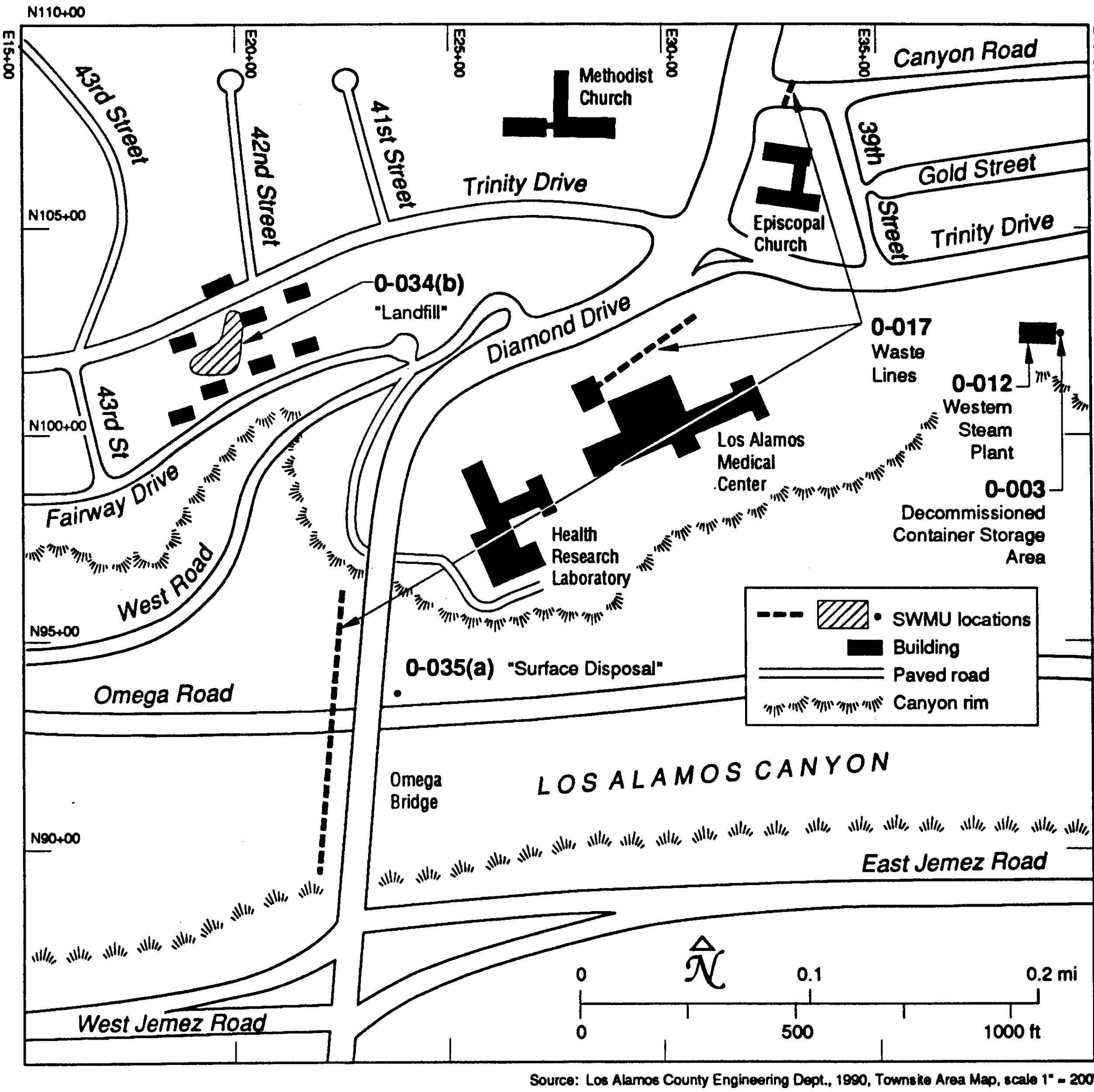


Figure 3-3. SWMU locations in TA-0, West.

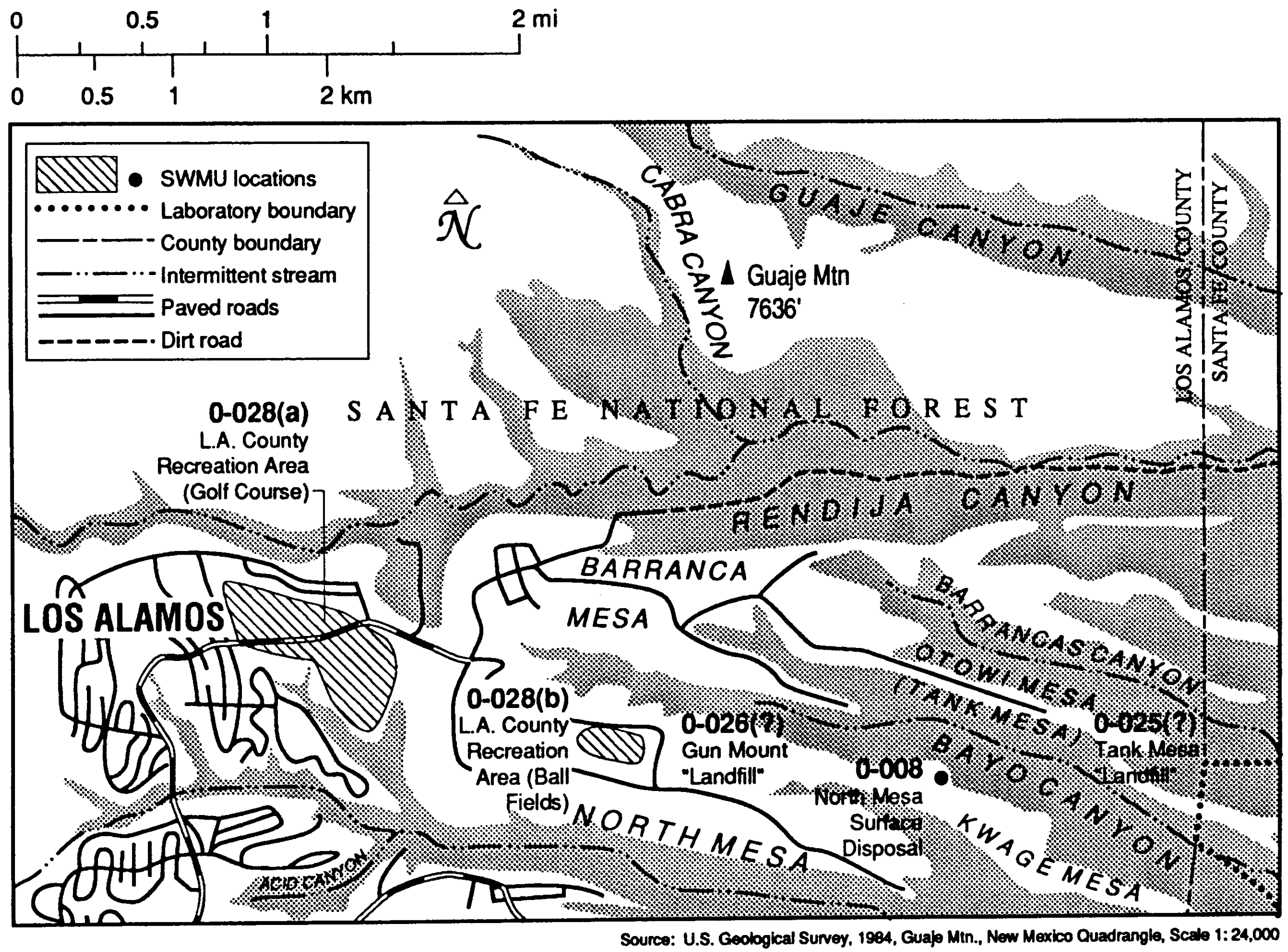
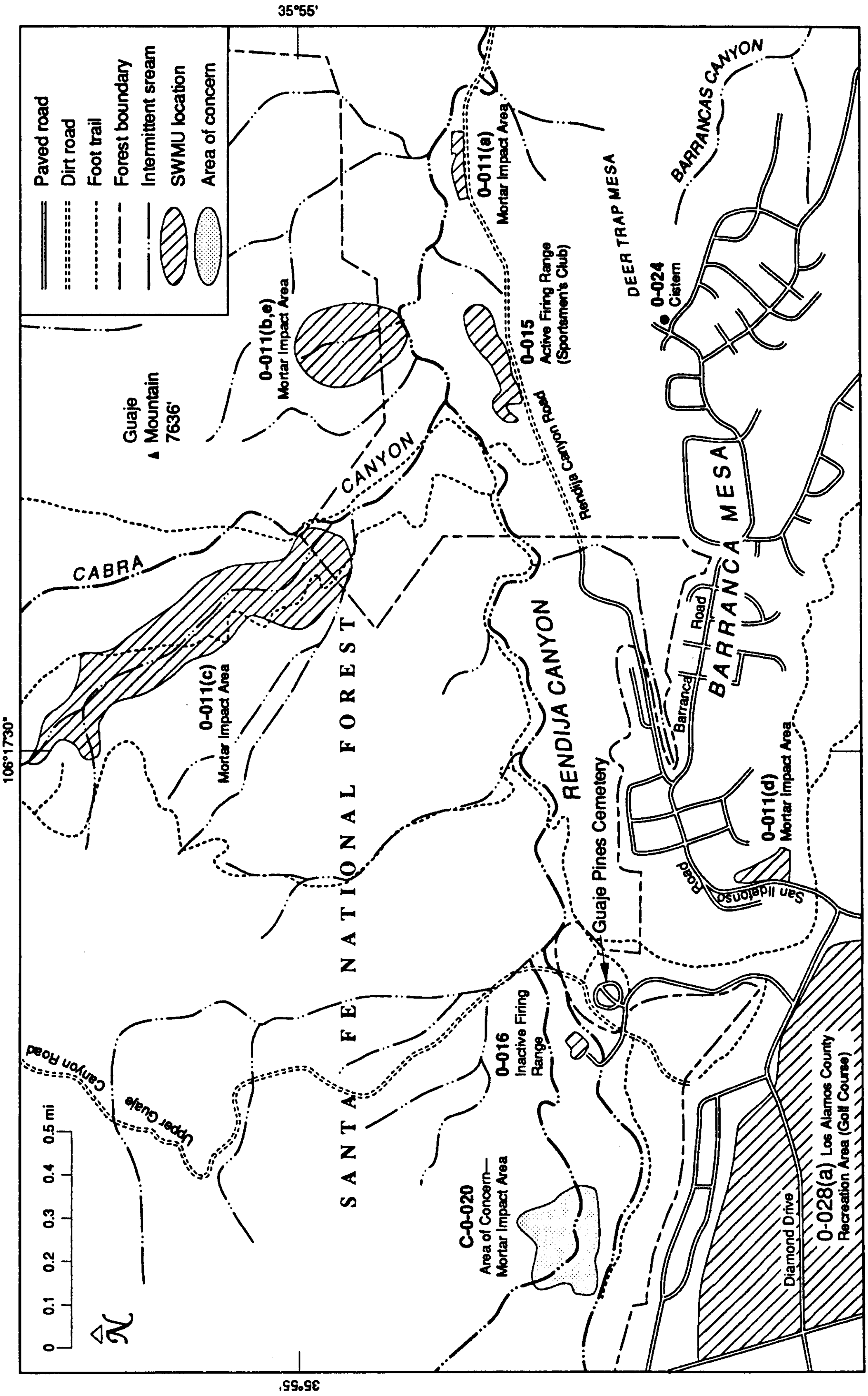


Figure 3-4. SWMU locations in TA-0, North Mesa. The areas in white are mesatops of the Pajarito Plateau. The shaded areas are canyon bottoms. The exact location of SWMU 0-025 is uncertain, which is indicated by a question mark following the SWMU symbol.



Source: US Geological Survey Guaje Mtn, New Mexico Quadrangle, 1984, 1:24,000.

Figure 3-5. SWMU locations in TA-0, North.

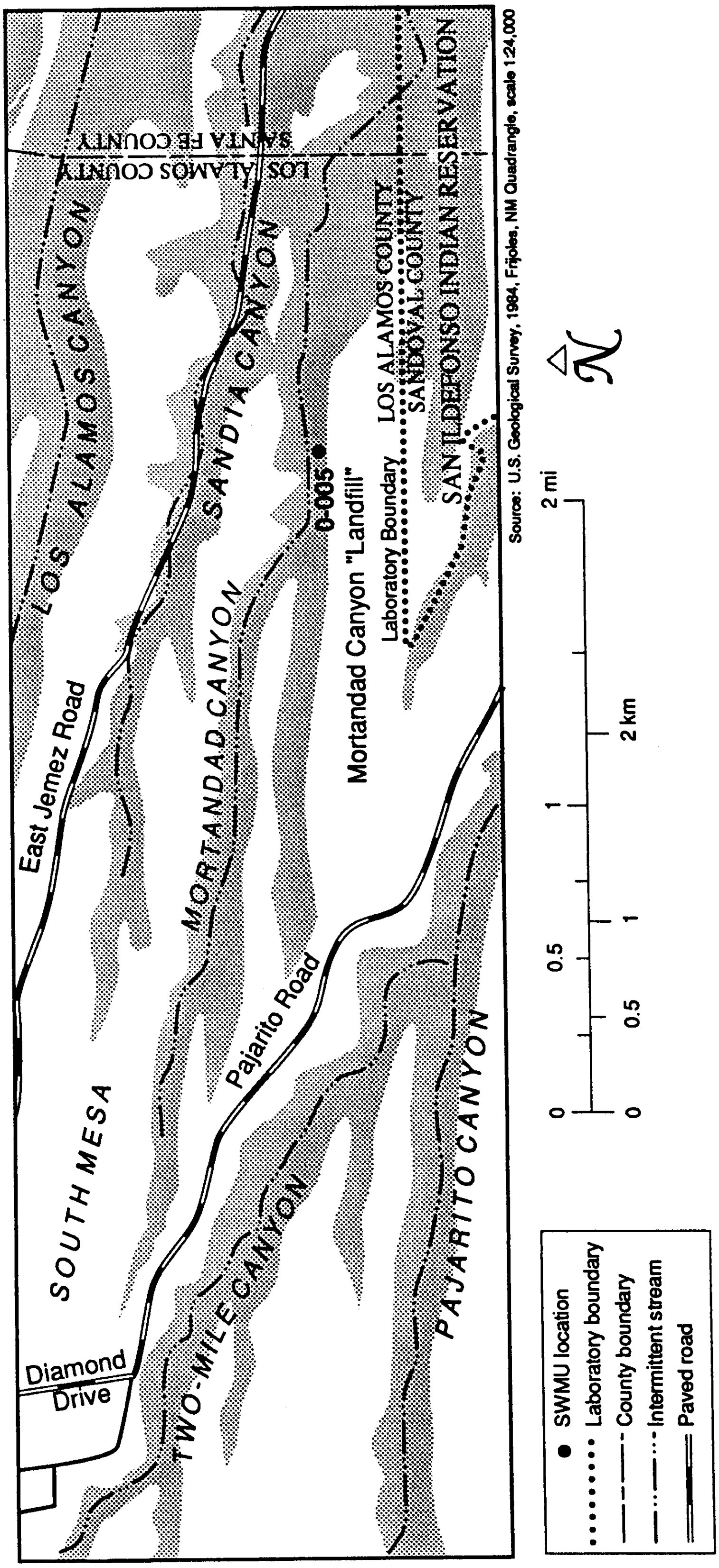


Figure 3-6. SWMU locations in TA-0, Mortandad Canyon. White areas are mesatops. Shaded areas are canyon bottoms.

active. A detailed description and history of each of the TA-0 SWMUs appear in Chapter 5, along with the data quality objectives (DQOs) and sampling plans, or in Chapter 6 if no further action is recommended.

3.2 Description of Technical Area 19 (East Gate Laboratory)

3.2.1 Physical Description

The former TA-19 (East Gate Laboratory) is now part of TA-72 and is located in Santa Fe County east of the Los Alamos Airport. The site is situated on Los Alamos Mesa and is bounded by Pueblo Canyon on the north and by a small branch of Pueblo Canyon on the south at an elevation of approximately 6,910 ft above sea level (Figure 3-7).

The East Gate Laboratory was constructed in the summer of 1944 at the request of Dr. Emilio Segre, "who needed an isolated spot for exacting experimental work on small sources" (LASL 1947, 05-0009). In 1947, buildings in the technical area consisted of a wood frame laboratory building, a battery building (or storage hutment), and a guard building. Additional buildings were added throughout the late forties and early fifties, until the site eventually consisted of a laboratory building (TA-19-1), battery building (TA-19-2), guard building (TA-19-3), latrine (TA-19-4), retreat building (TA-19-5), septic tank (TA-19-6), and instrument (shelter) building (TA-19-7).

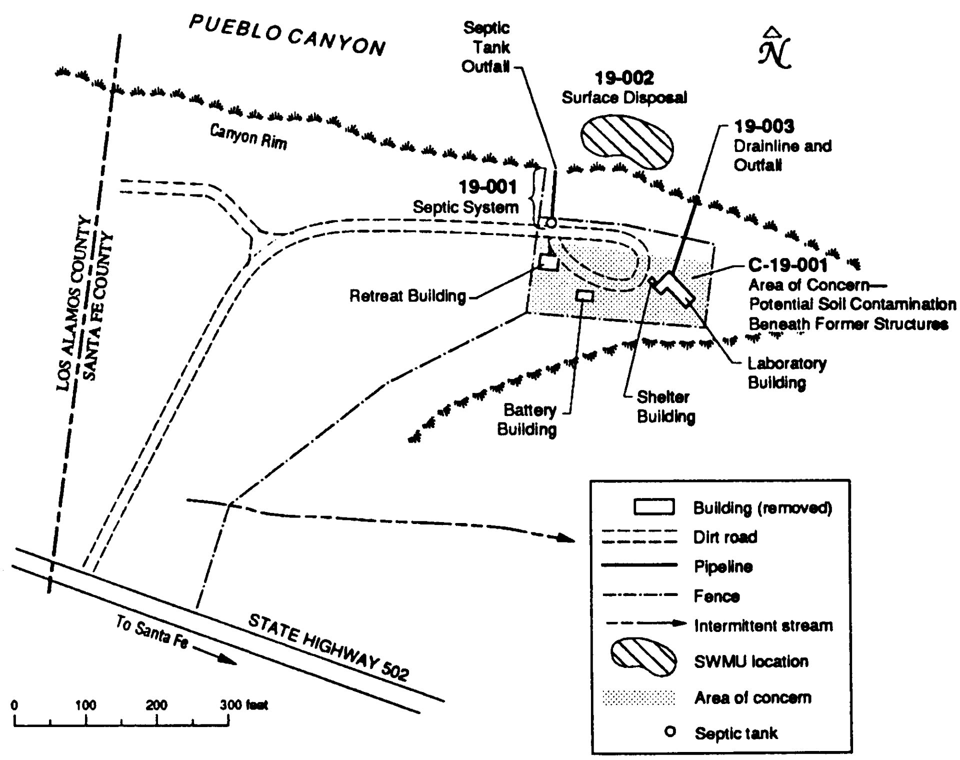


Figure 3-7. SWMU locations in TA-19, East Gate Laboratory.

A fence was constructed to enclose these structures and restrict access to the area. The septic tank for the sanitary waste system drained into Pueblo Canyon through an outfall near the northwest corner of the site. The laboratory building had a drainline and outfall to an area north of the security fence.

In December 1956, the battery building, guard building, and latrine were removed. No information has been found regarding the disposition of these structures. The septic tank was transferred to The Zia Company capital account in 1957. The laboratory building, retreat building, and guard station were transferred to The Zia Company on January 15, 1962 (Montoya 1974, 05-0095). All Los Alamos Scientific Laboratory (LASL) capital equipment remaining at East Gate Laboratory was assigned to E-Division and was used in civil defense activities by the Amateur Radio Club until late 1974, at which time the site was apparently abandoned (Clayton 1974, 05-0032). When the DOE visited the site in 1986 as part of the Comprehensive Environmental Assessment and Response Program, the only remaining structure at TA-19 was the septic tank (LANL 1990, 0145).

TA-19 contains three identified SWMUs: a septic system (SWMU 19-001), a surface disposal area with building debris and old batteries (SWMU 19-002), and a sewer drain and outfall (SWMU 19-003). TA-19 also has one AOC, identified as C-19-001 in Appendix C of the SWMU report (LANL 1990, 0145), in which soil at former building sites is potentially contaminated. Additional details on the SWMUs and AOC can be found in Section 5.14 of this work plan.

3.2.2 History

The property on which the former East Gate Laboratory was located is currently owned by the DOE. At present, the Laboratory is not using the land.

The East Gate Laboratory was established in 1944 for the purposes of testing electrical equipment (Brode 1944, 05-0022). Between 1945 and 1947, the site was used "only upon occasion by the Physics Division" (LASL 1947, 05-0009). Documented uses of TA-19 include spontaneous fission experiments (Ahlquist 1984, 05-0007) and storage of radioactive source material. Use of a 300-Ci ^{60}Co source was documented at TA-19 in 1961 (LASL 1961, 05-0079). Irradiation experiments using sealed radioactive lanthanum sources were conducted on monkeys. Two scintillation studies involving the use of aromatic compounds were documented in 1952 (H-Division 1952, 0643).

An executive order that provides for identification of unneeded federal real property (The White House 1970, 0586) initiated preliminary investigations into the possible transferral of LASL technical areas and properties to the public. In July and November 1974, various H-Division groups (i.e., H-1, H-3, H-5, and H-8) conducted surveys of the existing buildings and property at TA-19 to identify any potential contamination. The results of the surveys indicated that the structures were free of HE and radioactive, chemical, and toxic contamination (Montoya 1974, 05-0096; 05-0097). Soil samples collected in August 1974 in the vicinity of the two effluent discharge points indicated that "no radioactive contamination was released from the building during early operations" (Garde 1974, 05-0040).

3.3 Description of Technical Area 26 (D-Site)

3.3.1 Physical Description

Former TA-26 covers about 5 acres within the present boundaries of TA-73. Bisected by East Road (State Road 502), TA-26 is situated toward the east end of Los Alamos Mesa and is bounded by Los Alamos Canyon on the south and Pueblo Canyon to the north at an approximate elevation of 7,015 ft above sea level. Los Alamos Airport is located directly northwest of TA-26 (Figure 3-8).

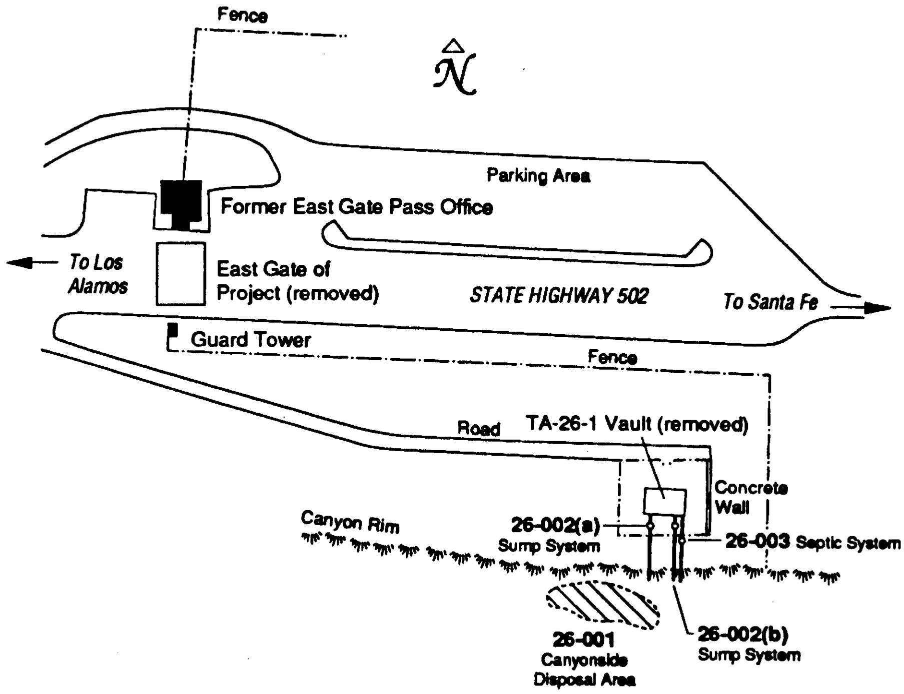


Figure 3-8. SWMU locations in TA-26, D-Site.

The maps of TA-26 and some of the documentation suggest that TA-26 included the land on both sides of East Road. The area south of East Road that contained the East Gate vault appears to be the portion of TA-26 designated as D-Site (Figure 1-3). The area being considered for environmental investigation is restricted to D-Site.

D-Site was established for LASL's Chemistry and Metallurgical Research (CMR) Division for the purpose of storing radioactive materials (LASL 1947, 05-0072). The area consisted of several structures, including the East Gate vault (TA-26-1), Guard Tower A (TA-26-2), Guard Tower B (TA-26-3), a guard building (TA-26-4), east room septic system (TA-26-5), and a sump system (TA-26-6). TA-26 structures not included in D-Site were the East Gate pass office and the East Gate guard tower.

Construction at D-Site began on April 1, 1946. The concrete storage vault, Guard Tower A, the guard building, and the sump system were completed in October 1946. Guard Tower B was relocated from TA-21 to TA-26 in March 1948. The septic system was installed in August 1948 (LASL no date, 0402).

TA-26 contains three SWMUs: a disposal area in Los Alamos Canyon that contains debris from demolition of the concrete storage vault (SWMU 26-001), an acid sump and equipment room drainage system that served the vault (SWMU 26-002), and a sanitary septic system (SWMU 26-003) (LANL 1990, 0145).

3.3.2 History

Only two of the original TA-26 structures remain: the East Gate guard tower stands south of East Road and the East Gate pass office (once known as Philomena's Restaurant) to the north. The land on which the East Gate pass office is located is privately owned. The parking lot east of the East Gate pass office is a rest area currently owned by Los Alamos County. The TA-26 SWMUs are located south of East Road on land currently owned by DOE.

Although the vault was constructed for storing radioactive materials, documentation describing the specific type and quantity of radioactive materials has not been located (LASL 1947, 05-0072). One document states that the vault "stored friable containers which now contain, or have contained radioactive material" (Maddy 1957, 05-0086). The vault was originally used to store radioactive sources and was later used by The Zia Company for storing HE (IT Corporation 1991, 05-0148, 05-0149). Special clearance was required from H-1 before work activities associated with the vault and septic and sump system could begin (Blackwell 1960, 05-0013). The period during which the vault operated was approximately 1946 to 1966.

3.4 Description of Technical Area 73 (Los Alamos Airport)

3.4.1 Physical Description

TA-73 comprises the current and former operational structures located at the site of the Los Alamos Airport, as well as a former municipal landfill used by DOE and Los Alamos County. This technical area, located in Los Alamos County east of the townsite, is situated on Los Alamos Mesa and is bounded by Pueblo Canyon on the north and DP Canyon (a branch of Los Alamos Canyon) on the south. Its elevation ranges from approximately 6,600 to 7,200 ft above sea level (Figure 3-9).

During a redefinition of Laboratory boundaries in 1989, the Los Alamos Airport and associated SWMUs were renumbered from TA-0 to TA-73. TA-73 includes that portion of former TA-26 retained by the DOE. Existing structures in this technical area include the airport terminal building (TA-73-1), a storage building converted from the former incinerator (TA-73-2), a Morgan shed (TA-73-3), the airport fire station (TA-73-4), a gas meter station (TA-73-5), three transformer stations (TA-73-6, -7, and -8), and four USTs used for gasoline storage (TA-73-1-1, -2, -3, and -4). The USTs are owned by a private aviation club but are located on DOE property. A number of privately owned buildings, storage sheds, and hangars are also located at the site.

Several structures, which include a steam-cleaning plant for garbage trucks, cans, and dumpsters and four storage bunkers (magazines), have been removed from TA-73. The truck- and can-cleaning plant, which was removed in 1971, was located immediately south of the incinerator. The four storage bunkers, removed in 1974, were located on Fox Street at the northeastern end of the runway.

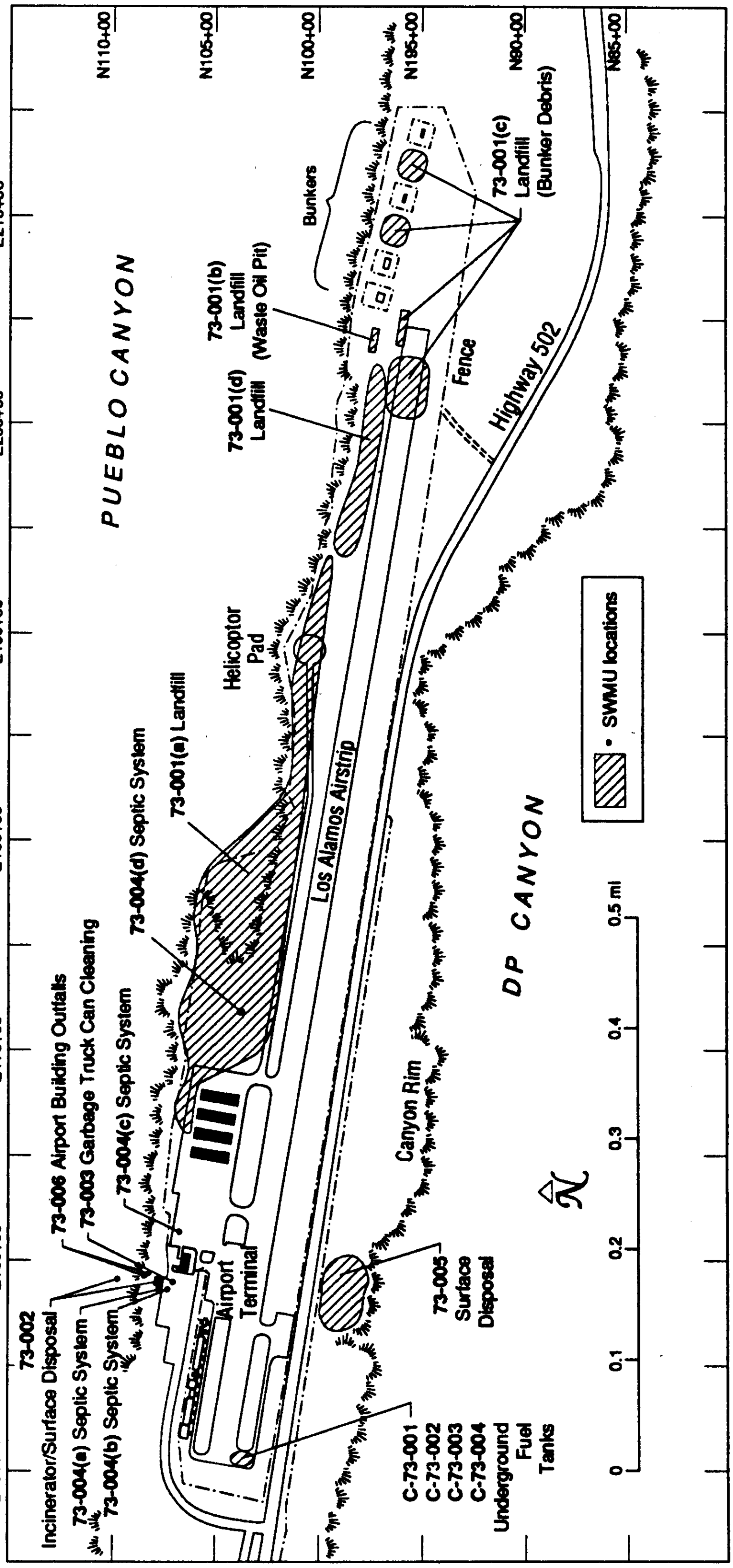


Figure 3-9. SWMU locations in TA-73, Los Alamos Airport.

Other operations at TA-73 included a landfill, a portion of which underlies the tie-down area for private planes, a waste oil pit located just west of the bunkers, and a surface disposal area located south of East Road and north of DP Canyon. Outfalls, drainlines, and septic systems were associated with a number of former operations at TA-73.

Four AOCs at TA-73 (C-73-001 through C-73-004) are identified in Appendix C of the SWMU report (LANL 1990, 0145). These sites are four USTs located at the airport fuel facility in the southwest corner of the airport.

3.4.2 History

DOE owns the property on which TA-73 is situated. Pueblo Canyon, adjacent to and north of TA-73, is Los Alamos County property.

Historical operations that have been documented at TA-73 include incinerating classified documents and disposing of various types of waste (SWMU 73-002); steam-cleaning garbage cans, trucks, and dumpsters (SWMU 73-003); operating a landfill and burning municipal and laboratory waste [SWMU 73-001(a)]; disposing of waste oil [SWMU 73-001(b)]; storing HE [SWMU 73-001(c)]; and operating a surface disposal facility (SWMU 73-005). The only ongoing operation at TA-73 is the Los Alamos Airport, currently operated for the DOE by Johnson Controls, Inc.

An airport improvement project included excavating a portion of the inactive landfill in 1984 and backfilling with clean, compacted fill to produce a firm base for construction of hangars and a plane tie-down area. The western half of the landfill was excavated and placed in two 60-ft-deep pits in the northeast portion of the airport. The soil and tuff removed from the pits were subsequently used to backfill the excavated landfill.

In April 1987, as part of a DOE environmental survey, soil and waste samples were collected in the vicinity of the airport landfill and from the canyon disposal area behind the incinerator (DOE 1987, 05-0035; DOE 1987, 05-0057). The sample from the landfill was analyzed for organic, inorganic, and radiological contaminants. The sample from the canyon disposal area was analyzed for inorganic metals and radiological contaminants. A request will be made to DOE to provide these data.

3.5 Description of Technical Area 74 (Buffer Zone)

3.5.1 Physical Description

TA-74 (the Otowi Section) is a safety buffer zone located in the northeast corner of the current Laboratory site. Lying north of East Road (State Road 502), TA-74 is bounded by Forest Service land to the north, San Ildefonso Pueblo land to the east, Los Alamos County land to the west, and TA-72 to the south. Elevations at TA-74 range from approximately 6,000 ft above sea level in the northeast corner to more than 7,000 ft above sea level on the mesatops (USGS 1977, 05-0125).

Most of TA-74 is located in Santa Fe County; however, a narrow band along the stream bed of Pueblo Canyon lies in Los Alamos County. The large rectangular section of land that makes up TA-74 is known as Parcel D (the Otowi Section). The total area of TA-74 is approximately 2,800 acres (LANL 1990, 0144; Herceg 1971, 05-0044). During a redefinition of technical area boundaries in 1989, Parcels C and D were combined and identified as TA-74.

No historical or current laboratory structures are associated with TA-74; the Laboratory maintains the site strictly as a safety buffer zone. Because TA-74 has not been used for any Laboratory operations, it has no SWMUs.

3.5.2 History

Before 1962, the Otowi Section lay within the boundaries of Bandelier National Monument and was under the jurisdiction of the National Park Service. A June 12, 1962, document proposed the acquisition of the Otowi Section by the Atomic Energy Commission (AEC) and detailed the need for, and possible uses of, the land by the AEC (Campbell 1962, 05-0030). The formal transfer of the Otowi Section to the administrative control of the AEC was accomplished by Presidential Proclamation No. 3539, dated May 27, 1963 (LASL 1963, 05-0066).

Historically, effluent from the liquid waste treatment plant (formerly TA-45) was discharged into the Pueblo Canyon drainage system, which runs through Parcels C and D of TA-74. Because detectable amounts of plutonium were found in the stream channel alluvia of these areas, an easement extending approximately 50 ft on each side of the Pueblo Canyon stream bed was arranged to facilitate future monitoring and sampling of the channel (Herceg 1971, 05-0044; Purtymun 1970, 0190).

Operations at former TA-10, which is adjacent to and upstream of TA-74, may also have created environmental impacts at TA-74. TA-10 was located in Bayo Canyon just west of the Otowi Section. The area was used primarily as a firing site; however, it was also the site of a chemical laboratory. Releases from the laboratory, including radioactive materials, acids, and laboratory wastes, occurred until the site was decontaminated and decommissioned in the early 1960s (LANL 1990, 05-0058). TA-10 is included in OU 1079 and will not be discussed further in this document.

Currently, sewage effluent from the Bayo Canyon treatment plant is released to the stream beds flowing through TA-74. A detailed characterization of these canyon areas will be provided in the canyons study (OU 1049) work plan and is not addressed in this work plan.

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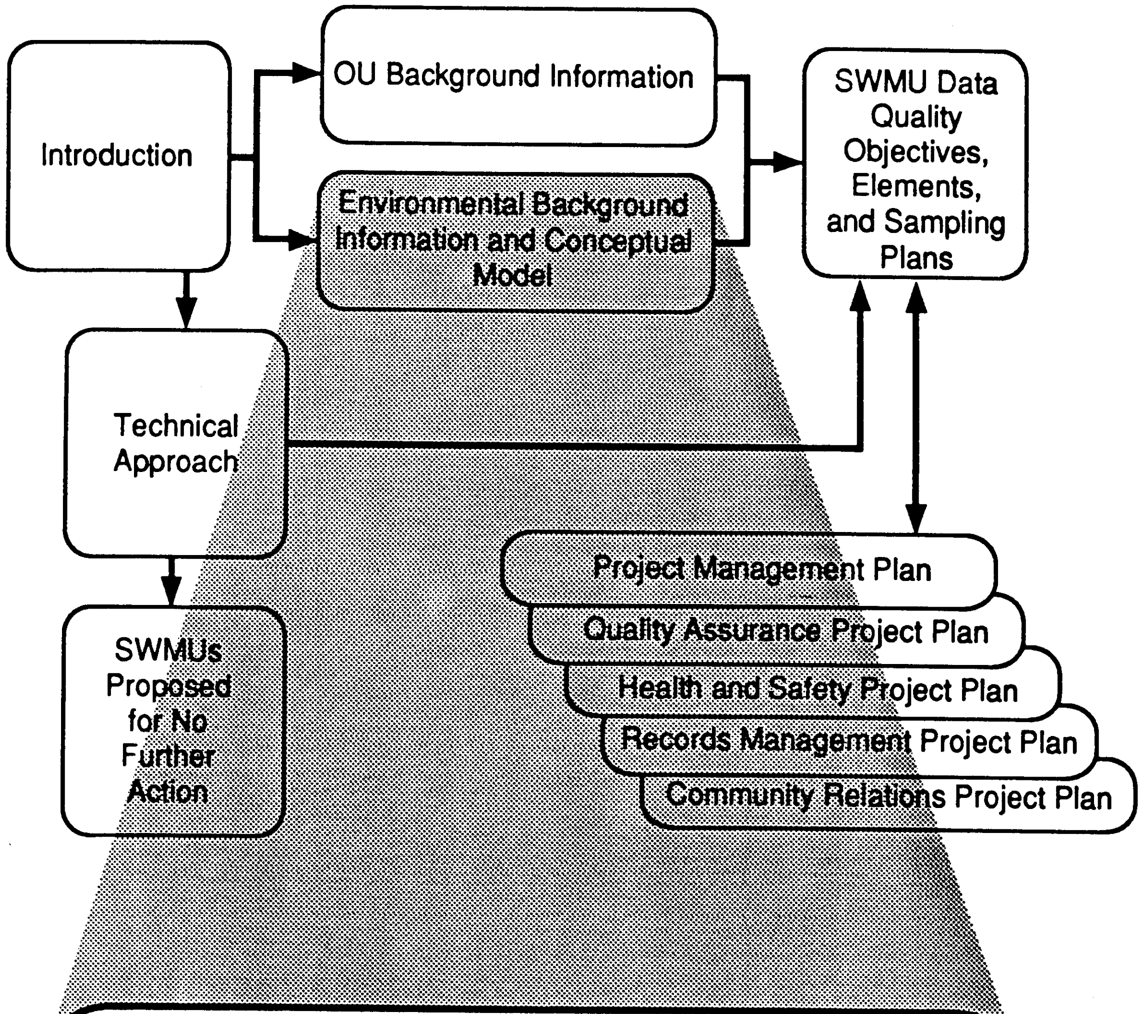
CHAPTER 4



Environmental Background Information and Conceptual Model

- Environmental Setting
- OU Conceptual Model

4.0 ENVIRONMENTAL BACKGROUND INFORMATION AND CONCEPTUAL MODEL

4.1 Environmental Setting

This section describes in detail the existing environmental information for Operable Unit (OU) 1071 [Technical Areas (TAs) -0,-19,-26,-73, and -74)] and provides a conceptual model for the potential migration pathways of contaminants from solid waste management units (SWMUs) that have been identified in OU 1071.

4.1.1 Topographic Setting

OU 1071 is located on the Pajarito Plateau (Figure 4-1). The Pajarito Plateau is bounded on the west by the Jemez Mountains volcanic complex at an elevation of about 7,800 ft and on the east by the Rio Grande, whose valley walls descend from an elevation of about 6,300 ft. SWMUs in OU 1071 are located on Barranca, North, and Town Site mesas, and in Rendija, Guaje, Bayo, Pueblo, Los Alamos, and Mortandad canyons. The canyons, up to 400 ft deep, drain east-southeast to the Rio Grande. The surface of the plateau narrows from west to east as the valleys get progressively wider. The sides of the valleys are generally very steep, colluvium-covered slopes or bedrock cliffs. Thus, the wider parts of the valleys generally possess wider alluvium-filled valley floors than do the narrower canyons, in which sediment storage is limited. The mesatops, which generally have a thin veneer of surficial deposits covering bedrock, narrow from fairly broad mesas to the west to narrow fingertip mesas at their eastern termini. OU 1071 covers an area of about 36 mi^2, which is 9 mi long (west to east) and 4 mi wide (north to south). The SWMUs range from 5,840 to 7,400 ft elevation.

4.1.2 Climatic Setting

Los Alamos County has a semiarid, temperate mountain climate. Bowen (1990, 0033) describes the climate of the county in detail. Climatic data have been collected in the county since 1911. Currently, eight weather stations on the Pajarito Plateau collect precipitation data (Figure 4-2). The original weather station was located at the Ranch School on Town Site Mesa at an elevation of 7,330 ft. This weather station has been moved several times, although the elevation of the station has varied by less than 100 ft. Since 1979, it has been located at TA-59 at an elevation of 7,380 ft. Additionally, a weather station has been located at Area G since 1980, collecting precipitation, temperature, and other climatological data (Bowen 1990, 0033).

Summer afternoon temperatures in Los Alamos County are typically in the 70s and 80s (°F), infrequently reaching 90°F, and nighttime temperatures are typically in the 50s. Typical winter temperatures are from 30 to 50°F in the daytime to 15 to 25°F at night, occasionally dropping to 0°F or below (Bowen 1990, 0033).

Annual precipitation (including both rain and snow) averages about 18 in., and annual snowfall averages about 51 in. at TA-59. Precipitation generally decreases eastward toward the Rio Grande and increases westward toward the Jemez Mountains (Figure 4-3). As summarized by Bowen (1990, 0033, p. 5), "Los Alamos precipitation is characteristic of a semiarid climate in that variations in precipitation from year to year are quite large." Recorded extremes in annual precipitation range from 6.8 to 30.3 in. An average of 40% of the annual precipitation falls during

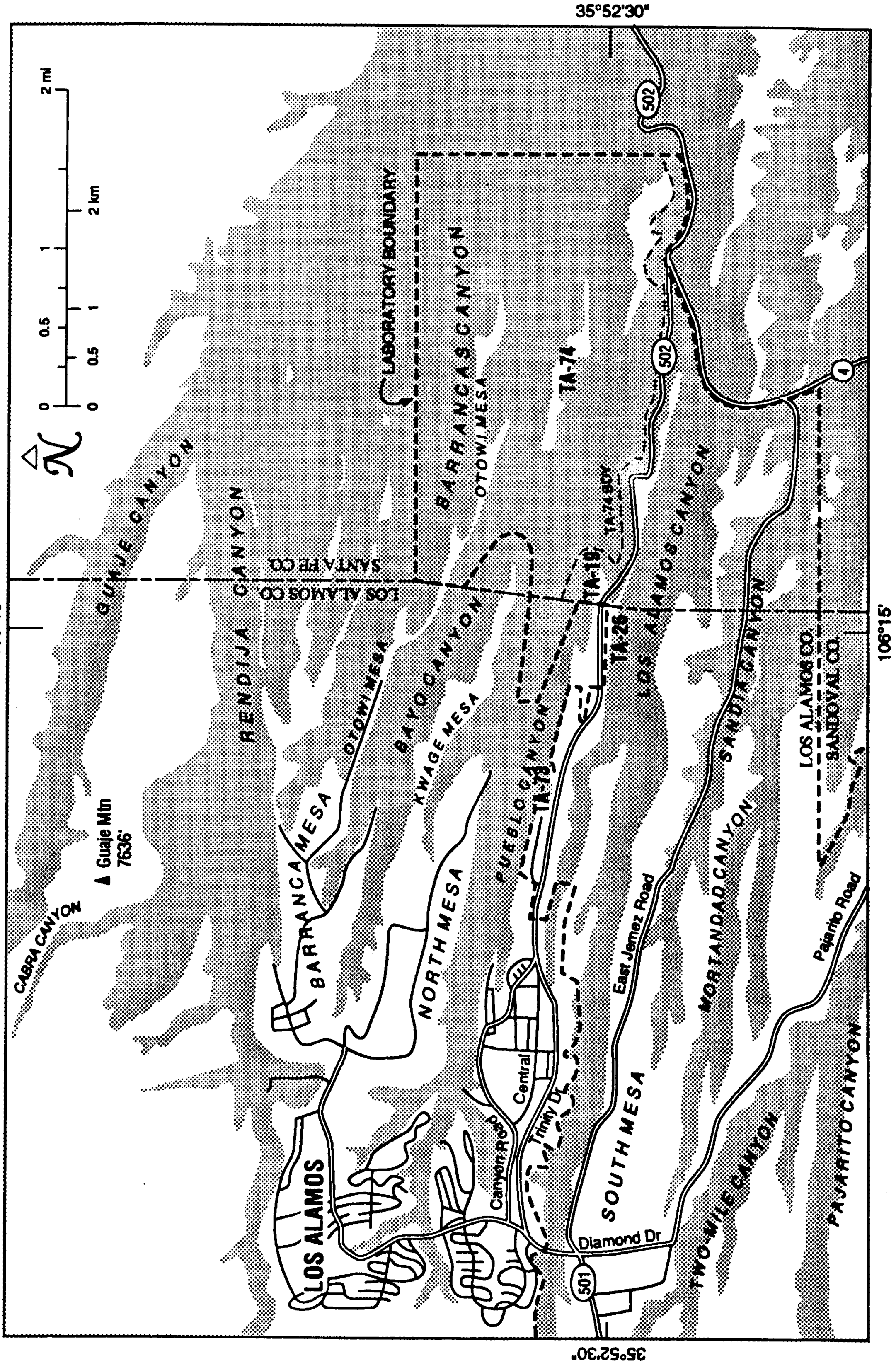


Figure 4-1. Portion of Pajarito Plateau that includes OU 1071.

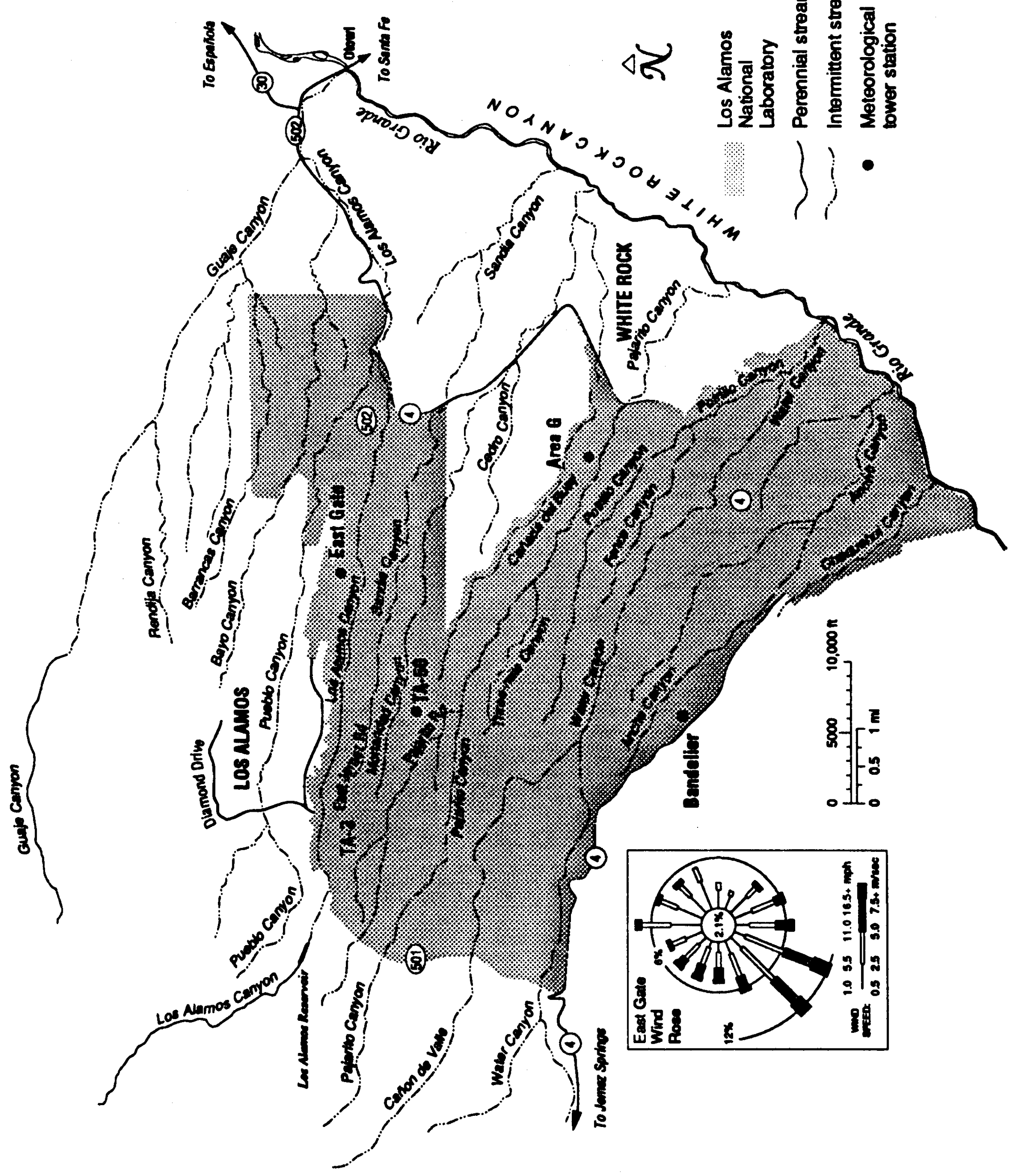


Figure 4-2. Locations of meteorological towers in 1988.

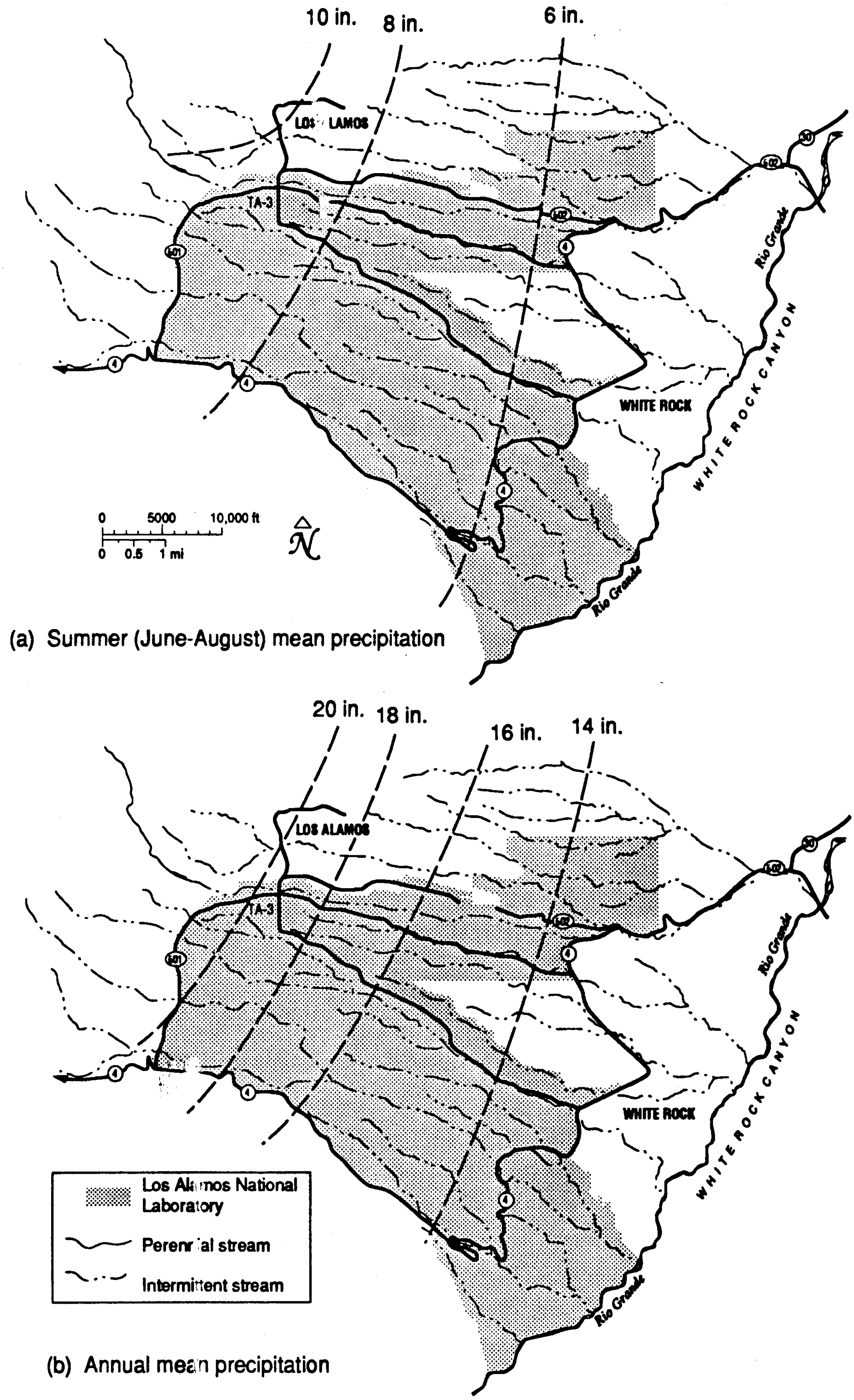


Figure 4-3. Annual and summer mean precipitation on the Pajarito Plateau.

thunderstorms in July and August, often in brief, high-intensity rains. Daily rainfall extremes of 1 in. or greater occur in most years, and the estimated 100-yr daily rainfall extreme is about 2.5 in. Snowfall is greatest from December through March, and heavy snowfall is infrequent in other months (Bowen 1990, 0033).

An extension of the historic record of annual precipitation at Los Alamos has been presented in a study that correlates historic precipitation and widths of tree rings (Abeele 1980, 0637). Comparing indices of tree ring widths with historic rainfall measurements, Abeele estimated that the largest precipitation event in the last 100 yr was about 31.0 in., which agrees well with the estimated 100-yr maximum precipitation of 30.2 in. based on historic climatic records. The estimated maximum annual precipitation (39.9 in.) during the period of tree ring record (1510 AD to present) occurred in 1597 AD (Abeele 1980, 0637).

4.1.3 Geologic Setting

4.1.3.1 Bedrock Stratigraphy

The mesa surfaces at OU 1071 are immediately underlain by the Bandelier Tuff of Pleistocene age, which outcrops in a few places on mesa surfaces and is exposed along all canyon walls. The Bandelier Tuff comprises two units: the Tshirege and Otowi members. The Tshirege Member (Smith and Bailey 1966, 0377) is the uppermost rock unit and consists of multiple-flow units of crystal-rich ash-flow tuff and displays significant variations in welding and vapor phase alteration, both within a single stratigraphic section and at varying distances from the caldera.

The Otowi Member of the Bandelier Tuff underlies the Tshirege Member beneath the Pajarito Plateau and outcrops along canyon walls throughout OU 1071. The Otowi Member is a nonwelded, vitric ash-flow tuff composed of multiple-flow units.

Beneath the Bandelier Tuff, a sequence of interstratified sedimentary and volcanic rocks of Miocene to Pleistocene age occur, which have been penetrated by water supply wells and which also outcrop on the margins of the Pajarito Plateau (Figure 4-4). Along the walls of the canyons in OU 1071 below the Bandelier Tuff, Pliocene-Pleistocene andesite and latite volcanic rocks of the Tschicoma Formation crop out. The Tschicoma Formation consists of voluminous domes and flows of dacite and andesite that interfinger with sediments of the Puye Formation and are exposed in the upper canyons in OU 1071.

In the subsurface beneath the eastern edge of the Pajarito Plateau in OU 1071, basaltic to andesitic flows, breccias, and scoria associated with the Cerros del Rio volcanic field, most of which lies east of the Rio Grande, interfinger with the Puye Formation. These rocks also crop out beneath the Bandelier Tuff in lower Los Alamos Canyon in road cuts along State Road 502.

Pliocene-Pleistocene sedimentary rocks of the Puye Formation crop out in the eastern sections of Guaje and Los Alamos canyons. The formation consists of a variable, volcaniclastic fanglomerate that was shed eastward from the Tschicoma volcanic centers in the northeastern Jemez volcanic field. The beds include stream flow deposits, debris flow deposits, volcanic ash and block flow deposits, and ash fall and pumice fall deposits (Waresback and Turbeville 1990, 0543). Interbedded finer-grained sediments commonly occur with the Puye conglomerates.

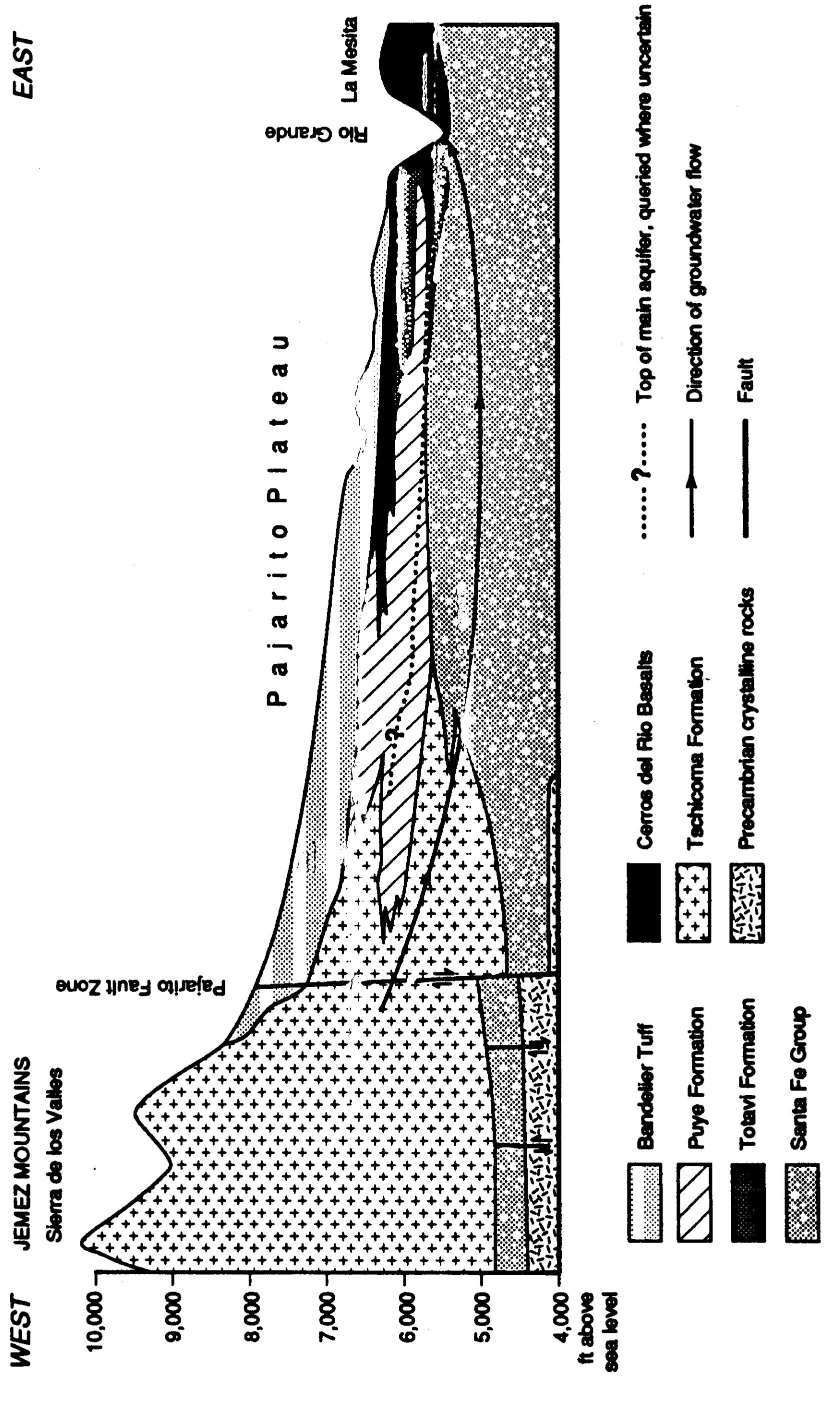


Figure 4-4. Generalized cross section showing stratigraphy and structure of the Pajarito Plateau from the Sierra de los Valles to the Rio Grande.

The Totavi Lentil is a coarse, poorly consolidated axial channel conglomerate deposited by the ancestral Rio Grande, which occurs at the base of the Puye Formation and overlies Santa Fe Group sediments. Although the Santa Fe Group sediments do not crop out in OU 1071, they underlie the units in which the canyons are cut and crop out at lower elevations east of OU 1071. Rocks of the Santa Fe Group consist of fluvial sandstone, siltstone, and conglomerate, with subordinate eolian deposits, ash beds, and lacustrine sediments. These rocks host the main aquifer in the Los Alamos area.

A general discussion of the geology at the Laboratory can be found in Section 2.6 of the Installation Work Plan (IWP) (LANL 1991, 0553).

4.1.3.2 Structure

A number of near-vertical faults have been observed that show small amounts of primarily down-to-the-west displacement in the Bandelier Tuff within the boundaries of OU 1071. Only two of these faults (the Guaje Mountain and Rendija Canyon faults) have broken the surface of the Bandelier Tuff within the confines of OU 1071 (Gardner and House 1987, 0110). Broad zones of intense fracturing superimposed on the primary cooling joints (Vaniman and Wohletz 1990, 0541) sometimes accompany these faults. In contrast to cooling joints, these tectonic fractures are more likely to cross flow unit and lithologic unit boundaries and thus may provide more continuous and more deeply penetrating flow paths for groundwater migration than are provided by cooling joints.

4.1.3.3 Surficial Deposits

4.1.3.3.1 Alluvium and Colluvium

Surficial deposits on the plateau surface of OU 1071 consist of coarse-grained colluvium on steep hillslopes and along the base of cliffs, generally fine-grained fluvial and colluvial sediments with a thin cover of eolian fine-grained sediments on the flatter parts of mesa surfaces, and alluvial fan deposits at the mouths of drainages cut into the mountain front or escarpments related to post-Bandelier faulting. Deposits in the major canyons consist of colluvial materials on and at the base of cliffs and canyon walls, representing large-volume mass wasting, and fluvial sediments deposited by intermittent streams along the axis of canyon floors. Alluvial fans may be present at the mouths of smaller canyons. Fluvial sediments dominate the surficial materials found on the canyon floors, and colluvial materials, including landslides and finer-grained debris flow sediments, predominate on and at the base of canyon walls. Alluvium in the canyons tends to thicken eastward as the canyons widen in their downstream reaches. Older alluvial deposits are represented by terrace deposits along canyon margins at elevations higher than that of the modern alluvium that covers the canyon floors.

The alluvium of the canyon floors in OU 1071, when dated, is entirely of Holocene age (less than 10,000 years old). Radiocarbon dating has shown the base of the Holocene sediments in Rendija Canyon to be less than about 6,000 years old (Gardner et al., in preparation, 0639). The lack of older alluvium beneath the Holocene deposits and the relatively young age of the sediments in the canyon suggest that these sediments were removed before 5,000 years ago. Such sediment cycling through the canyons requires large flows and suggests that contaminants contained in the modern sediments in these canyons will probably be transported downstream during relatively infrequent large-magnitude flow events.

4.1.3.3.2 Soils

A large variety of soils have developed in the rocks and sediments in OU 1071. Based on a soil survey of Los Alamos County, Nyhan et al. (1978, 0161) describe the general character of these soils and their association with rock type, climate, slope, and vegetation. Unfortunately, as much as 75% of the area of OU 1071 was not mapped during this study, and no formal study of the soils of this area has been conducted since. However, by examining the soil maps included in the Nyhan et al. report, the types of soils that are likely to occur in the unmapped area can be inferred by noting the types of soils that exist in geomorphic settings similar to those that occur in this area.

Generally, weakly developed soils that possess only an A horizon (the uppermost mineral soil horizon, usually darkened by the accumulation of dark, humic material) and a C horizon (very weakly pedogenically modified colluvial, alluvial, and eolian materials) occur on relatively geologically young alluvial deposits (less than a few thousand years old) associated with major drainages, steep hillslopes, or areas flanking otherwise erosionally stable mesa tops.

Most of the moderately to well-developed soils that occur in OU 1071 are present on the gently sloping surfaces of the mesatops. These soils have formed primarily at elevations between 6,500 and 7,500 ft and in volcanic bedrock, such as the Bandelier Tuff. Such soils possess one or more Bt subhorizons, which are horizons that have significant accumulations of layer lattice clay when compared with the materials from which the horizons apparently formed. The Bt horizons of these soils have relatively large amounts of clay, which exhibit reddish hues and chromas. The reddish colors of these well-developed soils reflect the chemical weathering of iron-bearing aluminosilicate minerals and glass in the volcanic parent materials to pedogenic ferric iron oxyhydroxides under well-drained, oxidizing conditions. A large body of research shows that the formation of such horizons requires tens to perhaps hundreds of thousands of years in a semiarid climate such as that of the Pajarito Plateau. Moreover, in this climate, such soils usually occur on relatively stable land forms. Accordingly, these soils occur on the most shallowly sloping areas of mesas, which are typically underlain by the Bandelier Tuff or other similar tufaceous lithologies.

4.1.3.3.3 Erosional Processes

Erosion on the mesatops in OU 1071 is caused primarily by shallow run-off on the relatively flat part of the mesas, by deeper run-off in channels cut into the mesa surfaces, and by rockfall and colluvial transport on the walls of canyons. Erosion on canyon bottoms occurs primarily by channelized flow along stream courses on the canyon floors.

Movement of colluvial materials may occur as (1) small masses that tumble down canyon walls, (2) as small debris flows that issue from the mouths of small side channels into the main canyon drainage systems, or (3) as slides of large, relatively coherent blocks of the valley walls, which cause rapid retreat of cliff faces along the mesa edges.

Thus, contaminants stored in sediment fills on mesatops may be transported into the canyons by extreme run-off events on the mesa surface or may be carried in masses of rock and debris as they slide down valley walls onto the canyon floors. Contaminated sediments along the canyon floors are likely to be moved toward the Rio Grande during major run-off events. Waste sites in OU 1071 most likely to be exposed by erosion are those that lie close to the edges of mesas or near active channels in canyon bottoms.

4.1.4 Hydrogeologic Setting

The hydrogeology of the Pajarito Plateau and the occurrence of surface water and groundwater are summarized in Section 2.6 of the IWP. The canyon and mesa topography and the volcanic ash deposits of the Bandelier Tuff are key features of the Pajarito Plateau and are important in controlling the hydrogeology of OUs. The hydrology (occurrence and movement of water in surface and subsurface environments) of specific SWMU sites in OU 1071 is primarily controlled by the topographic location of the SWMU in either a canyon bottom, canyon rim, or mesatop. The majority of SWMUs in OU 1071 are located on mesatops. Thirteen sites [0-011 (a through e), 0-015, 0-016, 0-017, 0-018 (a and b), and 0-029 (a -c)] are located, in whole or in part, in canyon bottoms, specifically in Los Alamos, Pueblo, Rendija, and Guaje canyons. Five sites (19-002, 19-003, 26-001, 73-002, and 73-006), together with numerous septic outfalls, are situated along canyon rims or ledges. No detailed hydrogeologic characterizations have been conducted on mesatops in OU 1071. Surface water and alluvial and perched groundwater have been studied in Los Alamos and Pueblo canyons. The following discussion summarizes current knowledge, as reflected in the IWP, of hydrogeologic conditions in these two topographically controlled areas of the OU.

4.1.4.1 Hydrology of the Mesatops and Vadose Zone

The mesatop area of OU 1071 overlies up to 1,100 ft of unsaturated volcanic tuff and sediments of the Bandelier and Puye formations and Cerros del Rio basalts. The hydrology of the mesatop vadose zone is discussed in Section 2.6.3 of the IWP, "Review of Studies of the Geohydrology of Mesa Tops and Vadose Zone" (LANL 1991, 0553). Numerous investigations focusing on hydrologic characterization of the upper 100 ft of the Bandelier Tuff have been conducted in the Los Alamos area since the 1950s (Abrahams et al. 1961, 0015; Weir and Purtymun 1962, 0228; Abrahams 1963, 0011; Purtymun and Koopman 1965, 0201; Purtymun and Kennedy 1971, 0200; Purtymun et al. 1978, 0207; Abeele et al. 1981, 0009; Kearl et al. 1986, 0135; Purtymun et al. 1989, 0214). The remainder of the vadose zone below about 100 ft has not been adequately characterized. Moreover, it can only be assumed that findings from mesatop studies conducted in areas outside of OU 1071 are representative of conditions in this OU.

A summary of vadose zone studies on mesatops and the physical, hydrogeologic, and hydrogeochemical properties of the Bandelier Tuff is found in the IWP. In general, the findings summarized in the IWP indicate that the Bandelier Tuff (which forms the mesatop vadose zone) does not bear water, except in very shallow and localized areas. The low moisture content and extensive thickness of the unsaturated zone minimize the potential for downward movement of water through the Bandelier Tuff and on to the main aquifer.

4.1.4.2 Hydrology of Canyon Surface Water

Canyon surface water is discussed in Section 2.6.4 ("Geohydrology of Canyon Surface Waters and Alluvial Aquifers") of the IWP (LANL 1991, 0533). Surface water occurs primarily as ephemeral streams in all the canyons in which OU 1071 SWMUs are located, including (from north to south) Guaje, Rendija, Pueblo, and Los Alamos canyons (Purtymun 1975, 0194). Springs on the flanks of the Sierra de los Valles supply perennial base flow to the headwaters of Guaje and Los Alamos canyons (Abeele et al. 1981, 0009), but the amount of discharge is not sufficient to maintain perennial surface flow across the OU. In Guaje and Rendija canyons, run-off from heavy summer thunderstorms and spring snowmelt is the sole source of surface water within the boundaries of OU 1071. Perennial flow is maintained in sections of Pueblo and Los Alamos canyons by the release of effluents from industrial waste treatment plants, sewage plants, and cooling water from the power plant (Purtymun 1975, 0194) and may occur up to a mile downstream from points of discharge. Stream loss caused by infiltration into underlying alluvium and evapotranspiration typically prevents surface flow in these canyons from discharging across the eastern boundaries of OU 1071. During periods of excessive storm run-off or snowmelt, surface flow may reach the Rio Grande (Abeele et al. 1981, 0009). The drainages discussed in the following subsections contain SWMUs located in OU 1071.

4.1.4.2.1 Guaje Canyon

Guaje Canyon, which has a drainage basin of about 25 km^2, is the northernmost canyon transecting OU 1071, contains one SWMU [0-029 (c)] located in the lower reach of the canyon approximately 2 mi above its confluence with Los Alamos Canyon. The canyon heads on the flanks of the Jemez Mountains west of the plateau. Base flow is maintained in the canyon headwaters by two springs, and a reservoir is located in the upper reach of the canyon approximately 11.5 mi above Los Alamos Canyon. Perennial flow is maintained for about 7 mi below the reservoir [2.5 mi upcanyon from SWMU 0-029(c)] (Purtymun 1975, 0194), and intermittent surface flow occurs over the remainder of the canyon. The midreach of the canyon is the location of the Guaje well field, which provides a significant portion of the municipal water supply for the Los Alamos area. The lower reach of the canyon also receives intermittent run-off from Rendija and Barrancas canyons. No information is available regarding flood frequency and discharge, but heavy storm run-off carries surface flow to at least the location of SWMU 0-029(c) and probably beyond.

4.1.4.2.2 Rendija Canyon

Rendija Canyon, with a drainage basin of about 12 km^2, heads on the Pajarito Plateau just west of the townsite and is tributary to Guaje Canyon approximately 4 mi upcanyon from the confluence of Guaje and Los Alamos canyons [2 mi upcanyon from SWMU 0-029(c)]. Rendija Canyon contains five SWMUs: 0-011 (a-c), 0-015, and 0-016. No effluent discharges into Rendija Canyon, and surface flow is derived primarily from intermittent storm run-off, although run-off from spring snowmelt is a possible contributor. No data are available concerning drainage area or flood frequency and discharge, but it is likely that heavy storm run-off reaches as far as Guaje Canyon.

4.1.4.2.3 Pueblo Canyon

Pueblo Canyon heads on the flanks of the Sierra de los Valles and has a large drainage area of 22.3 km^2, which includes its tributary, Acid Canyon. The canyon drains most of the townsite and contains SWMUs 0-017 and 0-018(a and b). The canyon currently receives sewage effluent from the Pueblo and Bayo treatment plants. Effluent discharge causes perennial flow in the upper and lower reaches of the canyon. During periods of heavy storm run-off or snowmelt, surface discharge may reach the Rio Grande via Los Alamos Canyon. Infiltration of surface flow recharges underlying alluvial and perched bedrock aquifers beneath the mid- and lower reaches of the canyon. Maximum flood discharge and frequency for Pueblo Canyon range from 21 m^3/s for a 50-yr frequency to 3.1 m^3/s for a 2-yr frequency (Purtymun 1975, 0194).

4.1.4.2.4 Los Alamos Canyon

The Los Alamos Canyon drainage area covers about 27.5 km^2 and extends from the drainage divide on the flanks of the Sierra de los Valles to the Rio Grande near Otowi. Pueblo and Guaje canyons are major tributaries, which join Los Alamos Canyon in its lower reach. Los Alamos Reservoir, situated in the upper reach of the canyon, impounds water from a small, spring fed perennial stream, which is used for irrigating lawns in parts of the Laboratory. Surface flow below the reservoir is intermittent. The dam is a concrete-core rock- and earth-filled dam with a capacity of 4.9 x 10^4 m^3. Abeele et al. (1981, 0009) evaluated the flood hazard that would result from failure of the reservoir and found that the spillway would carry a flow of 13 m^3/s, which would easily accommodate a 100-yr flood discharge of 12 m^3/s. The Los Alamos Canyon drainage includes SWMUs 0-029 (a and b) and part of SWMU 0-017. Los Alamos Canyon currently receives discharge water from the TA-41 cooling tower, sewage effluent from TA-2 and TA-41, and industrial and sewage effluent from TA-21. Surface flow in Los Alamos Canyon recharges underlying alluvial and perched aquifers and may discharge to the Rio Grande during high run-off from summer storms. Maximum flood discharge and frequency vary from 20 m^3/s for a 50-yr frequency to 3 m^3/s for a 2-yr frequency (Purtymun 1975, 0194).

4.1.4.3 Hydrology of the Saturated Zone

Groundwater occurs under saturated conditions in three forms beneath OU 1071: (1) stream-connected alluvial aquifers [Subsection 2.6.4, IWP (LANL 1991, 0533)], (2) perched waters in shallow basalts and sediments underlying the alluvium (Subsection 2.6.5, IWP), and (3) the main aquifer of the Pajarito Plateau (Subsection 2.6.6, IWP).

Canyons in OU 1071 with effluent-fed perennial surface flow (Pueblo and Los Alamos canyons) have alluvial aquifers that are recharged by, and hydrologically connected to, surface stream flows. Surface water rapidly infiltrates through the permeable alluvium until downward movement is restricted by the less permeable sediments of the Tschicoma Formation, the Bandelier Tuff, or the Puye Formation, resulting in a shallow saturated zone perched in the alluvium. The areal extent of these alluvial aquifers along the main axes of the canyons is not well defined. As water flows downgradient (eastward) in the alluvium, water is lost to evaporation, transpiration, and infiltration into underlying sediments. Infiltration of alluvial groundwater appears to be the main source of recharge for two perched water bodies near the confluence of Pueblo and Los Alamos canyons and in the midreach of Pueblo Canyon (Purtymun 1973, 0191; Purtymun 1975, 0194; Abeele et al. 1981, 0009). Although the nature and location of the perched layers are not known, the main aquifer does not appear to be hydrologically connected to the overlying perched zones.

The main aquifer beneath OU 1071 serves as the municipal water supply for the Los Alamos area and is located in the lower Puye Formation and Santa Fe Group sediments. Depth to the main aquifer ranges from approximately 335 m at the western margin of the OU to about 75 m at the SWMUs in lower Los Alamos and Guaje canyons to the east. Three well fields have been developed in the main aquifer; two fields, the Los Alamos field and the Guaje field, are located along the eastern and northern margins of the OU. Based on current knowledge of the hydrology of the plateau as reflected in the IWP, the potential for impact to the main aquifer or the municipal drinking water supply from SWMUs in OU 1071 is thought to be extremely low. No migration pathway from the plateau's surface or the canyon bottom to the main aquifer is currently recognized by the Laboratory's hydrologists; however, faults and recently identified stream gravels at the base of the upper member of the Bandelier Tuff could act as such a pathway.

4.2 Conceptual Model of OU 1071

A conceptual model for OU 1071 has been developed based on the discussion of the environmental setting presented in Section 4.1. The conceptual model is presented in diagram form in Figure 4-5. The physical processes and major pathways included in the model are based on current knowledge of the OU's environment (Section 4.1) and the types of SWMUs present (Section 3) at OU 1071. The processes and pathways discussed below provide the basis for the SWMU-specific conceptual models for potential contaminant releases presented in Subsections 5.-.2.3). The primary release mechanisms and migration pathways of concern are

- surface run-off and sediment transport,
- erosion and surface exposure,
- infiltration and transport in the vadose zone, and
- atmospheric dispersion.

These pathways are believed to provide the greatest potential for release and transport of contaminants, when they are present, to the environment at OU 1071. Secondary release mechanisms and migration pathways of lesser concern are alluvial aquifers, springs, and seeps.

Based on existing data presented in the IWP and the present level of knowledge of the SWMUs in OU 1071, it has been concluded that no pathway exists to the main aquifer below the plateau; therefore, groundwater is not discussed further in this work plan. Release mechanisms and migration pathways of concern are discussed below.

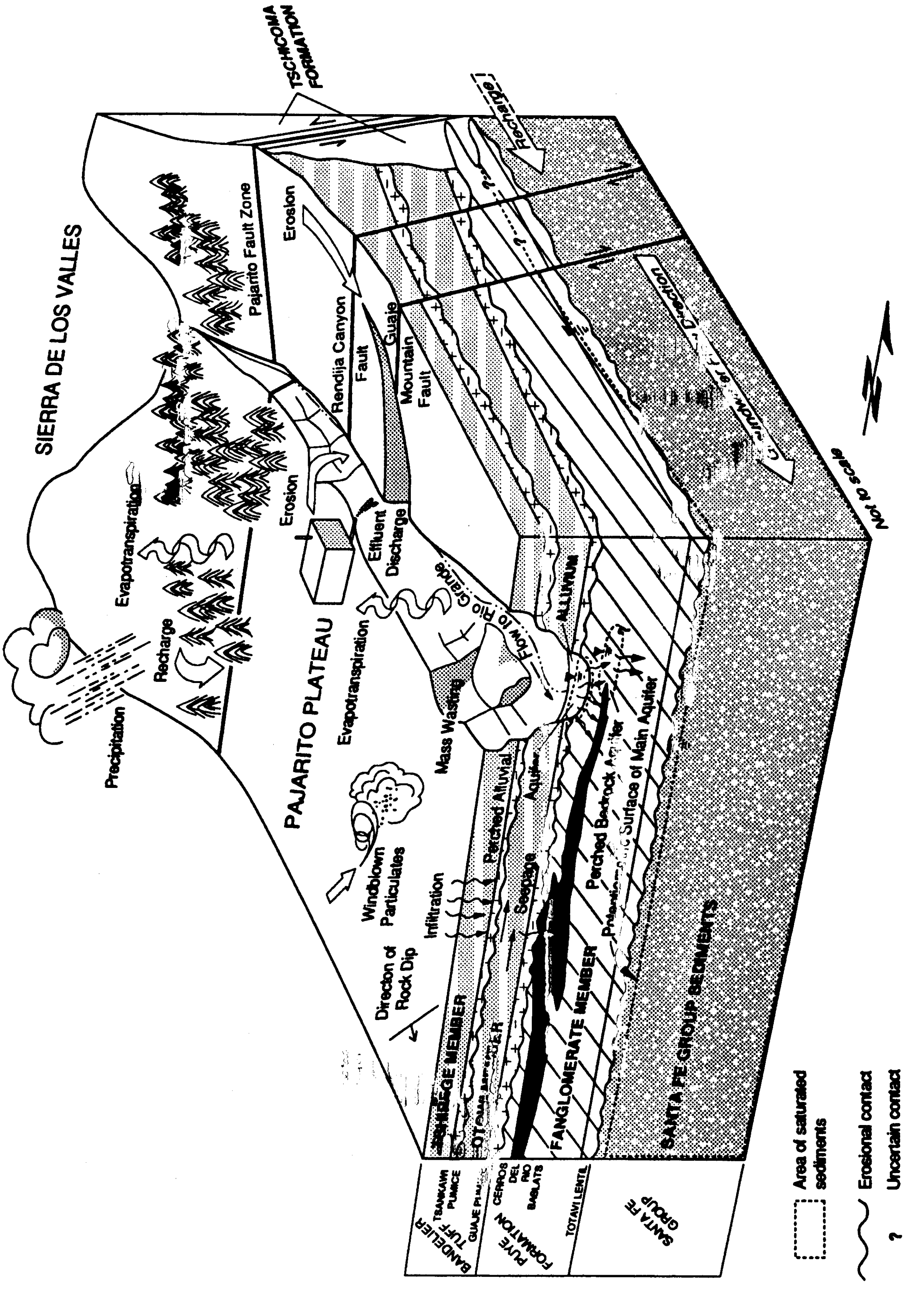


Figure 4-5. Conceptual geohydrologic model of OU 1071 showing general relationship of major geologic units.

4.2.1 Surface Water Run-Off and Sediment Transport

Surface run-off and sediment transport are the migration pathways of greatest concern for transport of contaminants on the surface to off-site receptors. Surface run-off is concentrated by natural topographic features and man-made diversions and flows toward the canyons. A topographic low can cause run-off to pond and infiltrate on the mesatop. Contaminant transport by surface run-off can occur in solution, adsorbed to suspended colloids, or with movement of heavier bedload sediments. Surface soil erosion and sediment transport are functions of soil properties and run-off intensity. Contaminants transported in run-off can concentrate in sediment traps in drainages. Erosion of drainage channels can disperse contaminants downgradient in the drainage.

4.2.2 Erosion and Surface Exposure

Soil erosion and mass wasting are long-term release mechanisms that may expose subsurface contaminants or allow water to access previously contained wastes. Erosion of surface soils depends on soil properties, vegetative cover, slope, exposure, and intensity and frequency of precipitation. Mass movement of rock from canyon walls is a discontinuous, observable process that proceeds at a very slow rate but that can be an important mechanism for exposing subsurface contaminants located on mesatops near canyon rims.

4.2.3 Infiltration and Transport in the Vadose Zone

Infiltration into surface soils and tuff depends on the rates of precipitation and snowmelt, the amount of ponding, antecedent moisture content, and the hydraulic properties of soil and tuff. Joints and faults may provide pathways for infiltration and release of contaminants into the shallow subsurface. Movement of liquids in soil and tuff is dominated by transient, unsaturated flow processes influenced by infiltration and evapotranspiration. The movement of contaminants by liquids in the unsaturated zone can occur in the free-liquid phase, in solution, or adsorbed on suspended colloids. Contaminants may be retarded as the result of adsorption on tuff or on organic material present in soil or alluvium. Lateral flow or perched water may occur at unit contacts, between layers whose hydraulic properties differ, and in alluvial aquifers. Saturated or unsaturated lateral flow may discharge as springs or seeps on canyon walls and in canyon bottoms. Vapor phase movement in the unsaturated zone is an important transport mechanism for volatile contaminants such as organic solvents and tritium. Movement of contaminants in the vapor phase is influenced by concentration gradients, temperature gradients, density gradients, and/or air pressure gradients. Fractures may facilitate vapor phase transport of contaminants.

4.2.4 Atmospheric Dispersion

Wind entrainment of contaminated particulates, tritiated water vapor, or volatile organic compounds is a potentially significant pathway for widespread atmospheric dispersion of contaminants. This dispersal mechanism is limited to surface contamination and vapors released to the atmosphere from soil pore gas. Entrainment and deposition of particulates are controlled by soil properties, surface roughness, vegetative cover, terrain, and atmospheric conditions, including wind speed, wind direction, and precipitation. Vapor dispersion is influenced by similar atmospheric conditions. Gas exchange between soil and tuff and the atmosphere is controlled by temperature gradients and air pressure gradients and may be facilitated by fractures.

Not all release mechanisms and migration pathways discussed in this section are believed to be significant at all SWMUs. The conceptual models of SWMUs that address site-specific migration pathways are presented in Subsections 5.-.3.

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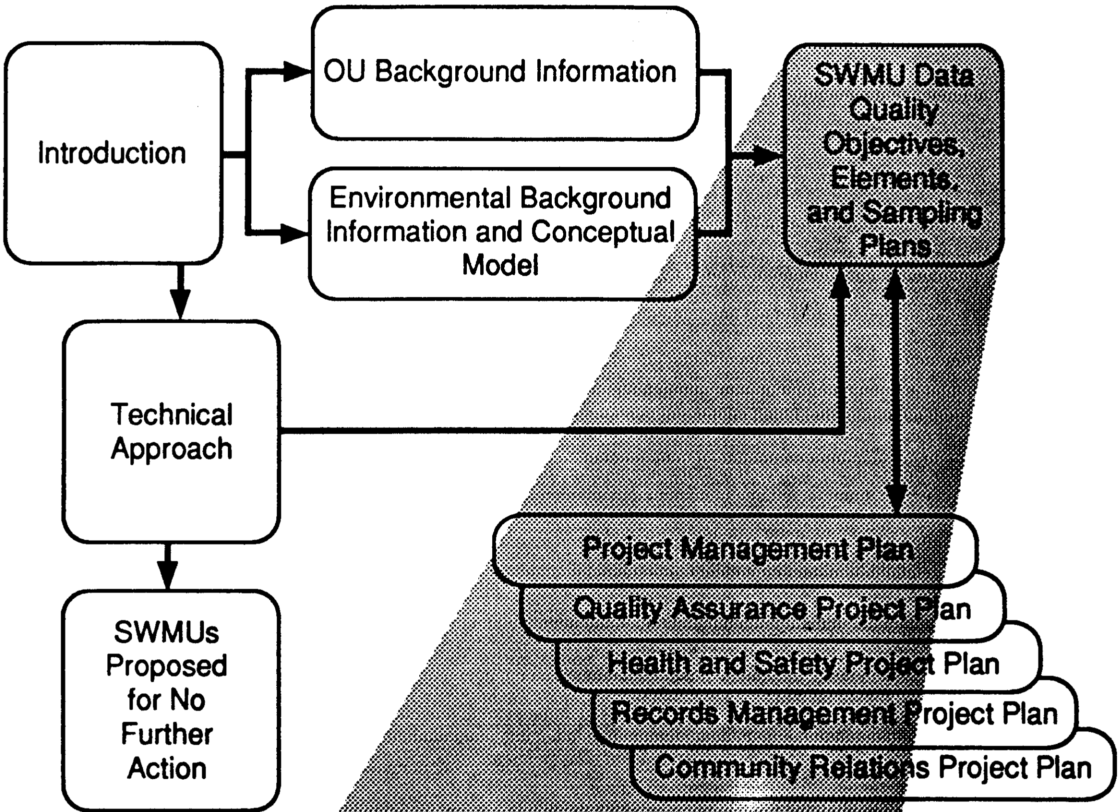
CHAPTER 5



SWMU Data Quality Objectives, Elements, and Sampling Plans

5.0 SWMU DATA QUALITY OBJECTIVES, ELEMENTS, AND SAMPLING PLANS

5.1 SWMU Aggregate 0-A (Western Steam Plant)

Solid Waste Management Unit (SWMU) Aggregate 0-A consists of SWMU 0-003, which is a decommissioned container storage area, and SWMU 0-012, the Western Steam Plant. SWMU Aggregate 0-A is located on property owned by the Department of Energy (DOE) (Figure 3-3).

5.1.1 Description and History

The Western Steam Plant (SWMU-0-012) is located at 3750 Finch Street, south of Trinity Drive, adjacent to the DOE's Los Alamos Area Office (LAAO) (Figure 5-1). The plant began operating in 1949 (DOE 1987, 0264) and was on standby status until it was removed from service in the spring of 1990. The Zia Company's wastewater laboratory operated as part of the Western Steam Plant between 1976 and 1983.

An outdoor, paved storage area, approximately 100 ft^2 (LANL 1990, 0145), is located at the east end of the steam plant. The area was used for storing waste in 55-gal. steel drums, which were loaded on wooden pallets (SWMU 0-003). It is not known how long the storage area operated; however, it was decommissioned in 1987 (LANL 1989, 0444; LANL 1990, 0145).

Three items in SWMU 0-012 are of primary environmental concern: an underground filtration tank, floor drains, and an outfall to Los Alamos Canyon.

Three USTs held diesel fuel for the plant in the event of an emergency (DOE 1987, 0264). Two tanks had a capacity of 14,500 gal., the third a capacity of 3,000 gal. The tanks were removed in September 1988; there was no evidence of leakage from the tanks (McInroy 1988, 05-0150).

The blowdown from the steam plant was diverted through a 3-in. drainline to an underground filtration tank located on the south side of the building. The filtration tank was intended to remove solids before the effluent was discharged through a 4-in. drainline to an outfall. The outfall [(National Pollutant Discharge Elimination System Permit Number 108)], drained to Los Alamos Canyon (LANL 1989, 0444; LANL 1990, 0145). The filtration tank is 10 ft long by 4 ft in diameter and has a 24-in.-diameter manhole.

Four drainpipes that appear to have served as floor drains extend from the south wall of the steam plant. Any discharge from these pipes would have flowed across the asphalt street and parking area and into Los Alamos Canyon. A drainline also extends out of the loading ramp and runs underground to the canyon edge. Additional floor drains for the steam plant are connected to the sanitary sewer and are routed to the Bayo Canyon Wastewater Treatment Plant [SWMU 0-018(b)]. Various chemicals used by the Zia wastewater laboratory for water and wastewater analysis are assumed to have been disposed via the floor drains (LANL 1990, 0145). There is no information on the types of chemicals used.

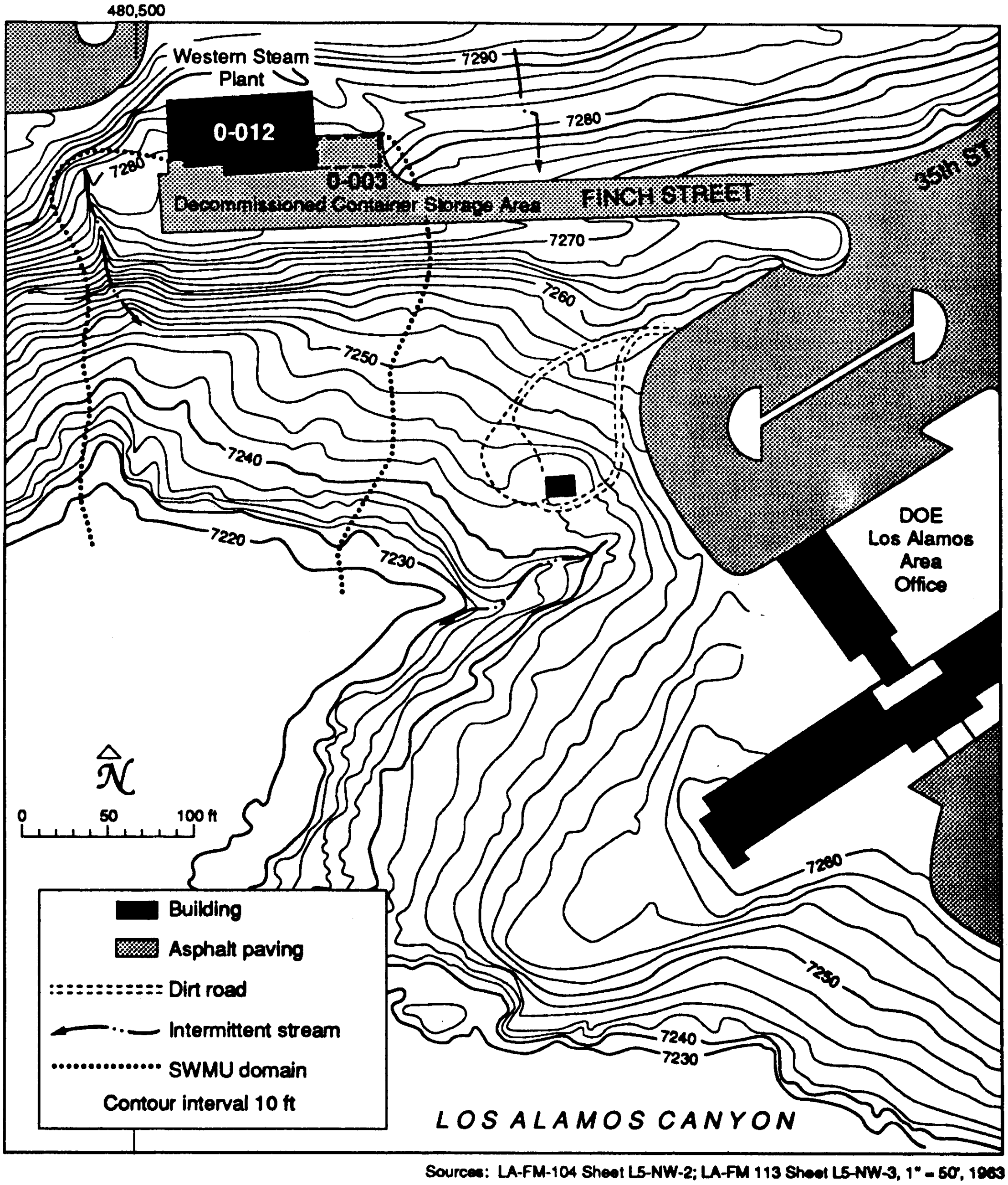


Figure 5-1. SWMU Aggregate 0-A (Western Steam Plant).

5.1.2 Nature and Extent of Contamination

5.1.2.1 Description and Contamination Levels

Possible solid and hazardous wastes include waste oil and algicides, which may have been used to treat the water in the boiler. Descaling chemicals and corrosion inhibitors may have been used in the filtration tank system. The chemicals and chemistry of these processes are unknown. The waste appears to have been discharged to the wastewater treatment plant in Bayo Canyon, into soils in the vicinity of the Western Steam Plant, and into Los Alamos Canyon. There is no known documentation of releases from this SWMU aggregate.

5.1.2.2 Potential Migration Pathways

Contaminants originating at the Western Steam Plant may have been released into the environment via leaks and/or discharges associated with the decommissioned container storage area or filtration tank. As a result, contaminants may be present in soil, channel sediments, tuff, and/or air. Contaminants in soil and channel sediments may be leached and disperse through the vadose zone, be entrained by surface water, and be transported downstream by run-off, or they may be entrained by air currents and transported off the site. Contaminants in tuff may be leached and disperse through the vadose zone.

5.1.2.3 Potential Public Health and Environmental Impacts

It is assumed that the steam plant land tract will eventually be used for private residences. Based on the migration pathways discussed in Subsection 5.1.2.2, it is possible that contaminants are currently present in or will migrate to soil or air. As a result, human exposure to contaminants from this SWMU aggregate may occur through inhalation of suspended particulates, incidental ingestion, or dermal contact with soil. Additionally, terrestrial animals may be exposed to site contaminants via incidental ingestion or dermal contact with soil or via inhalation of suspended particulates.

5.1.3 Conceptual Models

Figure 5-2 presents the conceptual model for potential contaminant releases from the container storage area or filtration tank and subsequent exposure by the receptors identified in Subsection 5.1.2.3. It shows only those pathways considered to be significant. In Figure 5-2, "off-site residents" refers to residents located in the vicinity of the Western Steam Plant (who are probably the closest downwind receptors), "site visitors" refers to people who may occasionally walk along the slopes of Los Alamos Canyon adjacent to the site, and "off-site workers" refers to employees at the adjacent LAAO. Terrestrial animals in the vicinity of the Western Steam Plant may also be impacted.

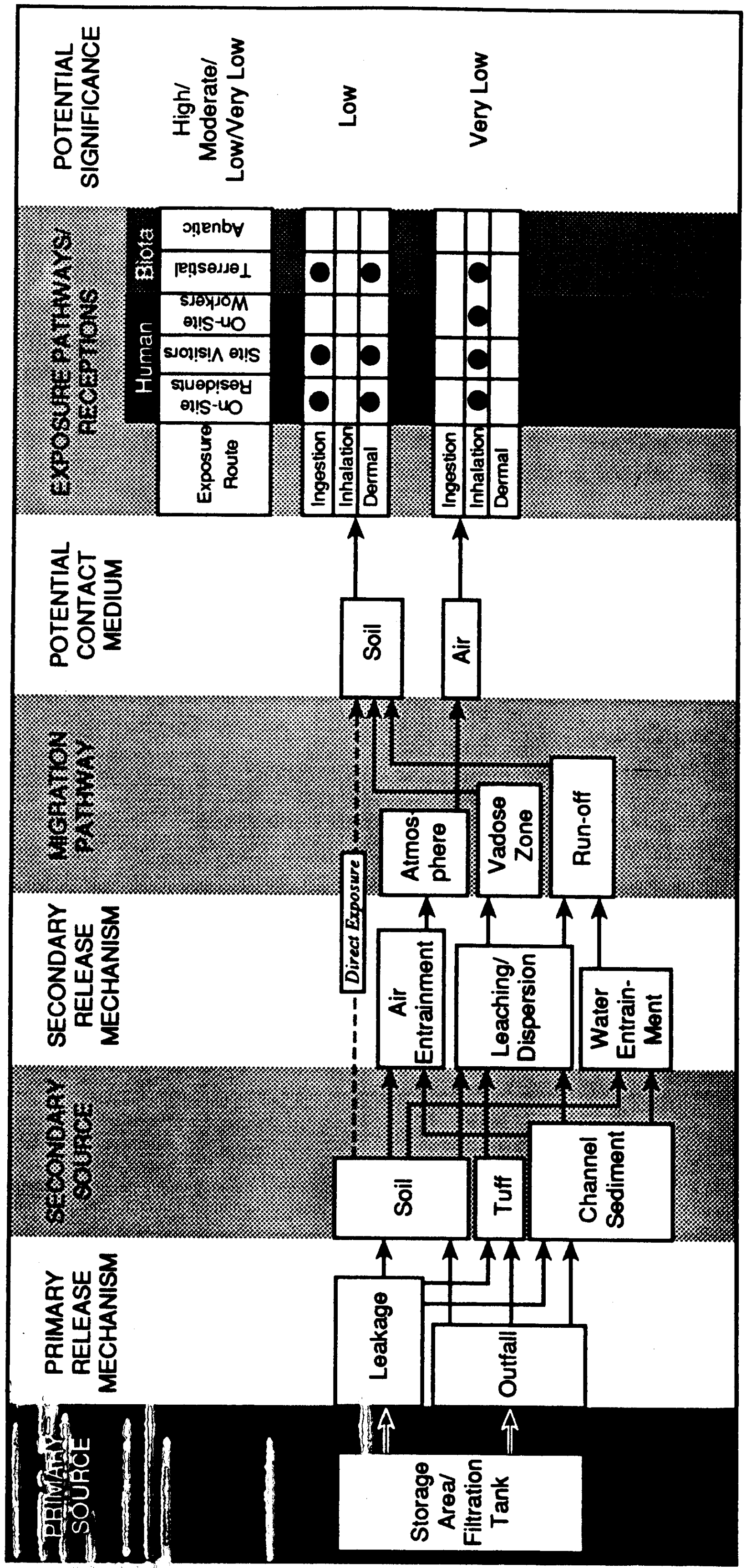


Figure 5-2. Conceptual model of SWMU Aggregate 0-A.

5.1.4 Decisions, Domain, and Approach

The domain of this SWMU aggregate includes the leveled area surrounding the steam plant building, the sloped fill south of the paved area (including the outfalls), and the channels down to Los Alamos Canyon (Figure 5-3). Any contaminants beyond the domain boundaries will be dealt with as part of the canyon studies (OU 1049). A stairway leads to the apartments above the steam plant, and LAAO is adjacent to the site. Therefore, the goal of the RCRA process at this DOE-owned property is to ensure that it will be suitable as a residential site. Remedial action will be proposed as necessary to clean the site to meet health-risk-based media cleanup standards for residential use.

Because there is no evidence of residual contamination in this domain, Phase I will consist of Stage I investigations to determine whether any secondary source of contamination is present. This decision will be based on analytical data from samples of soils and shallow tuffs beneath the decommissioned container storage area, on samples of sediments from the channels below the outfalls and pavement drainage on the south-facing slope, and on samples of material from the underground filtration tank. Stage I data from soil and sediment samples (Figure 5-4) will be compared with action levels (i.e., health-risk-based levels of contaminant concentrations for specific media) for soil and tuff to determine whether residual contamination is present at the sites. In the absence of contamination above action levels, no further action will be proposed at SWMU Aggregate 0-A. If contaminants are present above action levels, Phase II investigations will be initiated. These investigations will include removing the drainlines and filtration tank, sampling areas below pipe joints and/or cracks, and possibly obtaining sufficient data to support a baseline risk assessment and corrective measures study (CMS). Samples from the outfalls will address concerns about both the outfall and floor drains.

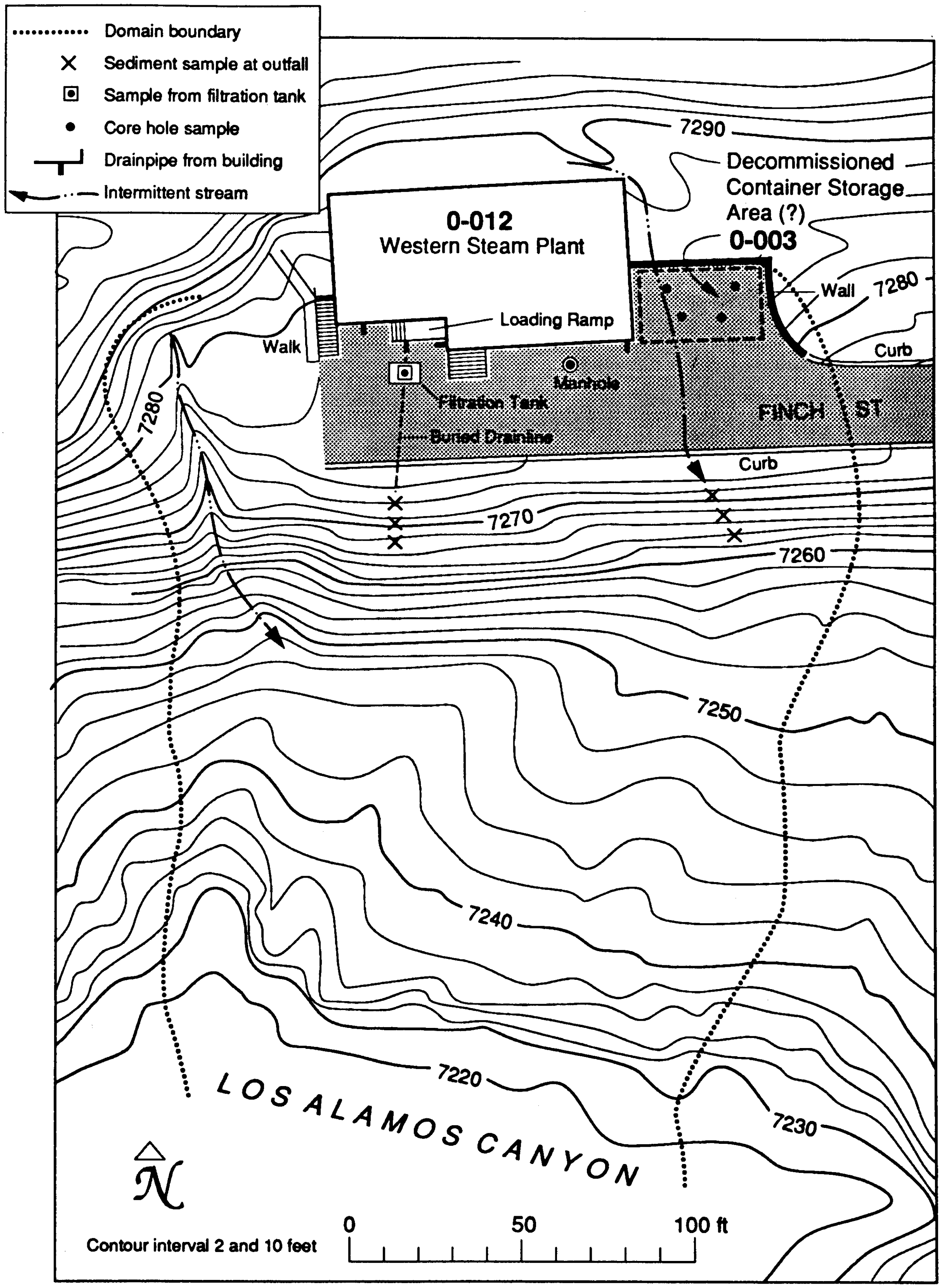
Because of the numerous uncertainties about potential contaminants associated with the filtration tank, samples from the tank are being analyzed for a wider-than-probable range of contaminants (Figure 5-4) to provide information concerning the need for decontamination of this decommissioned plant. Existing information indicates that no contamination has been associated with the tanks; therefore, no sampling is planned for the area in which they were located.

5.1.5 Data Required

5.1.5.1 Source Characterization

Specific data requirements for source characterization in Phase I investigations include

- determining as accurately as possible the location and boundaries of the decommissioned container storage area (SWMU 0-003), using field surveys and Level I data;
- using Level III/IV data to determine the presence or absence of and, if present, the nature and concentrations of, any contaminants in potential release areas or source media, including



Source: LA-FM-104 Sheet L5-NW-2, 1" = 50', 1963

Figure 5-3. Sampling locations in SWMU Aggregate 0-A.

Sample Location	No. of Samples	Sample Description	Field Surveys: Site Survey/Mapping	Field Surveys: Geophysical Survey (Level I)	Field Surveys: Soil Gas Survey (Level I/II)	Field Surveys: Gross Alpha, Beta, Gamma (Level I)	Field Screening (Level I): Lithologic Logging	Field Screening (Level I): Combustible Gas/Oxygen	Field Screening (Level I): Organic Vapor	Field Screening (Level I): Gross Alpha, Beta, Gamma	Laboratory Analysis (Level III/IV): Gamma Spectrometry	^{3}H	Total U (^{234}U, ^{236}U)	^{238}Pu, $^{239/240}Pu$	^{90}Sr	^{137}Cs	^{241}Am	^{60}Co	Volatile Organics (VOA) (SW 8240)	BTEX (SW 8020)	Semivolatile Organics (BNA) (SW 8270)	TPH(418.1)	Target Analyte List Metals	TCLP Metals	PCB and Pesticides (SW 8080)
0-012	2	Material from filtration tank						•			*										•		•	•	•
0-012	1?	Liquids from filtration tank						•			•										•		•	•	•
0-012, 0-003	8-10	Channel sediments below outfalls									*										•		•	•	•
0-003	9	Core samples from container storage area	•				•	•			*										•		•	•	•

Figure 5-4. Screening and analysis for initial investigations at SWMU Aggregate 0-A.

- surface and shallow subsurface material associated with the container storage area (SWMU 0-003),

- material remaining in the filtration tank associated with the Western Steam Plant (SWMU 0-012), and

- channel sediments from the filtration tank outfall, from the channels below the pavement drainage points that collect run-off from the container storage area, and from the drainpipes from the steam plant (which discharge onto the pavement).

Site surveys will be used to help locate and define the boundaries of the decommissioned container storage area and outfalls associated with surface drainages that originate on or transect the storage area. All surface and subsurface samples will be submitted for Level III/IV laboratory analysis. These data will be compared with action levels.

At least seven samples of channel sediments are required to bound contaminant concentrations in this population (Subsection 2.2.3). Because this area is paved and no contamination is expected beneath the pavement, fewer samples from beneath the former container storage area will be submitted for analysis unless field screening results are positive. If contaminant concentrations are below action levels, no further field investigations will be conducted.

If the data obtained in Phase I indicate that contaminant concentrations are above action levels, the necessity for and possible scope of additional Phase II field sampling will be evaluated. Based on current knowledge of past activities at these SWMUs, it is not expected that contaminants will be encountered above action level concentrations; accordingly, no detailed Phase II sampling plans have been developed. However, should Phase II investigations be necessary, additional source characterization data may be collected to determine the lateral and vertical extent of contamination, to perform a baseline risk assessment, and, if necessary, to provide a data base for designing and implementing corrective measures.

5.1.5.2 Environmental Setting

Data required to characterize the environmental setting of SWMU Aggregate 0-A include a map of surface water drainages that originate on or transect the decommissioned container storage area and the outfall point(s) and channel sediment traps associated with the drainage(s). The map will be used to select sampling sites for channel sediments.

If additional Phase II investigations are necessary, the information required may include detailed hydrogeologic and geologic characterization of subsurface soil and tuff. These data, if collected, will be used to analyze the risk associated with release and migration of contaminants and to design and implement corrective measures.

5.1.5.3 Potential Receptors

No specific information regarding the activities, behavior, or location of actua receptors is needed for the Phase I investigation. In the event that a Phase II investigation is necessary, the following information regarding the potential receptors identified in the conceptual model (Figure 5-2) may be needed:

- the frequency and duration of site visits,
- the location of the nearest off-site workers, and
- the location of the nearest downwind residents. In the event that the estimated risks to this receptor are considered unacceptable, a more detailed demographic survey may be required.

5.1.6 Field Sampling Plan

The field work in Phase I, Stage I, investigations of SWMU Aggregate 0-A will be completed in three field tasks: field surveys, surface sampling, and subsurface sampling, which are described in the following subsections. All field work will be performed in accordance with applicable Environmental Restoration (ER) Program standard operating procedures (SOPs).

5.1.6.1 Task 1—Field Surveys

The following field surveys will be performed: site survey and geomorphologic mapping.

5.1.6.1.1 Activity 1—Site Survey

A site survey will be conducted to determine the locations and boundaries of the decommissioned container storage area and the locations of any outfall points that lie within the domain along the rim of Los Alamos Canyon and that have been associated with the filtration tank or the storage area. The locations will be determined by examining historic aerial photographs; by reviewing records, including maps and engineering plans; and by conducting visual inspections.

5.1.6.1.2 Activity 2—Geomorphologic Mapping

First-order stream channels that originate on or transect the decommissioned container storage area or that carry discharges from the drain at the base of the building will be mapped to determine sites for sampling channel sediments. This activity will locate channel sediment traps as near as possible to outfall points on a map with a scale of 1:2000.

5.1.6.2 Task 2—Surface Sampling

Surface sampling in Task 2 will consist of sampling channel sediments from catchments beneath the drain outfall point(s).

5.1.6.2.1 Activity 1—Sampling Channel Sediments at Outfall Points

Sediment samples (two to four per outfall) will be collected from sediment catchments in first- or higher-order drainage channels that have developed downslope of the filtration tank drain outfall and from the drainage points in the pavement below the container storage area. A total of eight to ten channel sediment samples (including one field duplicate) will be screened and analyzed, depending on the number of drainage points located in the pavement (Figure 5-4). Samples will be collected using the procedures described in LANL-ER-SOP-06.14, Sediment Material Collection.

5.1.6.3 Task 3—Subsurface Sampling

Subsurface sampling will consist of sampling material from the filtration tank and coring and sampling at the container storage area.

5.1.6.3.1 Activity 1—Sampling at the Filtration Tank

Sampling the material within the filtration tank will occur through the access provided by the manhole cover. Two samples will be taken of the material at the bottom of the tank and will be screened and analyzed as indicated in Figure 5-4. If any liquids are present in the tank, a liquid sample will also be collected, screened, and analyzed. Samples will be collected using the procedures described in LANL-ER-SOP-06.10, Hand Auger and Thin-Wall Tube Sampler, and LANL-ER-SOP-06.19, Weighted Bottle Sampler for Liquids and Slurries in Tanks.

5.1.6.3.2 Activity 2—Coring at the Container Storage Area

Cores will be drilled at the decommissioned container storage area at a minimum of two locations, following the procedures described in LANL-ER-SOP-04.01, Drilling Methods and Drill Site Management (Figure 5-4). The cores will be biased toward the area in which the drums were stacked. The cores will be continuously field-screened for organic vapor and will be examined for staining or other evidence of contamination. A maximum of three samples will be collected from each core. One sample will be collected from the uppermost 6 in. directly beneath the pavement. A second sample will be taken from the core interval with the highest organic screen reading or with visible staining or contamination, if any. The core will penetrate to a point 3 ft below the last positive field screen response or to a depth of at least 3 ft, and a sample will be collected from the bottom of the hole. All samples will be analyzed as indicated in Figure 5-4. Up to two more holes, similarly sampled, may be drilled if there are any positive field indications, and one field duplicate will be included in the sample.

5.2 SWMU Group 0-1 (6th Street Warehouse Area)

SWMU Group 0-1 is located in the 6th Street (Zia) Warehouse area and consists of SWMU Aggregates 0-B and 0-C (Figure 3-2). SWMU Aggregate 0-B includes SWMU 0-004, container storage area; SWMUs 0-030(b, l, and m), septic systems; and a portion of SWMU 0-033, potential soil contamination beneath former Zia warehouses. SWMU Aggregate 0-C consists of SWMUs 0-010(b), "landfill," and a portion of 0-033, an underground storage tank (UST). All of the SWMUs in Group 0-1 are located on DOE property, with the exception of SWMU 0-030(b), which is partially located on private property.

5.2.1 Description and History

5.2.1.1 SWMU Aggregate 0-B

The 6th Street Warehouse, also known as Zia Warehouses 3 and 4, is located south of the intersection of DP Road and Trinity Drive (Figure 5-5). A container storage area (SWMU 0-004) located inside the 6th Street Warehouse is used to store chemicals. Releases of chemicals are expected to be minimal because the chemicals are stored indoors and the containers are regularly inspected (LANL 1989, 0444). Any spillage that occurred in the past in the sloped asphalt parking lot would have drained to an unlined storm water drainage ditch, whose outfall discharged into Los Alamos Canyon (LANL 1990, 0145).

SWMU 0-030(b), also known as Septic System #1, is located east of the Zia warehouses (US Engineer Office 1946, 05-0122; The Zia Company 1947, 05-0132). The septic system comprised four tanks that served Zia Warehouses 1, 2, 5, 6, 7, and 8; an office building; and the cold storage plant (US Engineer Office 1946, 05-0122). An engineering drawing prepared in 1943 indicates that the septic system also served eastern TA-1 (US Engineer Office 1943, 05-0121). The septic line system consisted of a main 8-in.-diameter drainline that received sanitary waste from the buildings and warehouses through 6-in.-diameter lines. The drainlines were probably constructed of vitrified clay pipe (VCP). The 8-in.-diameter main line discharged to the septic tanks. These septic tanks discharged to a leach field located east of the Zia warehouses, as well as directly to an outfall to Los Alamos Canyon (US Engineer Office 1943, 05-0121).

Zia Warehouses 3 and 4 were served by a 6-in.-diameter line connected to a 1,000-gal. septic tank [SWMU 0-030(l)] that discharged through an outfall into Los Alamos Canyon (US Engineer Office 1946, 05-0122).

SWMU 0-030 (m) consists of a septic tank south of Warehouses 3 and 4. Sometimes called the "grease trap," it served an incinerator building in which garbage collected from private residences was burned (US Engineer Office 1946, 05-0122). The outfall line ran east along the canyon rim some 500 ft, where it connected with the outfall line from SWMU 0-030(b) before discharging into Los Alamos Canyon (Figure 5-5).

Structures and operations associated with the Zia warehouses may have contaminated the soil in SWMU 0-033. The Zia warehouses consisted of the following structures: Warehouses 1 through 4, the cold storage plant, and the Materials Testing Laboratory (US Engineer Office 1946, 05-0122). The Zia warehouses contained a sheet metal shop, electric line shop, and various utility shops. Structures

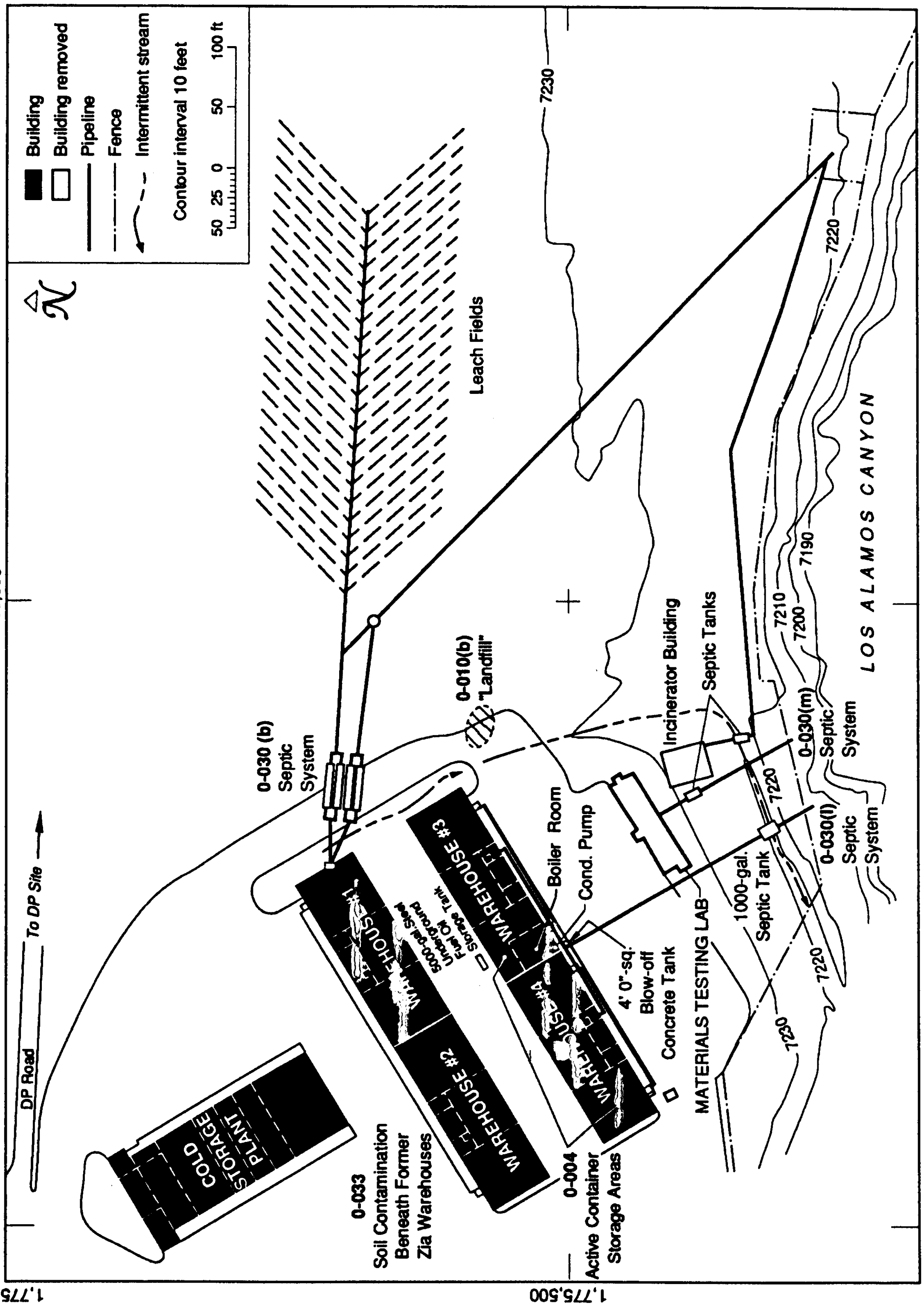


Figure 5-5. SWMU Group 0-1 (6th Street Warehouse Area).

of potential environmental concern include storm sewers, floor drains, a fuel oil UST, and a blow-off tank. Specific wastes generated by routine operations in the warehouses are unknown (LANL 1990, 0145).

A Materials Testing Laboratory was constructed south of Warehouses 3 and 4 in 1948 (LANL 1990, 0145). Operations at the Materials Testing Laboratory involved solvents, asphalt leaching, destructive testing of concrete cylinders, and sieve tests of aggregates for road work. The Materials Testing Laboratory had three floor drains, which discharged to an outfall in Los Alamos Canyon.
In 1961, Warehouses 3 and 4 were leased for commercial use by Sears, Metzgers, Los Alamos Transfer, Creamland Dairies, and other private businesses (The Zia Company 1961, 05-0143). The Laboratory's archives are currently located in Warehouses 1 and 2. EG&G storage and Johnson Controls' welding training center are located in Warehouses 3 and 4.

On March 15, 1984, an unknown quantity of methyl ethyl ketone peroxide (MEKP) spilled in one of the warehouses near some 55-gal. drums of Hetron (composition unknown), posing a high-explosive (HE) risk. The MEKP and Hetron drums were removed from the warehouse, and the fire department hosed off the floor of the warehouse, the pallet, and the parking lot. Laborers removed the water from the floor of the warehouse with squeegees (LANL 1984, 05-0054).

Another incident in the warehouses involved solvents that had crystallized. The crystallized solvent containers were "taken to the parking lot and washed down with water." The resulting effluent was discharged directly to the storm drains (LANL 1990, 0145).

Storm drains leading to outfalls in Los Alamos Canyon were constructed around the two buildings that compose Warehouses 1 and 2 and Warehouses 3 and 4 (LANL 1990, 0145). Faulty joints and/or cracks in the storm sewer and floor drain network of pipes may have allowed leakage that contaminated the soil. The types and quantities of contaminants that flowed through the drainlines are unknown.

A boiler room was located in Warehouses 3 and 4. A 4-ft^3 concrete blow-off tank released pressure from the boiler into the sewer (US Engineer Office 1946, 05-0122). The blow-off tank was located at the east end of the warehouse and discharged to the sewer system, which was served by a 1,000-gal. concrete septic tank [SWMU 0-030(l)]. Chemicals used to descale boilers may have been released to the sewer through the blow-off tank. No information exists as to the nature of these chemicals.

5.2.1.2 SWMU Aggregate 0-C

SWMU 0-010(b), an excavation to the east of the Zia warehouses has been observed on aerial photographs taken in 1946. There is no information as to the purpose of the excavation or its use; however, it has been designated as a SWMU because it may have been used as a disposal site for contaminated wastes. A 5,000-gal. steel UST containing fuel oil supplied the oil burner in the boiler room. The tank, which was located on the north side of Warehouses 3 and 4 (US Engineer Office 1946, 05-0122), may have released fuel oil to the soil (LANL 1990, 0145). No information on environmental surveys and/or decontaminating and decommissioning activities for SWMU 0-033 is available.

5.2.2 Nature and Extent of Contamination

5.2.2.1 Description and Contamination Levels

The indoor container storage area at the 6th Street Warehouse (SWMU 0-004) was used primarily to store solvents; however, liquid and solid waste, volatiles, and semivolatiles may also have been stored at this location. Liquids known to have been stored were methylene chloride, toluene, acetone, xylenes, 4-chlorobenzaldehyde, MEKP, Hetron, and solvents, volatiles, and semivolatiles. Other chemicals stored at this site by The Zia Company include asphalt, lubricants, pesticides, herbicides, and solvents. Solid waste may include filter papers and wipes contaminated with silica gel, Lauric (composition unknown), carbon, Norit (composition unknown), sodium sulfate, and trans-1,2-dibenzoylethylene. Two known releases were a release of MEKP and a release of unspecified crystallized solvents, which were washed into the storm drains.

Available information indicates that the septic systems [SWMUs 0-030(b, l, and m)] handled only sanitary waste. SWMUs 0-030(b) and 0-030(l) were associated with Zia warehouse operations. SWMU 0-030(b) may have also served TA-1. SWMU 0-030(m) served as an incinerator in the early days. The exact chemical description of the contents of this system is unknown. There is no documentation of any spills, releases, or environmental surveys.

Solid waste may have introduced contamination to the soil from SWMU 0-033. Possible sources of contamination are the storm sewers, floor drains, a fuel oil UST, and a blow-off tank; however, the potential contaminants themselves are unknown. It is possible that descaling chemicals were used in this operation. Soil contamination from the fuel oil tank is also possible.

The purpose of the trench/"landfill" [SWMU0-010(b)] just east of the 6th Street Warehouse is unknown.

5.2.2.2 Potential Migration Pathways

Contaminants originating from the area of the 6th Street Warehouse may have been released to the environment via leaks and/or discharges associated with the container storage area, septic systems, or underground fuel tank. Contaminants may have also leached/dispersed or volatilized from the trench [SWMU 0-010(b)], although there is no reason to believe that any hazardous material was placed there. As a result, contaminants may be present in soil, channel sediments, tuff, and/or air. Contaminants in soil and channel sediments may leach/disperse through the vadose zone, migrate upward via vapor phase diffusion, and enter the atmosphere; become entrained by surface water and transported downstream by run-off; or become entrained by air currents and transported off the site by wind. Contaminants in tuff may leach/disperse through the vadose zone.

5.2.2.3 Potential Public Health and Environmental Impacts

It may be concluded from the discussion of migration pathways (Subsection 5.2.2.2) that contaminants are present in or will migrate to soil or air. As a result, human exposure to contaminants from this SWMU aggregate may occur through inhalation of suspended particulates, incidental ingestion, or dermal contact with soil. Direct contact with soil on the mesatop would require significant disturbance of the surface soil and asphalt (e.g., digging or excavation). Additionally, terrestrial animals may be exposed to site contaminants associated with the septic systems via incidental ingestion or dermal contact with soil or inhalation of vapors or suspended particulates. Because the trench is beneath a large paved area and has no drainlines, it is not open or directly connected with the accessible environment; therefore, unless excavation or other disturbance occurs, no exposure is possible.

5.2.3 Conceptual Models

Figures 5-6 and 5-7 present the conceptual models for the most probable potential contaminant releases from the container storage area, septic systems, underground fuel tank, or trench/"landfill" and the most probable subsequent exposure by the receptors identified in Subsection 5.2.2.3. In Figures 5-6 and 5-7, "on-site residents" refers to a single residence located adjacent to the 6th Street Warehouses, "off-site residents" refers to residents located in the vicinity of the 6th Street Warehouses (who are probably the closest downwind receptors), "site visitors" refers to people who may occasionally walk the slopes of Los Alamos Canyon adjacent to the site, and "on-site workers" refers to employees of the businesses currently located at the 6th Street Warehouse. Terrestrial animals in the vicinity of the site, primarily in Los Alamos Canyon, may also be impacted.

5.2.4 Decisions, Domain, and Approach

The domain of this SWMU group includes the mesatop area bounded by Warehouses 1 and 2 on the north, by the drainages receiving outfall effluent on the west, and by the leach field and trench on the east. The SWMU group extends south down to the main channel in Los Alamos Canyon (Figure 5-8). Although the sites [except for parts of SWMU 0-030(b)] are located on property currently belonging to the DOE, long-term plans for the area anticipate its development for commercial use. The goal of the RCRA process at this site is to ensure that the property is suitable for unrestricted use. The underground fuel storage tank (SWMU 0-033) is no longer in use and will be removed. Other remedial action will be proposed as necessary to clean the site to meet health-risk-based media cleanup standards for residential use.

Because there is no evidence of residual contamination in the domain of the SWMU group, Phase I will consist of Stage I investigations to determine whether any source of contamination is present. The septic systems and UST will be investigated according to the procedures outlined in Subsection 2.3.4. Further decisions will be based on analytical data from samples of soil and tuff from the excavations below the septic and underground fuel tanks and from cores through the leach field of SWMU 0-030(b), the trench/"landfill" [SWMU 0-010(b)], and any other areas suggested by the results of a soil gas survey. Additional data will come from sediments collected along the channels on the south-facing slope below the outfalls and site drainage points.

Stage I data will be compared with action levels for soils, sediments, and tuff to determine whether contamination is present at any of these sites. In the absence of contamination, no further action will be proposed at SWMU Group 0-1. If levels above action levels are observed, Phase II investigations may be required to support a baseline risk assessment and CMS.

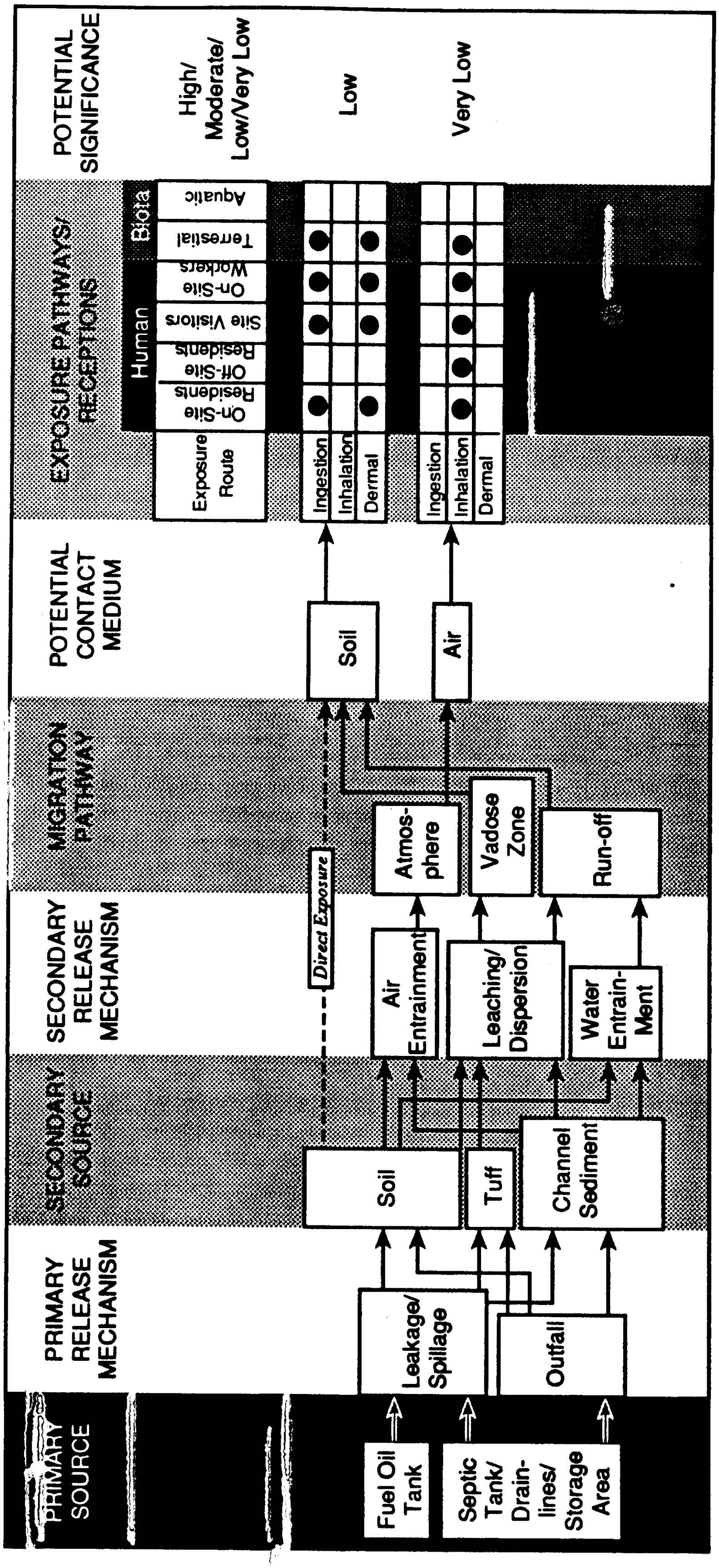


Figure 5-6. Conceptual model of SWMU Aggregate 0-B.

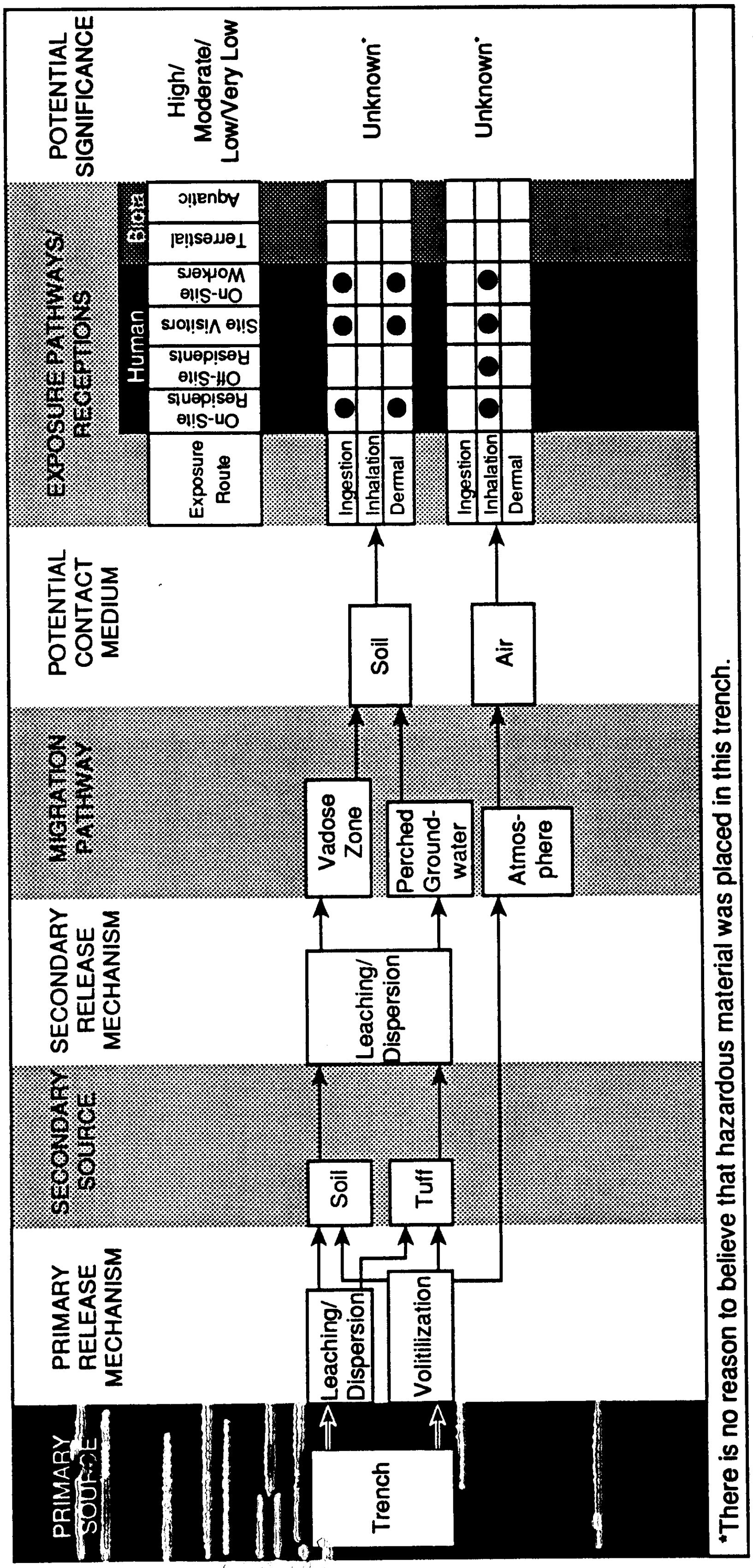


Figure 5-7. Conceptual model of SWMU Aggregate 0-C.

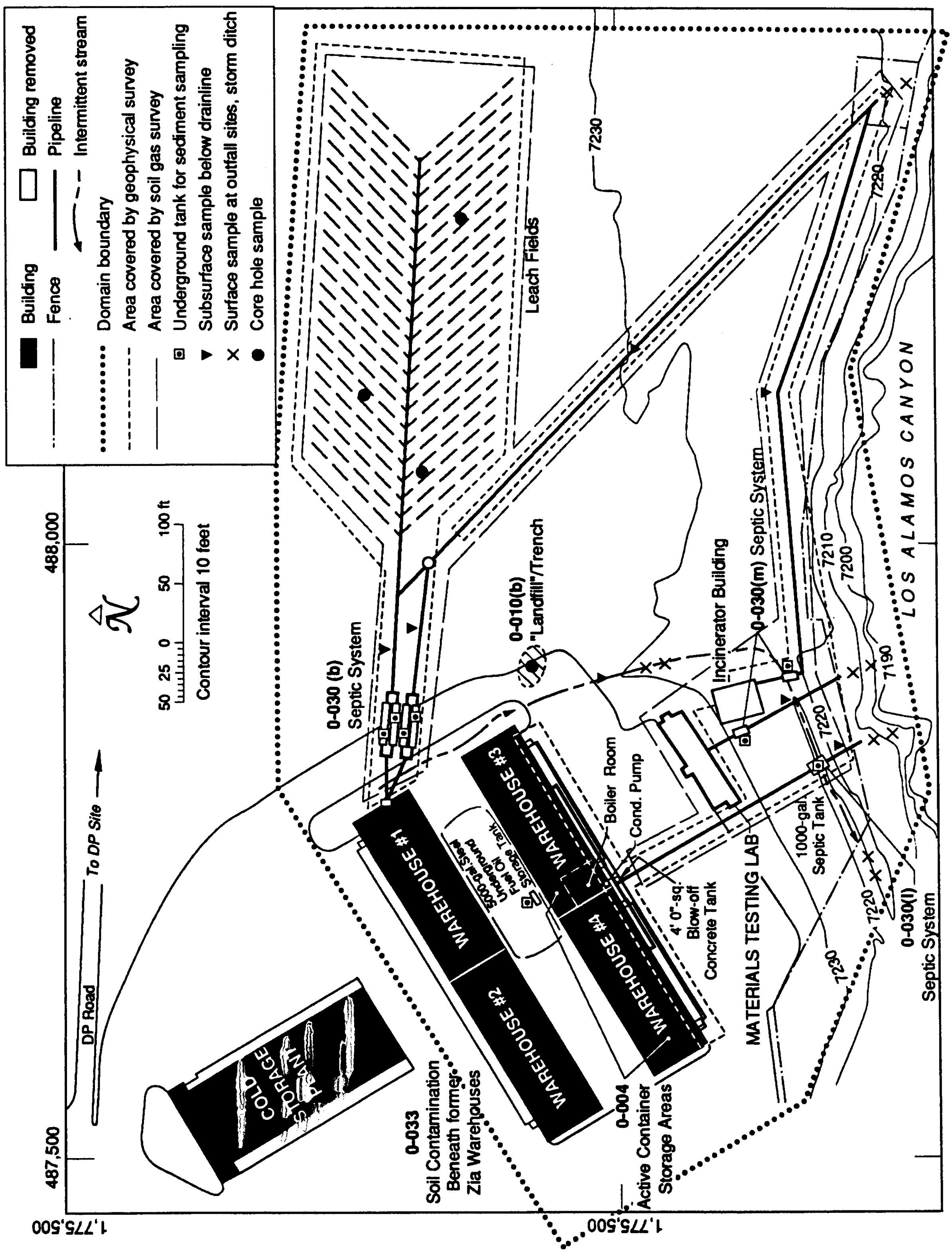


Figure 5-8. Sampling locations in SWMU Group 0-1 (6th Street Warehouse Area).

5.2.5 Data Required

5.2.5.1 Source Characterization

Specific data requirements for source characterization in Phase I investigations include

- determining as accurately as possible the locations, boundaries, and subsurface geometries of the septic system tanks and associated drainlines and leach field [SWMUs 0-030(b, l, and m)]; the underground fuel storage tank and storm drainlines (SWMU 0-033); and the trench [SWMU 0-010(b)], using field surveys and Level I data;
- determining the presence or absence of vapor phase contaminants in the soil on the mesatop, using a soil gas survey and Level II/III data; and
- using Levels III/IV data to determine the presence or absence of and, if present, the nature and concentrations of, any contaminants in potential release areas or source media, including
    - surface material from the storm ditch,
    - channel sediments in surface drainages originating at or transecting septic or storm drain outfall points, and
    - subsurface material from the UST area, the trench [SWMU 0-010(b)], the leach field, and beneath the septic tanks and drainlines.

Site and geophysical surveys will be used to help locate and define the boundaries of the trench, leach field, septic tanks, UST, and drainlines. A field survey for organic vapors will be used to determine whether organic contaminants in significant quantities exist at the site, and, if positive screen responses are obtained, the resulting data will guide selection of subsurface sampling locations. All surface and subsurface samples will be screened for organic vapor and gross alpha, beta, and gamma radiation to determine whether organic or radionuclide contamination is present. These Level III/IV data will be compared with action level concentrations, and, if contaminant concentrations are at or below action levels, no further field investigations will be conducted.

If the results of the laboratory analysis of Phase I samples indicate that contaminant concentrations are above action levels, the necessity for and scope of possible Phase II field sampling will be evaluated. Based on current knowledge of past activities at these SWMUs, it is not expected that contaminants will be encountered above action level concentrations; accordingly, no detailed Phase II sampling plans have been developed. However, should Phase II investigations be necessary, additional source characterization data may be collected to determine the lateral and vertical extent of contamination, to perform a baseline risk assessment, and, if necessary, to provide a data base for designing and implementing corrective measures.

5.2.5.2 Environmental Setting

Data required to adequately characterize the environmental setting of SWMU Group 0-1 include a map of surface water drainages, including sediment catchment sites originating at or transecting the mesatop domain and outfall points on the rim of Los Alamos Canyon. The map will be used to select sampling sites for channel sediments.

If Phase II investigations are necessary, the information required may include detailed hydrogeologic and geologic characterization of subsurface soil and tuff. These data, if collected, will be used to perform transport modeling and analysis of risk associated with contaminant release and migration and to design and implement corrective measures.

5.2.5.3 Potential Receptors

No specific information regarding the activities, behavior, or location of actual receptors is necessary for the Phase I investigation. In the event that a Phase II investigation is necessary, the following information regarding the potential receptors identified in the conceptual model (Subsection 5.2.3) may be needed:

- the frequency and duration of site visits,
- the location of site residents and workers relative to source area(s), and
- the location of the nearest downwind resident. In the event that the estimated risks to this receptor are considered unacceptable, a more detailed demographic survey may be required.

5.2.6 Field Sampling Plan

The field work in Phase I, Stage I, investigations of SWMU Group 0-1 will be completed in three field tasks: field surveys, surface sampling, and subsurface sampling, which are described in the following subsections. All field work will be performed in accordance with applicable ER Program SOPs.

5.2.6.1 Task 1—Field Surveys

Four field surveys will be performed in Task 1: (1) site survey, (2) geophysical surveys, (3) geomorphologic mapping, and (4) soil gas survey.

5.2.6.1.1 Activity 1—Site Survey

A site survey will be conducted to determine the location of buried structures (septic tanks, fuel tank, drainlines, trench, and leach field), the outfall points, and the storm ditch. The locations will be determined by examining historic aerial photographs, by reviewing records, including maps and engineering plans, and by performing a visual inspection of the site.

5.2.6.1.2 Activity 2—Geophysical Surveys

If the site survey does not provide sufficiently detailed information on the location of buried structures, geophysical surveys will be conducted to more precisely locate and define the boundaries and subsurface geometries of any structure inadequately located during the site survey. A magnetic survey will be performed with appropriate spacing to ensure full resolution of large metallic objects and metallic components in the tanks, lines, and leach fields. An electromagnetic conductivity (EMC) survey will be conducted to further define buried features. If necessary, ground-penetrating radar may be used to supplement the magnetic and EMC surveys. Once located, the sites will be marked in the field.

5.2.6.1.3 Activity 3—Geomorphologic Mapping

First-order stream channels within the domain of SWMU Group 0-1 and originating at or transecting the outfall points will be located and mapped to determine sites for sampling channel sediments. This activity will include all sediment catchment sites in the relevant drainages. Mapping will be completed on a scale of 1:2000.

5.2.6.1.4 Activity 4—Soil Gas Survey

A soil gas survey will be conducted over the tanks, drainlines, and leach field of SWMU Group 0-1 (Figure 5-8) to determine whether gross soil contamination is present. A coarse grid with approximately 60-ft spacing will be used over most of this area, and a finer grid of approximately 20 ft will be used near the leach field for the drainlines associated with Warehouses 3 and 4 and for the Materials Testing Laboratory. At the trench in SWMU 0-010(b), the samples will be collected on a tight grid of a size to be determined by the actual geometry of the site as defined by the geophysical surveys. Additional soil gas samples will be taken at any locations for which visual evidence (soil staining, odors, etc.) suggests that contamination exists. The soil gas samples will be taken at a depth of 6 ft, using a stainless steel sample tube driven into the land surface. Drilling may be used to penetrate asphalt or concrete surfaces. Analytes will include benzene, toluene, xylene, trichloroethylene, 1,1-dichloroethene, vinyl chloride, freon-113, and dichlorobenzene because these compounds may have been used in the Materials Testing Laboratory.

5.2.6.2 Task 2—Surface Sampling

Task 2 will consist of sampling sediment catchments beneath outfall points and sampling surficial materials in the storm ditch.

5.2.6.2.1 Activity 1—Sampling Channel Sediments

Channel sediments will be collected from first-order drainages that originate at or transect the four outfall points associated with SWMUs 0-030(b) and 0-030(l) and from the storm ditch of SWMU 0-030. Two or three sediment samples will be taken from each of the three drainages below the septic system outfalls as close to the outfall points as possible. Five samples, including one field duplicate, will be collected from the outfall of the storm drain. If no distinct channels are discernible adjacent to the outfall points, two samples will be collected from likely sediment catchment areas adjacent to the outfall points, for a total of seven samples. A total of 11 samples (including one field duplicate) will be screened and analyzed (Figure 5-9). Samples will be collected using the procedures described in LANL-ER-SOP-06.14, Sediment Material Collection.

5.2.6.2.2 Activity 2—Sampling Storm Ditches

Three samples of surficial material will be collected from the storm ditch (SWMU 0-030). Together with the samples from the storm drain outfall, they will provide seven samples plus a field duplicate to represent the general surface drainage. The samples will be collected from likely sediment catchments and will be screened and analyzed (Figure 5-9). Samples will be collected using the procedures described in LANL-ER-SOP-06.14, Sediment Material Collection.

5.2.6.3 Task 3—Subsurface Sampling

Subsurface sampling will consist of three activities: (1) sampling septic tank system areas (including drainlines), (2) coring and sampling at the trench, leach field, and at sites for which anomalous soil gas concentrations have been obtained, and (3) assessing the UST area.

5.2.6.3.1 Activity 1—Sampling Septic Tank System Areas

The three septic tank areas will be sampled following the procedure outlined in Subsection 2.3.4.1. The samples will be screened for organic vapors and radioactivity and will be analyzed as indicated in Figure 5-9.

5.2.6.3.2 Activity 2—Coring

A minimum of five cores will be drilled: two cores at the trench, three cores in the leach field, and up to three cores at sites, if any, at which anomalously high levels of soil gas are obtained. Drilling will follow the procedures described in LANL-ER-SOP-04.01, Drilling Methods and Drill Site Management.

One of the trench cores will be drilled into the deepest part of the trench as defined by the geophysical surveys. The other may be sited based on the results of geophysical or soil gas surveys. Each core will penetrate the fill material to the fill/tuff interface and will be continuously screened for organic vapor and gross alpha, beta, and gamma radiation. Three to five samples will be collected from each core hole. Two to four samples of fill material will be collected from locations in which field screening indicates the presence of organic vapors or radionuclides, if any; otherwise, two samples will be collected at three approximately regularly spaced intervals. One additional sample will be collected in the uppermost tuff interval and screened. If field screening indicates the presence of organic vapors or radionuclides, coring will continue with field screening of samples at 3-ft intervals. At a point 3 ft below the last positive field screen response, a second, confirmatory sample will be collected. If field screening the first tuff sample does not indicate contamination,

Sample Location	No. of Samples	Sample Description	Field Surveys				Field Screening (Level I)				Laboratory Analysis (Level III/IV) Number of samples analyzed depends on results of field screening and/or field survey. * =50%, + =30%														
			Site Survey/Mapping	Geophysical Survey (Level I)	Soil Gas Survey (Level II/III)	Gross Alpha, Beta, Gamma (Level I)	Lithologic Logging	Combustible Gas/Oxygen	Organic Vapor	Gross Alpha, Beta, Gamma	Gamma Spectrometry	^{3}H	Total U (^{234}U, ^{236}U)	^{238}Pu, $^{239/240}Pu$	^{90}Sr	^{137}Cs	^{241}Am	^{60}Co	Volatile Organics (VOA) (SW 8240)	BTEX (SW 8020)	Semivolatile Organics (BNA) (SW 8270)	TPH(418.1)	Target Analyte List Metals	TCLP Metals	PCBs and Pesticides (SW 8080)
0-030(b,l,m), 0-033	11	Channel sediments below outfalls	•						•	•	•										•		•		•
0-033	3	Surface material in storm ditch	•		•				•	•	•										•		•		•
0-030(b)	4	Septic tank sludge	•	•				•	•	•	•										•		•		•
0-030(b)	8	Subsurface material beneath tanks	•				•	•	•	•	*								*		*		*		*
0-030(b)	6	Subsurface material beneath drainlines	•	•			•	•	•	•	*								*		*		*		*
0-030(l)	1	Septic tank sludge	•	•				•	•	•	•										•		•		•
0-030(l)	2	Subsurface material beneath tanks	•				•	•	•	•	•								•		•		•		•
0-030(l)	2	Subsurface material beneath drainlines	•	•			•	•	•	•	•								•		•		•		•
0-030(m)	2	Tank sludge	•	•				•	•	•	•										•		•		•
0-030(m)	4	Subsurface material beneath tanks	•				•	•	•	•	*								*		*		*		*
0-030(m)	4	Subsurface material beneath drainlines	•	•			•	•	•	•	*								*		*		*		*
0-033	~8	Subsurface material beneath UST	•	•				•	•											•			•		

Figure 5-9. Screening and analysis for initial investigations at SWMU Group 0-1.

Sample Location	No. of Samples	Sample Description	Field Surveys				Field Screening (Level I)				Laboratory Analysis (Level III/IV)														
											Number of samples analyzed depends on results of field screening and/or field survey. * =50%, + =30%														
			Site Survey/Mapping	Geophysical Survey (Level I)	Soil Gas Survey (LevelI/III)	Gross Alpha, Beta, Gamma (Level I)	Lithologic Logging	Combustible Gas/Oxygen	Organic Vapor	Gross Alpha, Beta, Gamma	Gamma Spectrometry	^{3}H	Total U (^{234}U, ^{236}U)	^{238}Pu, $^{239/240}Pu$	^{90}Sr	^{137}Cs	^{241}Am	^{60}Co	Volatile Organics (VOA) (SW 8240)	BTEX (SW 8020)	Semivolatile Organics (BNA) (SW 8270)	TPH(418.1)	Target Analyte List Metals	TCLP Metals	PCB and Pesticides (SW 8080)
0-010(b)	7-11	Core samples from trench/"landfill"	●	●	●		●	●	●	●	●								●		●		●		●
0-030(b)	10-20	Core samples from leach field	●	●	●		●	●	●	●	*								*		*		*		*
0-033	0-20	Core samples from areas (if any) of anomalous soil gas			●		●	●	●	●	*								*		*		*		*

Figure 5-9. Screening and analysis for initial investigations at SWMU Group 0-1 (concluded).

coring will terminate. All samples (with at least one field duplicate) will be submitted for laboratory analysis (Figure 5-9).

Three cores will be drilled in the leach field at the approximate locations indicated in Figure 5-8, one of which is near the inlet from the septic tanks. The cores will penetrate to the natural tuff boundary and will be continuously screened for organic vapors and gross alpha, beta, and gamma radiation. Two samples will be collected preferentially from the fill material at intervals for which field screening indicates the presence of contaminants, if any. One field duplicate of fill material will also be included. A third core sample will be collected at the base of the leach field. If field screening does not indicate contamination at this point, drilling will terminate. If field screening indicates the presence of organic vapors or radionuclides, coring will continue with field screening of samples taken at 3-ft intervals. At a point 3 ft below the last positive field screen response, a final sample will be taken. All samples with positive field screening results and 50% of those with negative results will be submitted for laboratory analysis (Figure 5-9).

In addition, up to three cores may be drilled at sites, if any, at which the soil gas survey indicates the presence of volatile contaminants. Drilling, screening, and sampling methods will proceed as for coring in the leach field.

5.2.6.3.3 Activity 3—Assessing the UST Area

Assessment of the UST area will proceed as described in Subsection 2.3.4.2. All activities will be conducted in accordance with New Mexico regulations, USTR-VIII and USTR-XII (New Mexico Environmental Improvement Board 1990, 0644), and guidelines on UST closure or UST assessment [based on the status of the tank as determined by the New Mexico Environment Department (NMED)]. Applicable regulatory requirements concerning notification of closure and/or release will be followed.

Samples from the UST area will be submitted for laboratory analyses (Figure 5-9). The closure of the fuel tank will then proceed following state regulations. If the extent of soil contamination is not adequately defined based on the analytical results, additional investigation (Stage II) may be required to comply with state UST regulations.

5.3 SWMU Aggregate 0-D (Mortar Impact Areas)

SWMU Aggregate 0-D includes SWMUs 0-011(a, c, d, and e) and Area of Concern (AOC) C-0-020, Ordnance Impact Areas (Figure 3-5). The SWMUs in Aggregate 0-D are located on property managed by the following organizations: SWMUs 0-011(a and c), General Services Administration; SWMUs 0-011(b and e) and AOC C-0-020, US Forest Service; and SWMU 0-011(d), Los Alamos County.

5.3.1 Description and History

This SWMU aggregate comprises four known mortar impact areas and one possible impact area (AOC) located in Rendija and Bayo canyons (Figure 5-10). SWMU 0-011(a) is a fenced and marked area located east of the Sportsmen's Club firing range. A second fenced area [SWMU 0-011(b)], north of the Sportsmen's Club, is labeled "37 mm Canyon" on a 1962 range clearance map (LASL 1962, 05-0080) and, therefore, is the same site as SWMU 0-011(e) referred to in the SWMU report (LANL 1990, 0145). The SWMU report lists SWMU 0-011(e) as 37 mm Canyon but states that its location is unknown. Because these two SWMUs are the same, the designation "SWMU 0-011(b)" has been dropped.

The fenced area is smaller than the area shown on the range clearance map, so the exact boundary of the impact area is ambiguous. Laboratory protective force personnel operating tanks with 37-mm guns and/or soldiers on military reserve may have used this canyon for training (IT Corporation 1991, 05-0148; 05-0149). SWMU 0-011(c), marked by three nearly illegible signs, is in Cabra Canyon, a tributary of Rendija Canyon. The Barranca Mesa area [SWMU 0-011(d)], which is well fenced and marked, is in Bayo Canyon just northeast of the intersection of San Ildefonso Road and Diamond Drive. The army fired various types of ordnance into these areas between 1944 and 1948 (DOE 1987, 0264; DOE 1987, 05-0035; LANL 1990, 0145).

A fifth possible mortar impact area is designated as AOC C-0-020. This area is in a tributary of Rendija Canyon west of the Guaje Pines Cemetery and the inactive firing range (SWMU 0-016). According to IT Corporation (1991, 05-0149), the army fired mortars from Barranca Mesa into this impact area. The possible impact area was marked by a nearly illegible, bilingual sign (removed in June 1991), and a "US Property—No Trespassing" sign has been posted on a tree on the south side of the canyon. According to IT Corporation (1991, 05-0149), bilingual signs were used only for a short period in the early 1940s. In the summer of 1991, an ordnance team from Fort Bliss inspected this AOC and concluded that it is not a former impact area. However, the arrangement of signs in the AOC and the canyon geometry are similar to those of SWMUs 0-011(c) and 0-011(d), which raises questions about the validity of the ordnance team's conclusion. Because the information on this site is ambiguous, it has been designated an AOC.

A fatal accident involving a "dud" bazooka shell in the early 1960s (Williams 1964, 05-0129) prompted a semiannual sweep of known impact areas to pick up ordnance exposed by the weather. A 1965 resurvey of these impact areas resulted in the removal of two tail assembly shrouds from the Barranca Mesa area and a piece of shrapnel from an exploded 60-mm mortar at the Rendija Canyon area (McAndrew 1965, 05-0087). It is not known when these surveys were discontinued. The Department of Defense periodically conducts ordnance sweeps at some of the impact areas (DOE 1987, 0264).

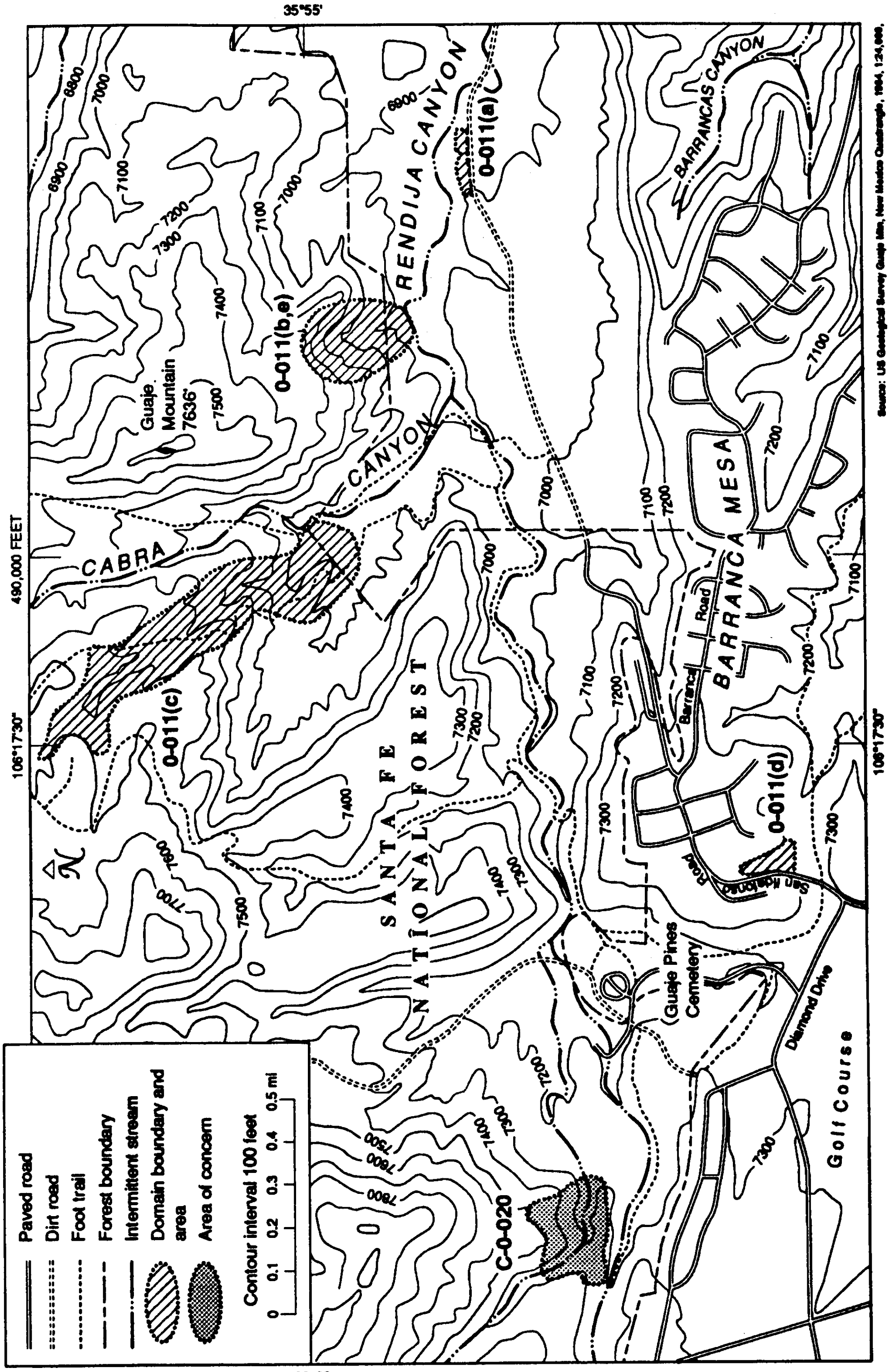


Figure 5-10. SWMU Aggregate 0-D (Mortar Impact Areas).

5.3.2 Nature and Extent of Contamination

5.3.2.1 Description and Contamination Levels

This SWMU aggregate consists of four SWMUs and one AOC that may contain unexploded ordnance and chemicals used in the ordnance fired into these areas. Weapons that might have fired into these areas include 2.36-in. bazookas, 60-mm and 81-mm mortars, and 37-mm tank rounds. Because these were standard weapons systems that were being tested, there is no reason to suspect the presence of radioactive materials. Wells G-1 and G-2, beyond the confluence of Rendija and Guaje canyons, show no contamination associated with HE (Environmental Protection Group 1990, 0497, p. 206); Purtymun et al. 1988, 0213, p. 4). These analyses included nitrates, 140 organic compounds, cyanides, and a base neutral acid fraction.

5.3.2.2 Potential Migration Pathways

Contaminants associated with mortar shells and other ordnance may have been released to the environment from the mortar impact areas via infiltration and/or entrainment by water. As a result, contaminants may be present in the soil, which can leach/disperse through the vadose zone or become entrained by surface water and transported downstream by run-off. Unexploded ordnance may still be present at the sites and may eventually be uncovered by erosion.

5.3.2.3 Potential Public Health and Environmental Impacts

Based on the migration pathways discussed in Subsection 5.3.2.2, it is possible that contaminants are currently present in or will migrate to soil or air. As a result, human exposure to contaminants from this SWMU aggregate may occur through incidental ingestion or dermal contact with soil. Unexploded ordnance that may be still present at the site may pose an explosion hazard. Additionally, terrestrial animals may be exposed to site contaminants via incidental ingestion or dermal contact with soil.

5.3.3 Conceptual Models

Figure 5-11 presents the conceptual model for potential contaminant releases from the mortar impact areas and subsequent exposure by the receptors identified in Subsection 5.3.2.3. In Figure 5-11, "site visitors" refers to people who may occasionally walk through one or more of the impact areas. Terrestrial animals in the vicinity of the mortar impact areas may also be impacted.

5.3.4 Decisions, Domain, and Approach

Phase I activities at the sites in SWMU Aggregate 0-D include voluntary corrective action. Each area will be surveyed to detect unexploded ordnance down to 37-mm shells, and such shells, as well as any other metallic artifacts detected, will be removed.

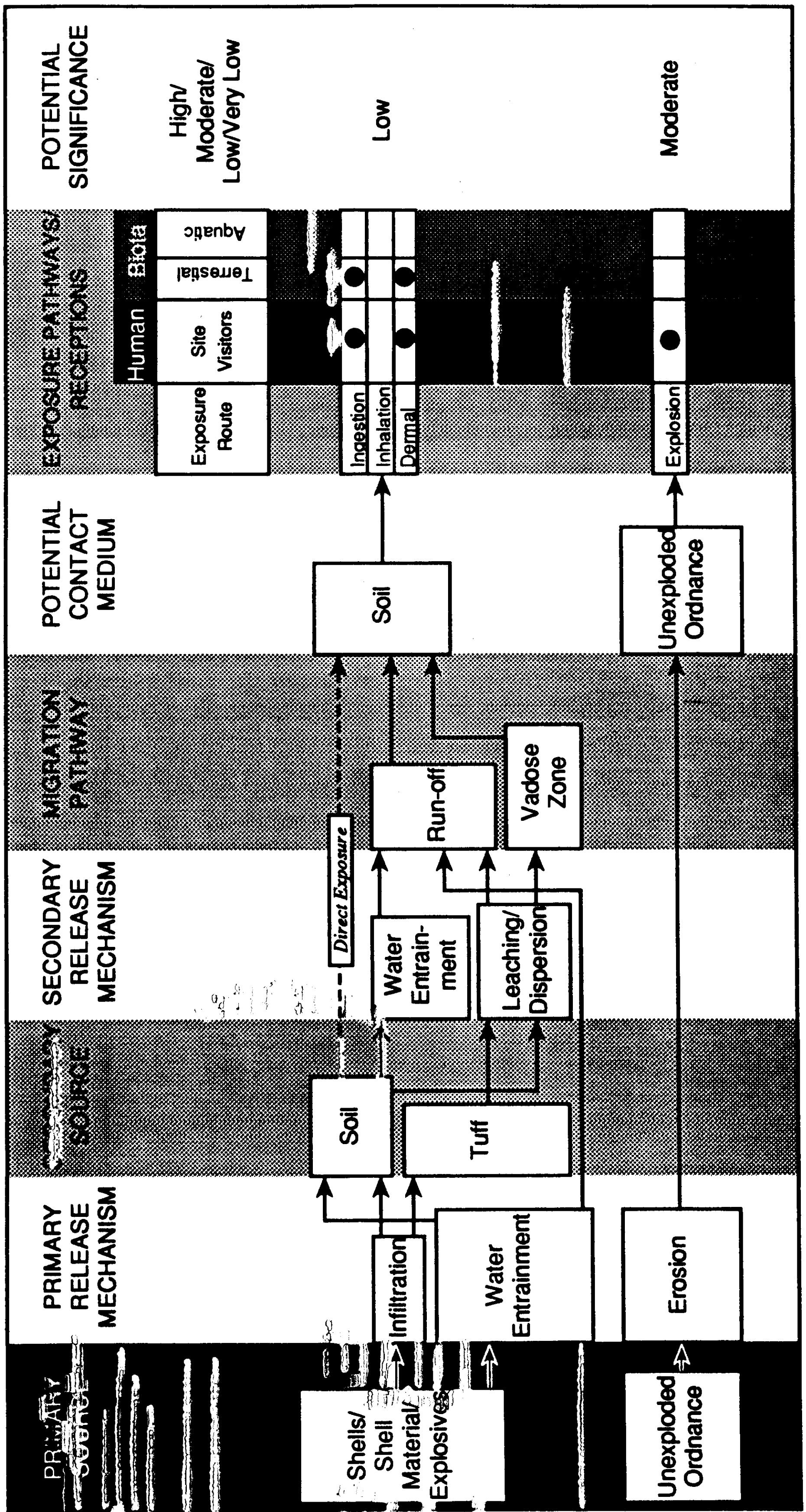


Figure 5-11. Conceptual model of SWMU Aggregate 0-D.

Further decisions will be based on Stage I investigation of residual contamination in surface soil and sediments from the drainage channels. Stage I data will be compared with action levels for soils and sediments to determine whether secondary sources of contamination remain at any of these sites. In the absence of such contamination, no further action will be proposed for SWMU Aggregate 0-D. If concentrations above action levels are observed, Phase II, Stage II, investigations of the extent of contamination may be required to support a baseline risk assessment and CMS.

5.3.5 Data Required

5.3.5.1 Source Characterization

Specific data requirements for source characterization in Phase I include

- determining as accurately as possible, using field surveys and Level I data, the boundaries of the unfenced mortar impact areas [SWMUs 0-011(b and c) and AOC C-0-020], as defined by topographic drainage boundaries, posted signs, and other available site information;
- determining the presence and distribution of shells, shell material, unexploded ordnance, and other metallic objects in each mortar impact area, using field surveys and Level I data;
- using Level III/IV data to determine the presence or absence of and, if present, the nature and concentrations of, any contaminants in potential release areas or source media, including surface soils and channel sediments in surface drainages originating on or transecting the mortar impact areas.

A site survey will be used to help locate and define the boundaries of the mortar impact areas, and a geophysical survey will be used to determine the distribution of ordnance and related material. This information will provide the data base to implement the voluntary corrective action. Laboratory analyses will be obtained for soil and channel sediment samples (Subsection 5.3.6). These Level III/IV data will be compared with background concentrations, and, if contaminant concentrations are at or below background levels, no further field investigations will be conducted.

If the laboratory results of Phase I sampling indicate that contaminant concentrations are above background levels, the necessity for, and possible scope of, Phase II field sampling will be evaluated. Based on current knowledge of past activities at these SWMU sites, it is not expected that contaminants will be encountered above action level concentrations; accordingly, no detailed Phase II sampling plans have been developed. However, should Phase II investigations be necessary, additional source characterization data may be collected to determine the lateral and vertical extent of contamination, to perform a baseline risk assessment and, if necessary, to provide a data base for designing and implementing corrective measures.

5.3.5.2 Environmental Setting

Data required to characterize the environmental setting of SWMU Aggregate 0-D include a map of (1) first-order drainage channels, including sediment catchment sites, that originate on or transect SWMU 0-011(a) and (2) the largest sediment catchment sites in the main drainage channels that transect the domains of SWMUs 0-011(b, c, and d) and AOC C-0-020 and that are located nearest the downstream boundaries of the domain.

A map of surface water drainages and sediment catchment sites is required because mortar impacts may have distributed contaminants over the land surface, which may then have been dispersed by run-off. By sampling channel sediments in drainages that originate on or transect the mortar impact areas, it is expected that any contaminants released via this pathway will be detected.

If Phase II investigations are necessary, the information required may include detailed hydrogeologic and geologic characterization of surface water, channel sediments, and subsurface soil and tuff. These data, if collected, will be used to perform transport modeling, to analyze risk associated with contaminant release and migration, and to design and implement corrective measures.

5.3.5.3 Potential Receptors

Action levels will be used in the Phase I investigation as the initial basis for determining whether there is a potential for adverse human health effects associated with soil contamination in the mortar impact areas. These action levels were established assuming constant on-site exposure and making conservative assumptions of human behavior; thus, no specific information regarding the activities, behavior, or location of actual receptors is required for this initial assessment. In the event that measured contaminant concentrations exceed action levels, a site-specific baseline risk assessment may be conducted to support a decision for no further action at the site. Information that may be required regarding the potential receptors identified in the Subsection 5.3.3 includes the frequency and duration of site visits.

5.3.6 Field Sampling Plan

The field work in Phase I, Stage I, investigations of SWMU Aggregate 0-D will be completed in three tasks: field survey, ordnance search and removal, and surface sampling, which are described in the following subsections. All field work will be performed in accordance with applicable ER Program SOPs.

5.3.6.1 Task 1—Field Surveys

Two field surveys will be performed in Task 1: site survey and geomorphologic mapping of first-order drainage channels and sediment catchment sites.

5.3.6.1.1 Activity 1—Site Survey

A site survey will be conducted to precisely define the domain boundaries of SWMUs 0-011(b and c) and AOC C-0-020. A detailed field map will be completed on a scale of 1:2000 and will include drainage divides, locations of sign posts, and impact debris and metal fragments. Boundary locations will also be determined by examining historic aerial photographs, by reviewing records, including maps and engineering plans, and by performing a visual inspection.

5.3.6.1.2 Activity 2—Geomorphologic Mapping

First-order stream channels that originate on or transect SWMU 0-011(a) will be mapped, and sediment catchment sites immediately upstream from the main channel will be located. The largest sediment catchments in the main drainage channels closest to the downstream domain boundaries of SWMUs 0-011(b, c, and d) and AOC C-0-020 will also be sited on the map. Mapping will be completed on a scale of 1:2000.

5.3.6.2 Task 2—Ordnance Search and Removal

A domainwide search of SWMUs 0-011(a, b, c, and d) and AOC C-0-020 will be conducted using a metal detector and magnetometer to locate unexploded ordnance, shells, shell material, and other metal objects related to the impact of mortars (Figure 5-12). The search will be conducted on a grid system and will be adequately detailed to detect objects 1 in. in diameter and larger that have been buried at depths up to 3 ft. A Department of Defense or Laboratory team with ordnance expertise will work with the survey crew to remove objects as they are located.

5.3.6.3 Task 3—Surface Sampling

Task 3 will consist of sampling the surface and channel sediments.

5.3.6.3.1 Activity 1—Surface Sampling

Five to 14 samples of surficial material will be collected from the domains of all mortar impact areas (Figure 5-12). Sampling points may be selected from a regular grid or according to a spatially stratified randomization scheme (Subsection 2.2.3). A sample will be collected from the uppermost 6 in. of surface material at each sampling point, following the procedures described in LANL-ER-SOP-06.09, Spade and Scoop Method for Collection of Soil Samples. Samples will be screened and analyzed as indicated in Figure 5-13.

5.3.6.3.2 Activity 2—Channel Sediment Sampling

Samples of channel sediments will be collected from the main stream channels transecting SWMUs 0-011(b, c, and d) and AOC C-0-020. Samples will be collected from the two prominent sediment catchments located closest to the downstream boundaries of the domain (Figure 5-12). A total of eight samples will be collected

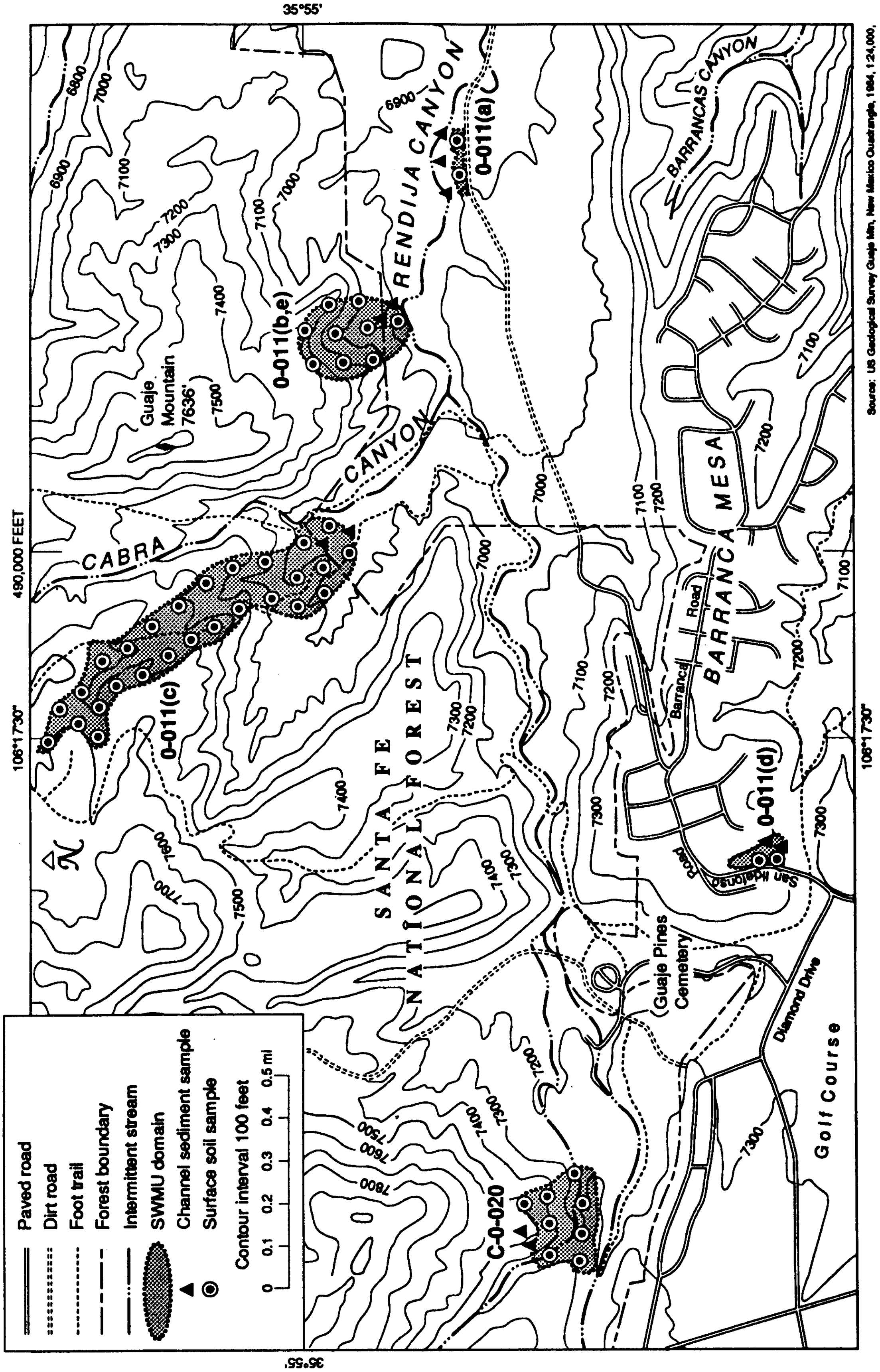


Figure 5-12. Sampling locations in SWMU Aggregate O-D (Mortar Impact Areas).

			Field Surveys				Field Screening (Level I)				Laboratory Analysis (Level III/IV)														
											Number of samples analyzed depends on results of field screening and/or field survey. * =50%, + =30%														
Sample Location	No. of Samples	Sample Description	Site Survey/Mapping	Geophysical Survey (Level I)	Soil Gas Survey (Level II/III)	Gross Alpha, Beta, Gamma (Level I)	Lithologic Logging	Combustible Gas/Oxygen	Organic Vapor	Photoionization Detection	Gamma Spectrometry	^{3}H	Total U (^{234}U, ^{236}U)	^{238}Pu, $^{239/240}Pu$	^{90}Sr	^{137}Cs	^{241}Am	^{60}Co	Volatile Organics (VOA) (SW 8240)	BTEX (SW 8020)	Semivolatile Organics (BNA) (SW 8270)	EPA High Explosives (USATHMA)*	Target Analyte List Metals	TCLP Metals	PCB and Pesticides (SW 8080)
0-011(a)	5	Surface materials	●							●												●	●		
0-011(a)	3	Channel sediments	●							●												●	●		
0-011(b)	10	Surface materials	●							●												●	●		
0-011(b)	2	Channel sediments	●							●												●	●		
0-011(c)	14	Surface materials	●							●												●	●		
0-011(c)	2	Channel sediments	●							●												●	●		
0-011(d)	5	Surface materials	●							●												●	●		
0-011(d)	2	Channel sediments	●							●												●	●		
AOC 0-011(f)	10	Surface materials	●							●												●	●		
AOC 0-011(f)	2	Channel sediments	●							●												●	●		

* USATHMA = U. S. Army Toxic and Hazardous Materials Agency

Figure 5-13. Screening and analysis for initial investigations at SWMU Aggregate 0-D.

from the uppermost 6 in. of sediment and will be screened and analyzed as indicated in Figure 5-13. Samples of channel sediments will also be collected from each of the three largest first-order drainages originating on or transecting SWMU 0-011(a). A maximum of three samples will be collected from the sediment catchments immediately upstream from the main channel. The samples will be collected from the uppermost 6 in. of sediment and will be screened and analyzed as indicated in Figure 5-13.

5.4 SWMU 0-016 (Inactive Firing Range)

SWMU 0-016 is an inactive firing range located on the Santa Fe National Forest (Figure 3-5).

5.4.1 Description and History

SWMU 0-016, an inactive firing range located west of the Guaje Pines Cemetery in Rendija Canyon, was used for small-arms target practice from the late 1940s until the 1960s (LANL 1990, 0145). The site, which occupies about 2 acres, consisted of several small buildings and two earthen ridges arranged in a semicircle to retain bullets. No information on environmental surveys or decontamination and decommissioning activities for SWMU 0-016 is available. A field survey conducted by the Comprehensive Environmental Assessment and Response Program (CEARP) noted the remains of concrete steps, pads, and earthen ridges in the inactive firing range (DOE 1987, 0264). The DOE is currently negotiating with the Forest Service to exchange the land on which SWMU 0-016 is located.

5.4.2 Nature and Extent of Contamination

5.4.2.1 Description and Contamination Levels

Lead bullets, shot, and casings have not been removed from the site (LANL 1990, 0145), and lead projectiles are embedded in the earthen berms. The extent of soil contamination is unknown. No releases have been documented at these sites.

5.4.2.2 Potential Migration Pathways

Contaminants associated with spent bullets, primarily lead, may have been released to the environment via infiltration, water entrainment and/or leaching/dispersion from the inactive firing range. As a result, contaminants that may be present in soil can leach/disperse through the vadose zone or be entrained by surface water and transported downstream by run-off. Unexploded cartridges may also be present at the site and may eventually be exposed by erosion.

5.4.2.3 Potential Public Health and Environmental Impacts

Based on the migration pathways discussed in Subsection 5.4.2.2, it is possible that contaminants are currently present in or will migrate to the soil. As a result, human exposure to contaminants from this SWMU aggregate may occur through incidental ingestion or dermal contact with soil. Unexploded cartridges present at the site would pose a potential explosion hazard should they be struck by a heavy object. Additionally, terrestrial animals may be exposed to site contaminants via incidental ingestion or dermal contact with soil.

5.4.3 Conceptual Models

Figure 5-14 presents the conceptual model for potential releases of contaminants from the inactive firing range and subsequent exposure of humans and terrestrial animals. In Figure 5-14, "future residents" refers to people who may live on the site some time in the future, and "site visitors" refers to people who walk through the site under current conditions. Terrestrial animals in the vicinity of the firing range may also be impacted.

5.4.4 Decisions, Domain, and Approach

This SWMU is bounded by berms and former firing lines (Figure 5-15). The site is expected to be transferred soon to Los Alamos County as part of a land swap with the Forest Service, after which it may be used for residential development. Therefore, the goal of the RCRA process is to ensure that the site is suitable for unrestricted future use. Remedial action will be proposed as necessary to clean the site to meet health-risk-based media cleanup standards for residential use.

Phase I at this site includes voluntary corrective action. Samples from the berms will be analyzed for contamination to determine whether the soil in the berms can be used for clean fills, and the berms will be removed. The area will also be surveyed for unexploded cartridges. Any cartridges found will be removed. Further site decisions will be based on a Stage II investigation of the site to determine the extent of lead contamination, if any, in surface soil. Further site decisions will be based on a Stage II investigation of the site to determine the level and distribution of residual soil contamination. The means of lead concentrations in samples taken from 5,000-ft^2 units (the size of residential lots) will be estimated by kriging and will be compared with regulatory standards for lead in soil (which have not yet been finalized). If the standards as promulgated are met, no further action will be proposed for SWMU 0-016. If not, it is expected that the Phase I, Stage II, data will be sufficient to design additional corrective measures.

5.4.5 Data Required

5.4.5.1 Source Characterization

Specific data requirements for source characterization in Phase I, Stage II, investigations include

- determining as accurately as possible the locations, boundaries, and heights of the berms and the possible locations of firing points, using field surveys and Level I data;
- confirming the presence of and determining the distribution of unexpended shells, shell casings, and lead bullets, including identifying areas of concentrations of any of the above, using field surveys and Level I data; and
- using Level III/IV data to determine the concentrations and lateral and vertical extent of contaminants, specifically lead,

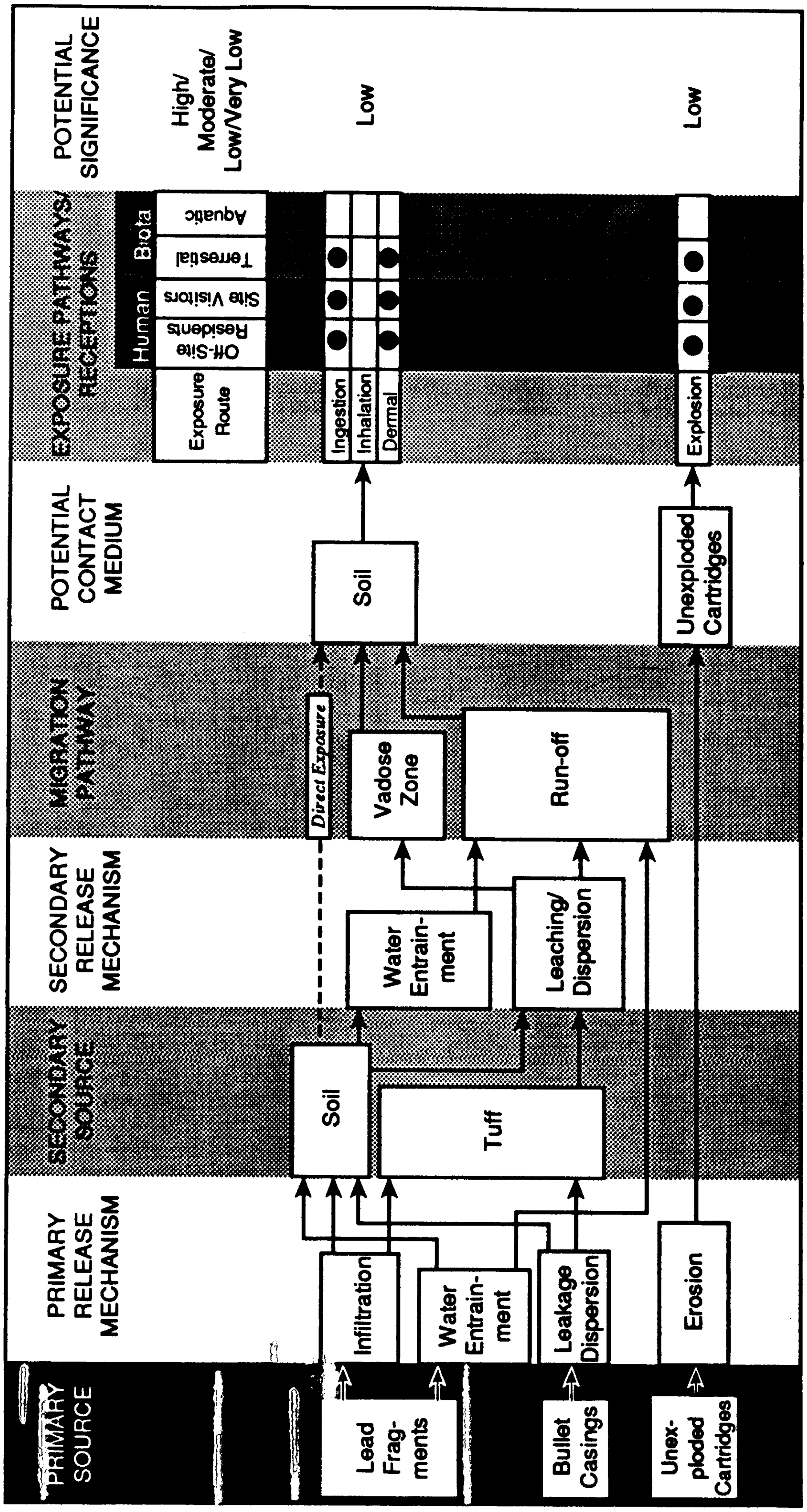


Figure 5-14. Conceptual model of SWMU 0-016.

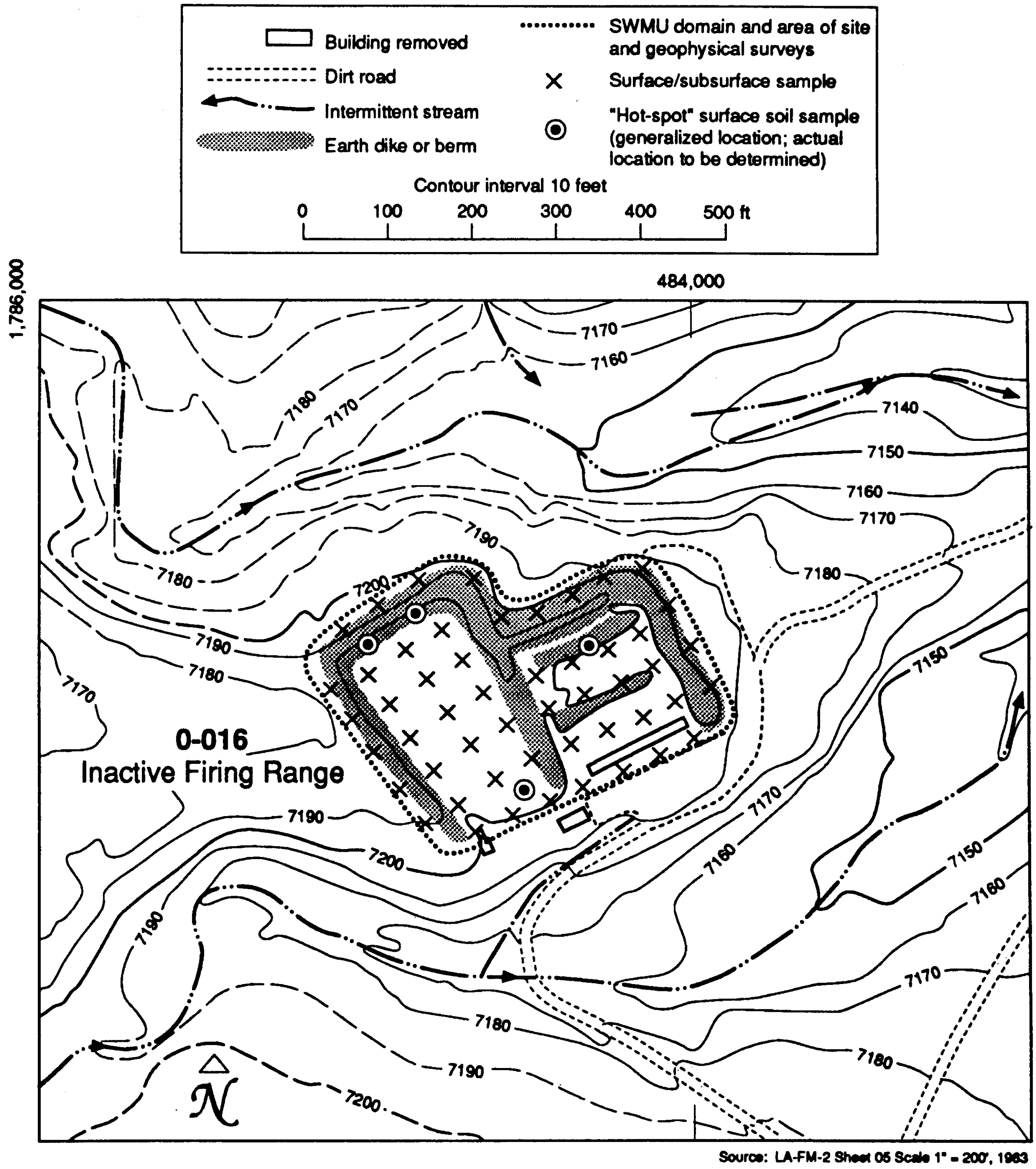


Figure 5-15. Sampling locations at SWMU 0-016 (Inactive Firing Range).

present on the site or in areas contaminated by releases, including concentrations in berm material and surface soils.

A site survey will be used to define the boundaries of the berms and to estimate the volume of material in the berms. Geophysical surveys will be used to help determine the distribution and areas of concentration of lead bullets in surface and berm material. These data will guide selection of sampling locations and implementation of voluntary corrective actions. Because the future-use scenario involves residential development, grid sampling will be done to ensure that all contamination has been identified. Level III/IV laboratory analysis will be obtained for surface and subsurface samples to determine the extent of lead contamination. These results will be compared with action level criteria, and, if contaminants are at or below action levels in all samples, no further field investigations will be conducted.

If the results of laboratory analyses of Phase I, Stage II, samples indicate that contaminant concentrations are above action levels, the need for a baseline risk assessment and a CMS will be evaluated. It is expected that the results of the Phase I, Stage II, investigation will provide sufficient data for this purpose.

5.4.5.2 Environmental Setting

No additional data are required to characterize the environmental setting of SWMU 0-016 in Phase I investigations.

5.4.5.3 Potential Receptors

Action levels will be used in the Phase I investigation as the initial basis for determining whether there is a potential for adverse human health effects associated with the inactive firing range. These action levels were established assuming constant on-site exposure and making conservative assumptions of human behavior; thus, no specific information regarding the activities, behavior, or location of actual receptors is required for this initial assessment. In the event that measured contaminant concentrations exceed action levels, a site-specific baseline risk assessment may be conducted to support a decision for no further action at the site. Information that may be required regarding the potential receptors identified in the Subsection 5.4.3 includes

- the frequency and duration of site visits and
- type of housing (e.g., apartments, single-family houses) that may be built on the site. In the event that the estimated risk to future site residents is considered unacceptable, a more detailed demographic survey may be required.

5.4.6 Field Sampling Plan

The field work in Phase I, Stage II, investigations of SWMU 0-016 will be completed in two field tasks: field surveys and surface/subsurface sampling, which are described in the following subsections. All field work will be performed in accordance with applicable ER Program SOPs.

5.4.6.1 Task 1—Field Surveys

Two surveys will be performed in Task 1: (1) site survey and (2) geophysical survey.

5.4.6.1.1 Activity 1—Site Survey

A site survey will be conducted to determine the locations, boundaries, and heights of the berms and the locations of firing and target points. The locations will be determined by examining historic aerial photographs, reviewing records, including maps and engineering plans, and by performing visual inspections. A site map of the firing range will be produced on a scale of 1:1000, showing accurate locations of all relevant features and using a 2-ft contour interval.

5.4.6.1.2 Activity 2—Geophysical Surveys

All of SWMU 0-016 will be surveyed with a metal detector to detect concentrations of lead bullets. Areas of heightened sensor response will be marked in the field and on the site map prepared in Task 1, Activity 1 (Subsection 5.4.6.1.1). This survey is intended to define areas in which lead bullets are concentrated and to guide selection of sampling sites.

5.4.6.2 Task 2—Surface and Subsurface Sampling

Task 2 will consist of sampling surface and near-surface material at areas of high metal concentration ("hot spots," which are defined as containing more than 100 ppm lead) and grid sampling for surface and subsurface material.

5.4.6.2.1 Activity 1—Sampling Hot Spots

Samples of surface and near-surface material will be collected from four sites (Figure 5-16)—three berm sites and one site in the flat, intraberm area—that are associated with the highest concentration of lead bullets. At each sampling site, three samples will be collected from separate intervals: one from the surface to a depth of 4 in., the second from 4 to 8 in., and the third from 8 to 12 in. A hand auger will be used to collect the samples from the side of the berm and the level soil surface, following the procedures described in LANL-ER-SOP-06.10, Hand Auger and Thin-Wall Tube Sampler. The samples will be submitted for Level III/IV laboratory analyses as indicated in Figure 5-16. Because the firing range was used only for training in the use of small arms, radiological contaminants are not potential contaminants and therefore are not screened.

5.4.6.2.2 Activity 2—Grid Sampling

A 50-ft grid consisting of approximately 50 nodes will be imposed over the surface of the SWMU domain, excluding the berm areas, and a sample will be collected from the uppermost 6 in. at each node. At 15 of these sampling sites, a hand auger will be used to core to a depth of approximately 1 ft, and a second sample will be collected at that depth, following the procedures described in LANL-ER-SOP-06.09, Spade and Scoop Method for the Collection of Soil Samples, and LANL-ER-SOP-06.10,

Sample Location	No. of Samples	Sample Description	Field Surveys: Site Survey/Mapping	Field Surveys: Geophysical Survey (Level I)	Field Surveys: Soil Gas Survey (LevelII/III)	Field Surveys: Gross Alpha, Beta, Gamma (Level I)	Field Screening (Level I): Lithologic Logging	Field Screening (Level I): Combustible Gas/Oxygen	Field Screening (Level I): Organic Vapor	Field Screening (Level I): Gross Alpha, Beta, Gamma	Laboratory Analysis (Level III/IV): Gamma Spectrometry	^{3}H	Total U (^{234}U, ^{238}U)	^{238}Pu, $^{239/240}Pu$	^{90}Sr	^{137}Cs	^{241}Am	^{60}Co	Volatile Organics (VOA) (SW 8240)	BTEX (SW 8020)	Semivolatile Organics (BNA) (SW 8270)	TPH(418.1)	Target Analyte List Metals	TCLP Metals	PCB and Pesticides (SW 8080)
0-016	4	"Hot spot" surface samples	●	●																			●	●	
0-016	8	"Hot spot" near-surface samples					●																●	●	
0-016	60	Grid surface samples	●	●																			*	*	
0-016	17	Grid subsurface samples					●																●	●	

Note (Laboratory Analysis): Number of samples analyzed depends on results of field screening and/or field survey. * =50%, + =30%

Figure 5-16. Screening and analysis for initial investigations at SWMU 0-016.

Hand Auger and Thin-Wall Tube Sampler. These samples, plus 6 field duplicates and 6 neighbors (Subsection 2.2.3), will be submitted for Level III/IV laboratory analysis as indicated in Figure 5-16.

5.5 SWMU 0-017 (Waste Lines)

SWMU 0-017 consists of waste lines that were or are located in TA-0 on privately owned and Los Alamos County lands (Figure 3-3).

5.5.1 Description and History

In 1943, the Laboratory began to install underground industrial waste lines. These waste lines and associated sumps and pumps were used to transport contaminated liquid wastes generated by Laboratory operations to various treatment facilities. Between 1953 and 1963, wastes from the Health Research Laboratory (HRL) in TA-43 were piped into the line. After 1963, TA-43 wastes were rerouted to the sanitary sewer system.

Most of the contaminated waste lines have been removed; however, some small isolated sections of waste line remain in place (Figure 5-17). This discussion is limited to the contaminated liquid waste lines that were or are within the boundaries of TA-0, with the exception of the line that connected TA-1 to TA-45, which is addressed in the work plan for OU 1078.

The contaminated liquid waste lines in TA-0 were located as follows: one set originated in TA-1 in the south-central part of the townsite and ran northward to TA-45 near the rim of Acid Canyon; the other main line ran from TA-3 down through Los Alamos Canyon under Omega Bridge, splitting into two branches north of the HRL building. These two lines ran northeast, roughly parallel to Diamond Drive, reconnecting near the intersection of Diamond Drive and Trinity Drive. The line continued northeast to a point north of Canyon Road, where it turned eastward, eventually terminating at the TA-45 treatment plant (Elder et al. 1986, 0456). Contaminated waste lines in TA-0 were constructed of either VCP or cast iron pipe. Both types of pipe have the potential for leaks at connections and/or via breaks in the lines. Releases from VCP occurred more frequently because of the fragility of the material and the nature of the connections. Leaks are also known to have occurred in the sumps associated with the waste lines. Releases occasionally occurred while the pipes were being decommissioned.

Portions of the abandoned contaminated liquid waste lines and associated structures in TA-0 were removed between 1964 and 1967 (DOE circa 1980, 05-0034). During this period, the lines from TA-1 to TA-45 and from the intersection of Trinity Drive and Diamond Drive to TA-45 were excavated and disposed in the Laboratory's radioactive waste disposal area. Sections of waste line not removed were located under Central Avenue, Rose Street, Canyon Road, and the intersections of Diamond Drive with Trinity Drive and Canyon Road. Details on decontamination conducted during the decommissioning are lacking.

An additional 1,300 ft of waste line and associated structures were removed from Laboratory and Los Alamos County lands during an 11-week project in 1977. The items removed were several manholes, a section of pipe under the north end of Omega Bridge, and a length of line from just west of the HRL building to a point past the intersection of Trinity Drive and Diamond Drive. Decontamination levels during the project were based on the stated DOE policy of "as low as practicable." Economic and practical considerations were weighed, along with health and safety issues, to determine cleanup levels on an individual basis. DOE's LAAO had the responsibility for determining the level of decontamination.

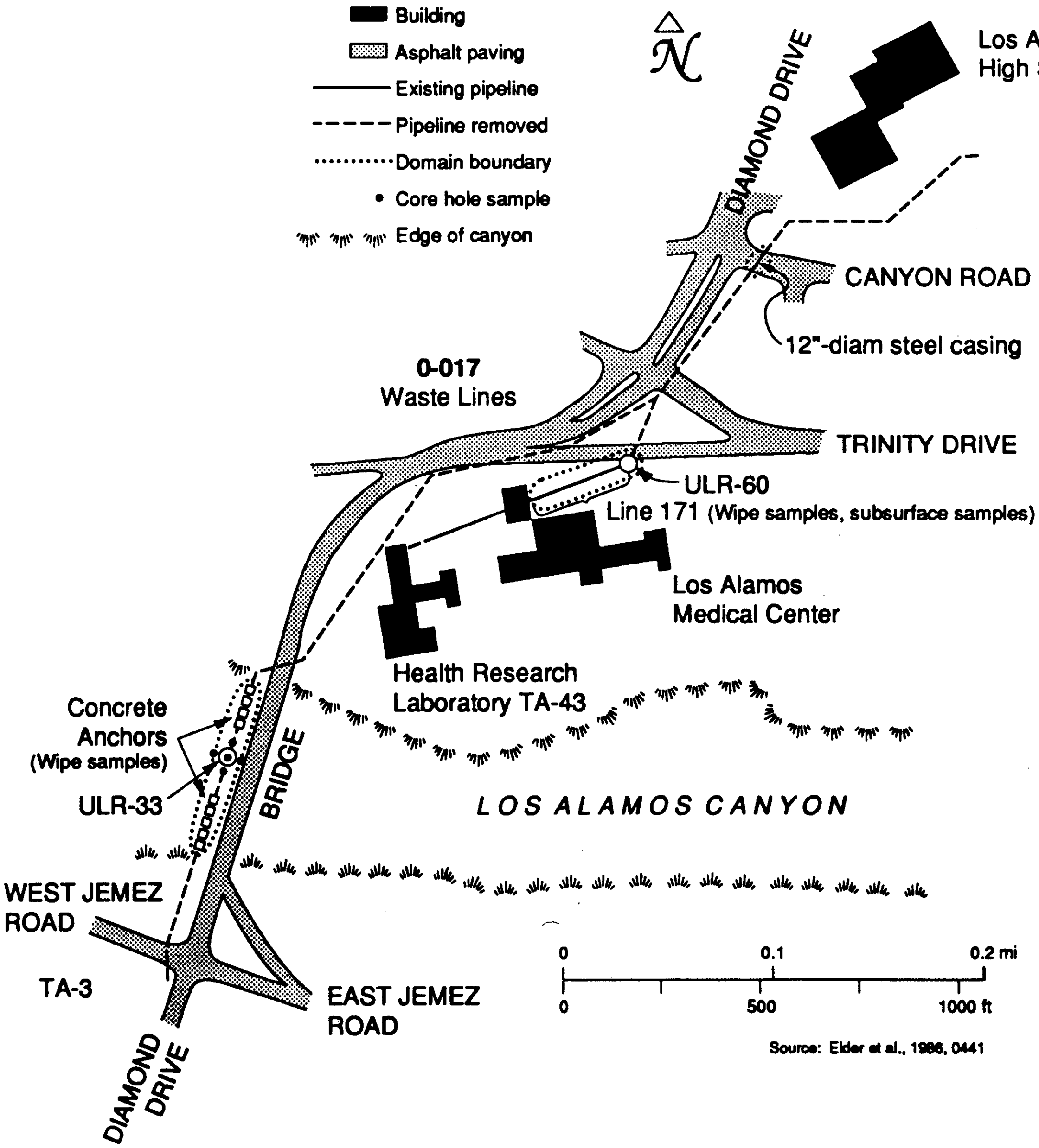


Figure 5-17. SWMU 0-017 (Waste Lines).

The contaminated liquid waste line through Los Alamos Canyon, one manhole, and sections of the waste line that had been left under roads in TA-0 were removed between 1981 and 1986 (DOE 1987, 0264). The following portions of waste line remained in TA-0 after these decommissioning activities (Elder et al. 1986, 0456):

- Line 167: a siphon line under Los Alamos Canyon Bridge, which was completely removed except for 9 concrete anchors and 3-ft-long sections of pipe that had been left during a removal project that occurred between 1981 and 1985;
- Line 170: a 225-ft section of pipe, believed to be uncontaminated, which was left under the north wing of Los Alamos Medical Center and parking lot east of HRL-1 and Manhole (MH) ULR-61 (Unassigned Land Reserve 61) after removal operations in 1977 (Elder et al. 1986, 0456); and
- uncontaminated 12-in.-diameter steel casing left near the intersection of Canyon Road and Diamond Drive.

Decontamination was taken to a level as low as reasonably achievable (ALARA). This policy, based on 1981 DOE guidance, specifies that "all contamination be removed to the extent possible, given existing technical and economic constraints" ((DOE 1987, 0264). The goal was to remove contamination until background levels had been reached, which was not, however, always feasible. In these cases, as much contamination was removed as was practicable.

5.5.2 Nature and Extent of Contamination

5.5.2.1 Description and Contamination Levels

Releases occurred from some of the sumps as a result of processes used during decommissioning. An area of contamination was found in the vicinity of Manhole ULR-33, located north of Omega Road in Los Alamos Canyon (Ahlquist 1977, 05-0006). Americium-241 and ^{137}Cs were identified, and it was thought likely that ^{139}Pu was also present. Cleanup action was recommended; however, no documentation has been located on decontamination of the site. In 1977, during a contaminated liquid waste line removal project, 17 m of exposed, partially cracked waste line was removed from beneath the north end of Omega Bridge (DOE circa 1980, 05-0034) and some soil contamination was found under the cracked pipe. The area was reportedly cleaned to equal to or less than 25 pCi/g. Releases of acids and other chemicals are not recorded. The outfall would have discharged into Los Alamos Canyon. No information is available on releases of other potential contaminants.

5.5.2.2 Potential Migration Pathways

Contaminants associated with the industrial waste lines may have been released to the environment as the result of leakage from the sections of pipe located in the vicinity of the Los Alamos Medical Center or from the manhole formerly located in Los Alamos Canyon. Surface water in Los Alamos Canyon may have discharged into the Rio Grande as the result of high run-off from summer storms or snowmelt, releasing contaminants into the soil and/or tuff. Contaminants in soil may leach/

disperse through the vadose zone or become entrained by surface water and transported downstream by run-off. Contaminants present in tuff may leach/ disperse through the vadose zone.

5.5.2.3 Potential Public Health and Environmental Impacts

Based on the migration pathways discussed in Subsection 5.5.2.2, it is possible that contaminants are currently present in or will migrate to soil or air. As a result, human exposure to contaminants from this SWMU aggregate may occur through incidental ingestion or dermal contact with soil or surface water. Additionally, terrestrial animals may be exposed to site contaminants via incidental ingestion, dermal contact with soil, or ingestion of surface water.

5.5.3 Conceptual Models

Figure 5-18 presents the conceptual model for potential contaminant releases from the industrial waste lines and subsequent exposure of humans and terrestrial animals. The future-use scenario for this site assumes that the land will become part of the Los Alamos Medical Center. In Figure 5-18, "off-site residents" refers to residents in Totavi (likely closest downstream receptors), and "on-site workers" refers to people who may be required to work in the vicinity of former ULR-33. Potential exposure of residents in Totavi to run-off will be addressed in the work plan for the canyons study (OU 1049). Terrestrial animals in the vicinity of ULR-33 in Los Alamos Canyon may also be impacted.

5.5.4 Decisions, Domain, and Approach

The fragmented domain of this SWMU includes the existing sections of industrial waste lines shown in Figure 5-17, together with adjacent tuff and soil, and the area around ULR-33. These sections of the industrial waste lines have not yet been removed because of their inaccessibility. The goal of the RCRA process is to ensure that these sites present no hazards that could constrain future use of the properties on which they are located. The ER Program proposes to remove contaminated pipe or to decontaminate it in place, together with cleaning up secondary sources to meet health-risk-based media cleanup standards.

The strip of land from which thousands of feet of waste line have already been removed is not included in this investigation because there is no evidence to indicate that significant quantities of contaminants were left in place. To look for contamination along the path of the removed waste line would be very costly because any release would have been a point source, and, therefore, verifying the absence of contamination would require coring and sampling every few feet along the entire length of the former line. Investigation of the location of the removed line will be considered only if contamination of the soil and/or rock is found at the remaining pieces of line.

Phase I activities are designed to locate and remove as much of the remaining pipe as possible as a voluntary corrective action. Removal of the waste lines may have to be deferred until the mixed-waste storage and disposal facility (MWSDF) comes on line. Further decisions will be based on analytical data from swipe samples from remaining lines, samples of soil and tuff from excavations, and samples from augur holes near ULR-33. These Phase I data will be compared with action levels to

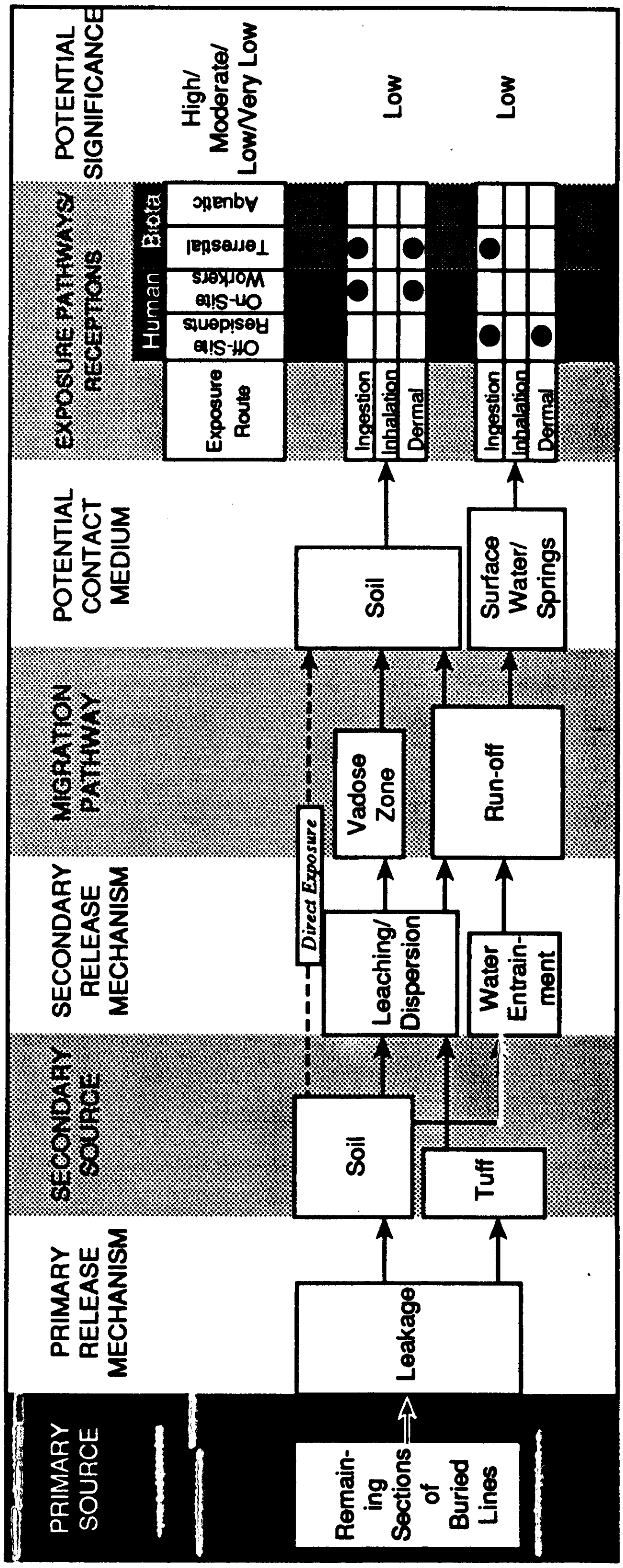


Figure 5-18. Conceptual model of SWMU 0-017.

determine whether residual contamination exists. In the absence of contamination, no further action will be proposed at SWMU 0-017. If levels above action levels are observed, Phase II investigations may be required to support a baseline risk assessment and CMS.

5.5.5 Data Required

5.5.5.1 Source Characterization

Specific data requirements for source characterization in Phase I investigations include

- determining as accurately as possible the original design, construction, and current locations of remaining sections of industrial waste lines and manholes, using field surveys, and Level I data (Figure 5-19) and

- using Level III/IV data to determine the presence or absence of and, if present, the nature and concentrations of, any contaminants in potential release areas, including remaining waste lines; manhole(s); casing(s); concrete anchors; and soil, tuff and/or alluvium surrounding the remaining sections of lines and associated structures.

Site and geophysical surveys will be used to help locate the remaining sections of buried line. All surface and subsurface samples will be screened for gross alpha, beta, and gamma radiation to determine whether radioactivity is present. The Level III/IV data from these samples will be compared with conservative risk-based action levels, and, if contaminant concentrations are below these levels, no further field investigations will be conducted.

If the Level III/IV results of Phase I sampling indicate that contaminant concentrations are above action levels, the necessity and possible scope of additional Phase II field sampling will be evaluated. Based on current knowledge of past activities at this SWMU, it is not expected that contaminants will be encountered above action levels; accordingly, no detailed Phase II sampling plans have been developed. However, should Phase II investigations be necessary, additional source characterization data may be collected to determine the lateral and vertical extent of contamination, to perform a baseline risk assessment, and, if necessary, to provide a data base for designing and implementing corrective measures.

5.5.5.2 Environmental Setting

No additional data are required to characterize the environmental setting of SWMU 0-017 in Phase I investigations because sufficient information exists.

5.5.5.3 Potential Receptors

No specific information regarding the activities, behavior, or location of actual receptors is required for the Phase I investigation. In the event that a Phase II

Sample Location	No. of Samples	Sample Description	Field Surveys: Site Survey/Mapping	Field Surveys: Geophysical Survey (Level I)	Field Surveys: Soil Gas Survey (Level I/II)	Field Surveys: Gross Alpha, Beta, Gamma (Level I)	Field Screening (Level I): Lithologic Logging	Field Screening (Level I): Combustible Gas/Oxygen	Field Screening (Level I): Organic Vapor	Field Screening (Level I): Gross Alpha, Beta, Gamma	Laboratory Analysis (Level III/IV): Gamma Spectrometry	^{3}H	Total U (^{234}U, ^{235}U)	^{238}Pu, $^{239/240}Pu$	^{90}Sr	^{137}Cs	^{241}Am	^{60}Co	Volatile Organics (VOA) (SW 8240)	BTEX (SW 8020)	Semivolatile Organics (BNA) (SW 8270)	TPH(418.1)	Target Analyte List Metals	TCLP Metals	PCB and Pesticides (SW 8080)
Aboveground lines/ anchors	27	Wipe samples	•			•				•	•														
Buried line 171	~10	Wipe samples of inner line	•	•				•	•	•	•														
Buried line 171	~10	Materials beneath line		•				•	•	•	•								*		*		*		*
ULR-33 manhole	5	Core samples	•				•		•	•	•								*		*		*		*

Number of samples analyzed depends on results of field screening and/or field survey.
* =50%, + =30%

5-19. Screening and analysis for initial investigations at SWMU 0-017.

investigation is required, the following information regarding the potential receptors identified in the conceptual model (Figure 5-18) may be required:

- the location of on-site workers, off-site residents, and terrestrial biota relative to source area(s) and
- the frequency and duration of worker activity in the vicinity of ULR-33.

5.5.6 Field Sampling Plan

The field work in the Phase I, Stage I, investigations of the waste lines will be completed in three tasks: field surveys, surface sampling, and subsurface sampling, which are described in the following subsections. All field work will be performed in accordance with applicable ER Program SOPs.

5.5.6.1 Task 1—Field Surveys

Three field surveys will be performed in Task 1: site survey, geophysical surveys, and radiological survey.

5.5.6.1.1 Activity 1—Site Survey

A site survey will be conducted to locate the remaining sections of buried waste lines, manholes, sumps, sections of line aboveground, and concrete anchors to generally define the boundaries of the sampling domain and to determine, to the extent possible, the original design and construction of the buried lines. Locations will be determined by examining historic aerial photographs, by reviewing records, including maps and engineering plans, and by performing visual inspections. A detailed site map showing the remaining sections of the waste lines and associated structures will be prepared on a scale of 1:1000.

5.5.6.1.2 Activity 2—Geophysical Surveys

If the site survey does not reveal the locations of buried structures in sufficient detail, geophysical surveys will be conducted to more precisely define the boundaries and subsurface geometries of the buried lines and associated structures. A magnetic survey and an EMC survey will be conducted, and, if necessary, ground-penetrating radar will be used to supplement these methods. Once located, the sites will be marked in the field.

5.5.6.1.3 Activity 3—Radiological Survey

Concurrently with Tasks 2 and 3, a field survey for gross alpha, beta, and gamma radiation will be conducted on the exposed surfaces of aboveground lines and excavated sections of buried waste line to determine whether areas of line or surrounding material exist in which radiation is above action levels. Screening for radioactivity will delineate locations in which releases have occurred, and, therefore, will also identify material that contains any other contaminants present in the waste. Thus, the survey will help guide selection of sampling locations. In addition, all excavated material and samples will be screened for radioactivity for the purposes of identifying health risks and selecting samples to be submitted for Level IV laboratory analysis.

5.5.6.2 Task 2—Surface Sampling

Task 2 will consist of screening, sampling, and removing the remaining sections of aboveground line and concrete anchors in Los Alamos Canyon. Three wipe samples will be collected for each section of line that remains anchored to the wall of Los Alamos Canyon (Figure 5-17). One sample will be taken from the inside of the line, one from the outside of the line, and one from the concrete anchor post nearest the exposed section of line. The field survey will help guide the selection of sampling locations. Because any releases from the line should also have contained other contaminants in the waste, the samples will be field-screened for gross alpha, beta, and gamma radiation. All samples that indicate an activity above action levels and 50% of the remaining samples will be analyzed as indicated in Figure 5-19. Data from wipe samples will also be used to determine appropriate means of removing and disposing of the anchors and line sections.

5.5.6.3 Task 3—Subsurface Sampling

Task 3 will consist of sampling and removing buried lines and coring at ULR-33.

5.5.6.3.1 Activity 1—Sampling and Removal of Buried Lines

This activity will proceed in three consecutive steps: (1) site preparation, including excavation, (2) field screening and removing lines, and (3) sampling material beneath the lines. Site preparation will consist of excavating the overburden around the lines to pinpoint the boundaries and to expose the lines and manhole(s). The lines will be inspected for evidence of leakage, such as corrosion or breaks in the lines. The exposed sediments surrounding the lines and manhole(s) and the lines themselves will be field-surveyed for radionuclides.

Wipe samples will be used for field screening. The samples will be collected from inside the exposed lines at approximately 30-ft intervals (Figure 5-17) and will be field-screened for gross alpha, beta, and gamma radiation and organic vapors. All samples that indicate an activity above action levels and/or the presence of organic contaminants and 50% of the remaining samples will be analyzed as indicated in Figure 5-19. The rationale for using field screening to select these samples is that releases would not only have contained radionuclides but also any other contaminants in the waste. The results of field screening and sample analyses will determine health and safety procedures and appropriate disposition of the lines and associated structures. The lines will be removed as soon as practicable to avoid excessive disruption of the medical facility and inconvenience to the public.

The sediments exposed beneath the removed lines will be field-screened for gross alpha, beta, and gamma radiation and organic vapors. Samples of the material beneath the lines will be collected at 7 to 10 points in the excavated trench at intervals in which radioactivity or organic contaminants are detected above action levels, if such exist (Figure 5-17). Samples will be collected using the procedures described in LANL-ER-SOP-06.09, Spade and Scoop Method for Collection of Soil Samples. All samples with a positive field screen and 50% of the remaining samples will be analyzed as indicated in Figure 5-19.

5.5.6.3.2 Activity 2—Coring at ULR-33

Hand augering equipment or, if necessary, power-driven coring apparatus will be used to collect subsurface samples in the area of ULR-33. Cores will be drilled following the procedures described in LANL-ER-SOP-04-01, Drilling Methods and Drill Site Management. The purpose of subsurface sampling is to confirm that no contamination is present in the vicinity of ULR-33; however, if contamination is detected during the course of drilling, samples will be collected to define the vertical extent of contamination. Five cores will be drilled in the vicinity of ULR-33 (Figure 5-17). One core will be located in the fill material directly over the old manhole, and four cores will be drilled around the manhole at radial distances of 5 ft from the first core. Each core will penetrate to the alluvium/tuff interface and will be continuously screened for organic vapor and gross alpha, beta, and gamma radiation. Two samples will be collected from each core from intervals for which field screening indicates the presence of organic vapors or radionuclides, if such exist. Coring will continue into the tuff with continuous field screening. At a point 5 ft below the last positive field screen response, a final sample will be collected. If screening procedures do not indicate the presence of contaminants, a single sample will be collected in the uppermost tuff interval. All samples that indicate a positive screen response and 50% of the remaining samples will be analyzed as indicated in Figure 5-19.

5.6 SWMU Group 0-2 (Wastewater Treatment Plants)

SWMU Group 0-2 includes SWMU 0-018(a), Pueblo Canyon Wastewater Treatment Plant (Figure 3-2); SWMU 0-018(b), Bayo Canyon Wastewater Treatment Plant (Figure 3-1); and SWMU 0-019, the decommissioned Central Wastewater Treatment Plant (Figure 3-2). The SWMUs are located on Los Alamos County property.

5.6.1 Description and History

The Pueblo Canyon Wastewater Treatment Plant [SWMU 0-018(a)] is located at the end of Olive Street in Pueblo Canyon. The plant, owned and operated by Los Alamos County, receives sanitary waste from businesses and residences east of Diamond Drive and north of Canyon Road (DOE 1987, 0264). The plant is currently operated only during warm weather to provide treated effluent to the county golf course for irrigation.

The Bayo Canyon Wastewater Treatment Plant [SWMU 0-018(b)], also owned and operated by Los Alamos County, is located at the intersection of Pueblo and Bayo canyons east of Kwage Mesa. The Bayo Canyon Wastewater Treatment Plant receives waste from businesses and private residences (LANL 1990, 0145). Because it is possible that wastes from the Laboratory have been received at both the Bayo and Pueblo plants, the effluents from these plants are monitored for radionuclides (LANL 1990, 0145).

The decommissioned Central Wastewater Treatment Plant (SWMU 0-019) was located west of the East Park tennis courts (USGS 1948, 05-0124). The plant treated sanitary sewage from the Laboratory, residences, and industries (DOE 1987, 0264). The central plant was active from the 1940s until its abandonment and subsequent decommissioning in the 1960s (LANL 1990, 0145; Francis 1991, 05-0038).

Treated effluent from the central plant was diverted through an 8-in.-diameter steel drainline along Canyon Road to the golf course [SWMU 0-028(a) (Section 5.8)], beginning in May 1948. The Pueblo Canyon Wastewater Treatment Plant became the primary supplier of effluent for irrigation when it began operating in February 1951. At that time, most of the effluent from the central plant began to be used as make-up water for the cooling towers at TA-3. The cooling towers were supplied by a 6-in.-diameter drainline that crossed Los Alamos Canyon in the vicinity of 39th Street.

No information exists concerning accidental spills, releases, or incidents at SWMUs 0-018(a and b) and 0-019. The treatment plants have NPDES-permitted outfalls that drain into the Pueblo and Bayo tributaries of the Rio Grande (DOE 1987, 0264; LANL 1989, 0444; LANL 1990, 0145).

5.6.2 Nature and Extent of Contamination

5.6.2.1 Description and Contamination Levels

The Pueblo and Bayo plants manage sanitary waste and may have received radioactive waste and laboratory chemicals (LANL 1990, 0145). The Pueblo plant

5.6.2 Nature and Extent of Contamination

5.6.2.1 Description and Contamination Levels

The Pueblo and Bayo plants manage sanitary waste and may have received radioactive waste and laboratory chemicals (LANL 1990, 0145). The Pueblo plant received waste from the medical laboratory in TA-43 until 1983 (LANL 1990, 0145; Francis 1991, 05-0038). The Bayo plant, "because it serves the townsite, might have also received residual contamination left in drains from operations in TA-1" (Voelz 1973, 05-0128; DOE 1987, 0264).

The central plant handled waste from TA-1 sanitary drains; the Zia motor pool building and warehouses; C-Shop; a septic tank west of Buildings HT and FP and a septic tank that served the latrine at the security vault, which are located southwest and south of Delta and Sigma Buildings, respectively; a septic tank that served Buildings J and ML, southwest of Building X, Building D-2; a septic tank southeast of Building Y; five septic tanks at DP Site; and residences east of Diamond Drive, south of Canyon Road, and between the treatment plant and the Los Alamos Airport (DOE 1987, 0264; LANL 1990, 0145; Williams 1946, 05-0151). Contamination could extend from the head of Pueblo Canyon to its confluence with Bayo Canyon and beyond.

The results of analyses of fluid and sludge from the Pueblo and Bayo plants are presented in Tables 5-1, 5-2, and 5-3 (LANL 1989, 0445; Pizzoli 1991, 05-0152). Two parameters not shown in the tables are fecal coliform (64 counts/100 ml maximum and 426 counts/100 ml maximum for the Pueblo and Bayo plants, respectively) and biological oxygen demand (34 mg/l maximum and 27 mg/l maximum, respectively). Samples taken in 1972 revealed radionuclide concentrations near the detection limit and included $^{238,239}Pu$, ^{137}Cs, ^{3}H, and uranium. The uranium was within the range for natural systems. Cadmium, beryllium, lead, and mercury were detected in effluent water and on particulates. The levels (tens of parts per billion) are well above those that occur naturally in water but are acceptable for permitting purposes. The effluent may have released these materials to Pueblo Canyon, the golf course, and the North Mesa athletic fields. There is no documentation of decontamination at any of the plants.

A sludge analysis for the Bayo Plant (Table 5-3) indicates that metals and radionuclides are not currently a problem in sludge (Pizzoli 1991, 05-0152). There are no data for metals or radionuclides in sludge before 1991. Based on detectable radionuclide concentrations in fluid effluent in 1972, sludge from this period may also be a source of radionuclide and metal contamination. Sludge from this period was used as fill material at the plants.

5.6.2.2 Potential Migration Pathways

Contaminants may have been released to the environment from the currently operating Pueblo and Bayo canyon plants and the decommissioned Central Wastewater Treatment Plant as the result of leaching/dispersion, entrainment by air and/or water from the sludge (pits or landfills), or as the result of percolation or run-off of effluent at various stages of treatment. Surface water resulting from heavy storm run-off or snowmelt may discharge from Pueblo Canyon into the Rio Grande via Los Alamos Canyon. As a result, contaminants may be present in soil, channel sediments, tuff,

TABLE 5-1[a]

SANITARY EFFLUENTS FROM PUEBLO AND BAYO WASTEWATER TREATMENT PLANTS
($\mu g/\ell$)

Pueblo

	1952	1961	1971	1972	1991
Calcium	--	--	26	14	
Magnesium	--	--	3	6	
Sodium	--	94	88	78	
CO_3	--	0	0	0	
HCO_3	176	121	120	140	
PO_4	--	35	--	--	
Chlorine	32	34	36	31	
Fluorine	1.6	1.6	0.8	0.7	
NO_3	40	30	66	26	
Total Dissolved Solids	350	400	420	403	37 max
pH	--	7.0	7.2	7.2	7.0-7.4

Bayo

	1971	1972	1991
Calcium	13	14	
Magnesium	2	5	
Sodium	89	78	
CO_3	0	0	
HCO_3	160	118	
PO_4	--	--	
Chlorine	30	55	0.01
Fluorine	1.5	1.2	
NO_3	31	57	8.4
Total Dissolved Solids	374	408	35 max
pH	7.2	7.3	7.1–7.6

a. Sources: Pizzoli 1991, 05-0152; LANL 1989, 0445.
b. Dechlorinators were installed after 1972.

TABLE 5-2

METAL ION AND RADIOCHEMICAL ANALYSIS OF SANITARY EFFLUENTS
($\mu g/\ell$ or pCi/ℓ)

	Pueblo			Bayo		
	1971	1972	1991	1971	1972	1991
Cadmium	1.3	0.48	<1	0.91	0.30	<1
Beryllium	0.29	<0.25	<1	1.4	<0.25	<1
Lead	<1	6.5	1	3.8	4.7	1
Mercury	0.5	0.34	<0.4	<0.02	0.05	<0.4
Gross Alpha		1			2	
Gross Beta		9			30	
Gamma		--			--	
^{238}Pu		<0.5			0.5	
^{239}Pu		<0.5			0.5	
^{137}Cs		<350			<350	
^{3}H		<1000			<1000	
Total Uranium		1.6			1.8	
Silver			<10			
Arsenic			<10			<10
Chromium			<10			<10
Copper			<40			<10
Nickel			<100			<100
Antimony			<10			<10

TABLE 5-3

SLUDGE ANALYSES FROM BAYO CANYON WASTEWATER TREATMENT PLANT

	Bayo 1991 (mg/ℓ)
Arsenic	0.018
Barium	1.28
Cadmium	<0.005
Chronium	<0.01
Lead	<0.02
Mercury	<0.0002
Selenium	<0.001
Silver	<0.01
	pCi/gm
Gamma	ND
Alpha	<0.3
Beta	<0.1

5.6.2.3 Potential Public Health and Environmental Impacts

Based on the migration pathways described in Subsection 5.6.2.2, contaminants may be currently present in SWMU Group 0-2 or may migrate to soil, channel sediments, surface water, or air. As a result, human exposure to contaminants from this site may occur through inhalation of suspended particulates, incidental ingestion, or dermal contact with soil, channel sediments, or surface water. Because any contaminants from the wastewater treatment plants could be taken up by plants (deposition, followed by root uptake), human exposure may also occur through ingestion of home-grown produce. Additionally, terrestrial animals may be exposed to site contaminants via incidental ingestion, dermal contact with soil, or ingestion of surface water or vegetation.

5.6.3 Conceptual Models

Figures 5-20, 5-21, and 5-22 present the conceptual models for potential contaminant releases from the Pueblo Canyon, Bayo Canyon, and the decommissioned Central Wastewater Treatment plants and subsequent exposure by the receptors identified in Subsection 5.6.2.3. In these figures, "future residents" refers to people who may live on the site of the decommissioned Central Wastewater Treatment Plant sometime in the future, "off-site residents" refers to residents located in Totavi (likely closest downstream receptors), "site visitors" refers to people who may occasionally walk across the plant site(s), and "on-site workers" refers to current employees at the Pueblo or Bayo Canyon facilities. Potential exposure of residents in Totavi to run-off is addressed in the canyons study (OU 1079). Terrestrial animals in the vicinity of the current or former wastewater treatment plants may also be impacted.

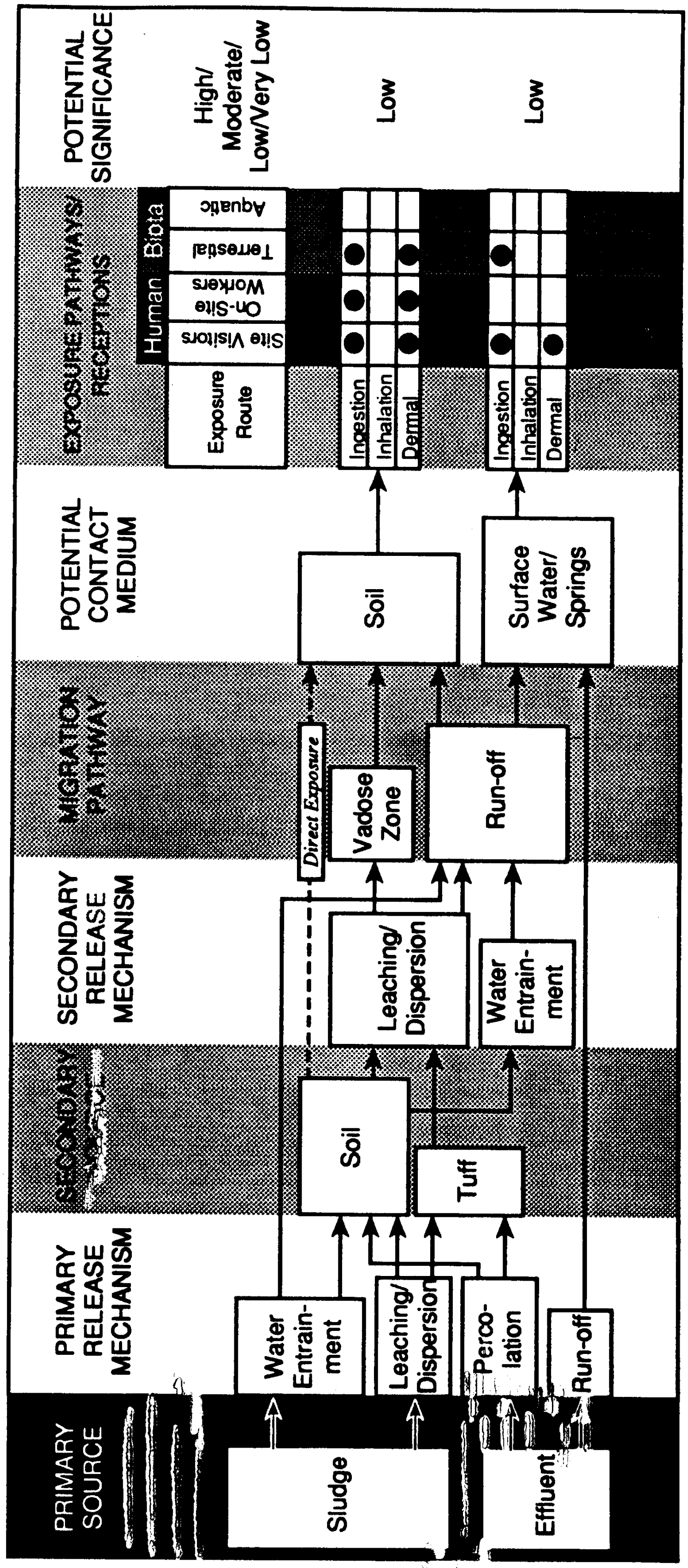


Figure 5-20. Conceptual model of SWMU 0-018(a).

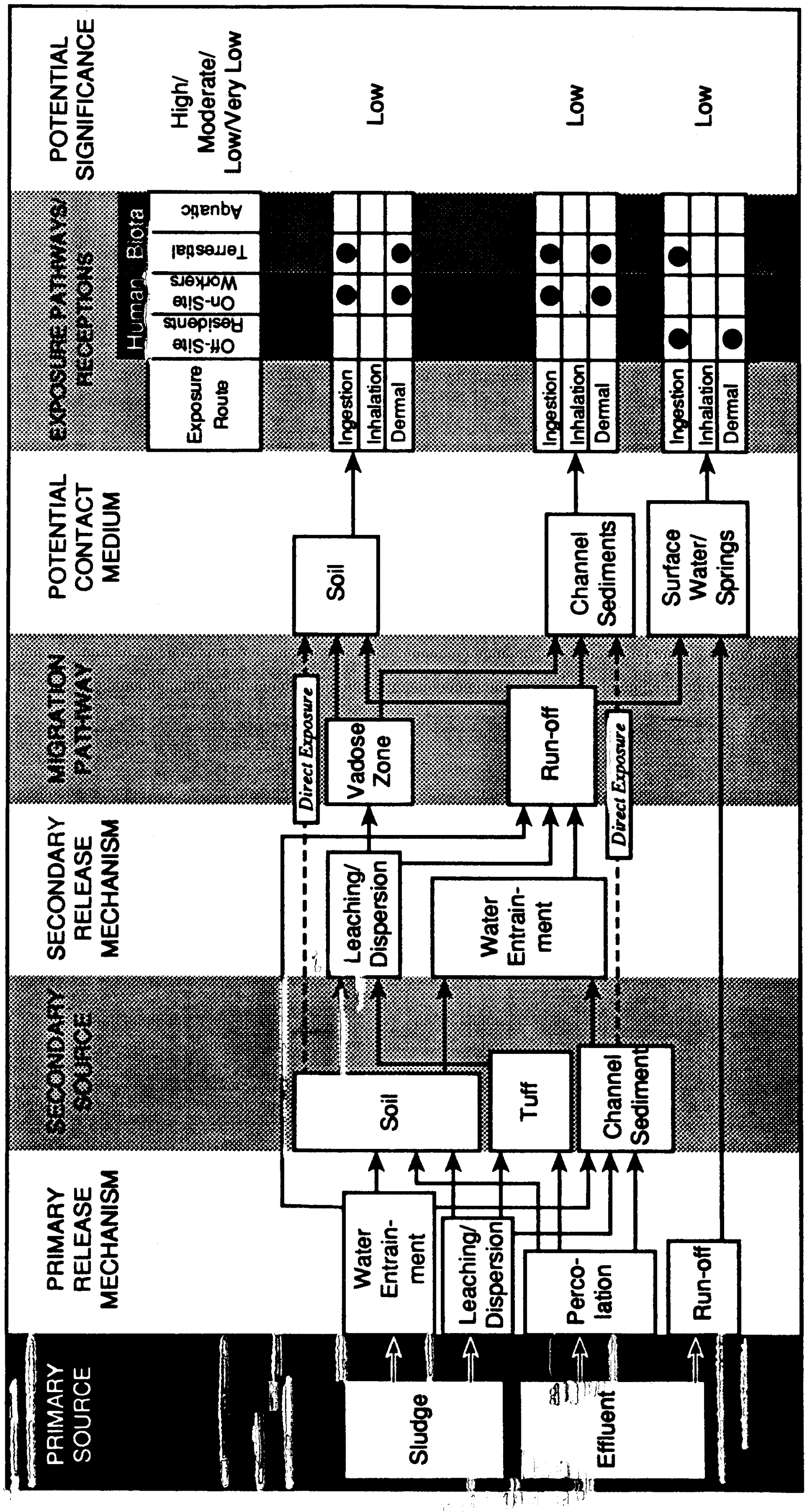


Figure 5-21. Conceptual model of SWMU 0-018(b).

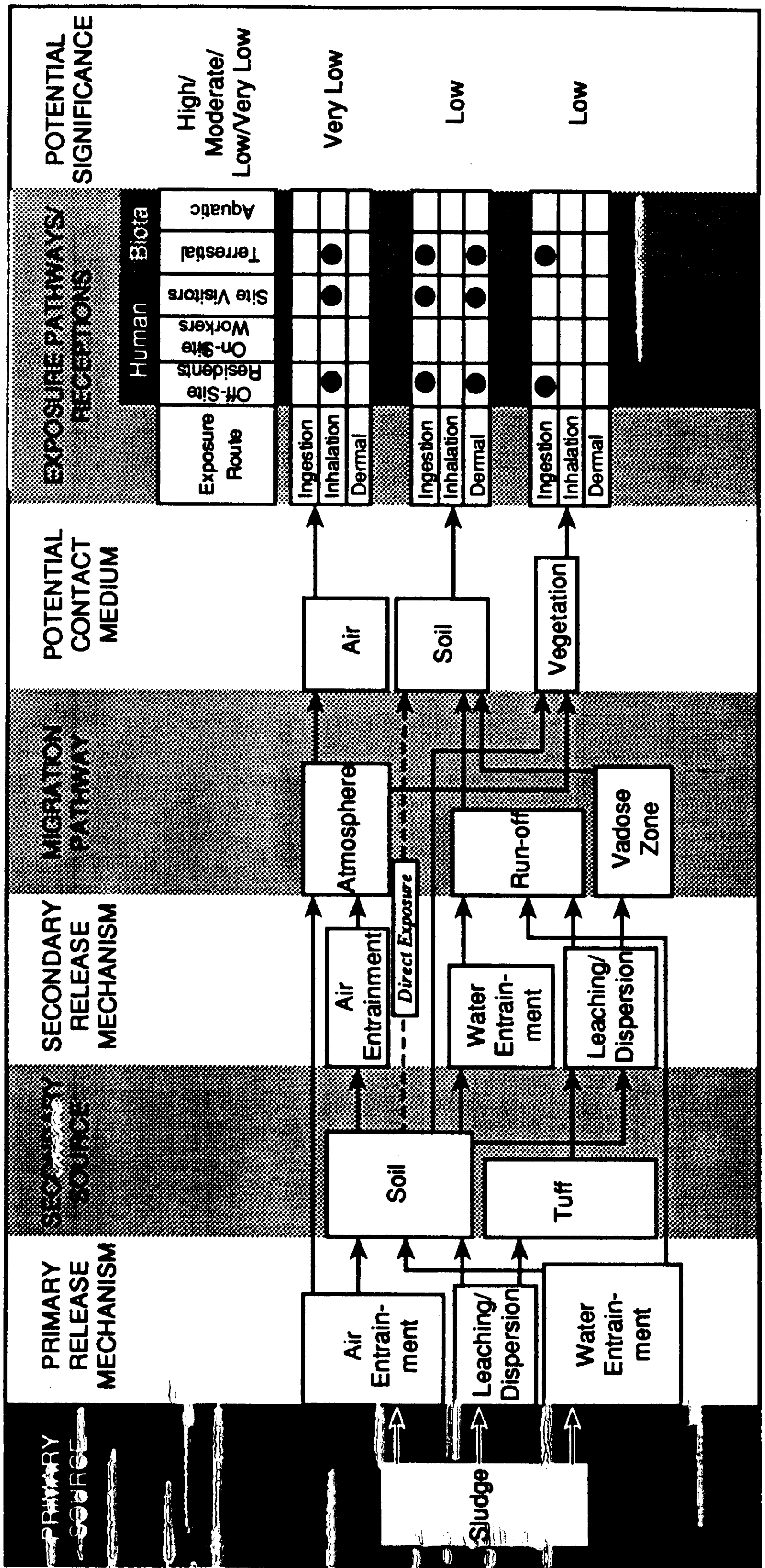


Figure 5-22. Conceptual model of SWMU 0-019.

5.6.4 Decisions, Domain, and Approach

The Pueblo and Bayo wastewater treatment plants [SWMUs 0-018(a and b)] no longer receive waste streams from Laboratory activities other than sanitary wastes from offices rented in the townsite. The domains of these SWMUs are therefore considered to primarily include the oldest evaporation pits and areas in which sludge was used as landfill, the areas that might have been contaminated when the plants were still receiving Laboratory wastes, and the drainages from these areas (Figures 5-23, 5-24, and 5-25).

The Pueblo Canyon Wastewater Treatment Plant is scheduled to shut down, probably during the period of this RFI. Options for this site include no action, removing contaminated tuff from beneath the site or soil from areas in which sludge was used as landfill, stabilizing and capping the filled area, and restricting access. No large landfills are located at the Bayo Canyon Wastewater Treatment Plant, and the likely alternative to be selected for this active site is to remove any contaminated material found.

The former Central Wastewater Treatment Plant (SWMU 0-019) is located near residential areas, and the site is a candidate for future residential use (possibly group residences). The domain of this SWMU includes all of the former treatment plant site, although the former evaporation pits and sludge landfills are the most likely portions to be contaminated. Remedial action will be proposed as necessary to clean the site or to cap contaminated fill to meet health-risk-based media standards for residential use.

Because there is no evidence of residual contamination within these domains, Phase I will consist of Stage I investigations to determine whether any source of contamination is present. This decision will be based on analytical data from samples of soil, tuff, or alluvium taken from beneath the older evaporation pits and on data from samples of sludge used in landfills.

This investigation is also closely linked to the investigation of the recreational areas watered by effluent from the Pueblo and Central plants (Section 5.9). Discovery of contamination in those areas would suggest that more extensive characterization of the media underlying other components of the plants will be necessary.

Stage I data from the Central Wastewater Treatment Plant will be compared with conservative health-risk-based levels for soils and tuff (Subsection 2.3.2) to determine whether contamination is present. For nonradioactive contaminants in sludge used as landfill at the active plants, current permit standards will be applied. If these criteria are met, no further action will be proposed at SWMU Group 0-2. Otherwise, Phase II investigations may be required to support a baseline risk assessment and CMS.

5.6.5 Data Required

5.6.5.1 Source Characterization

Specific data requirements for source characterization in Phase I investigations include

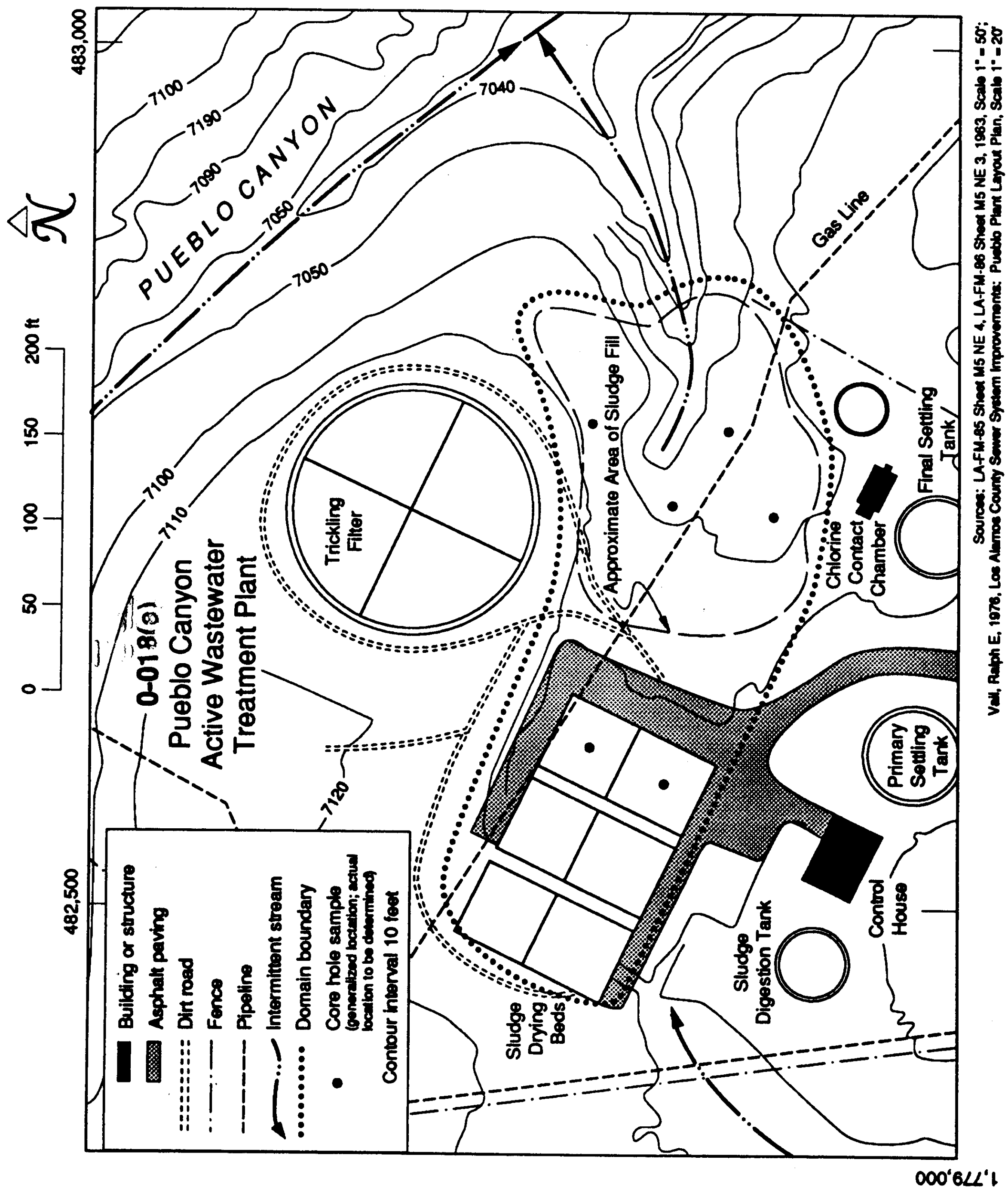


Figure 5-23. Sampling locations in SWMU 0-018(a) (Pueblo Canyon Wastewater Treatment Plant).

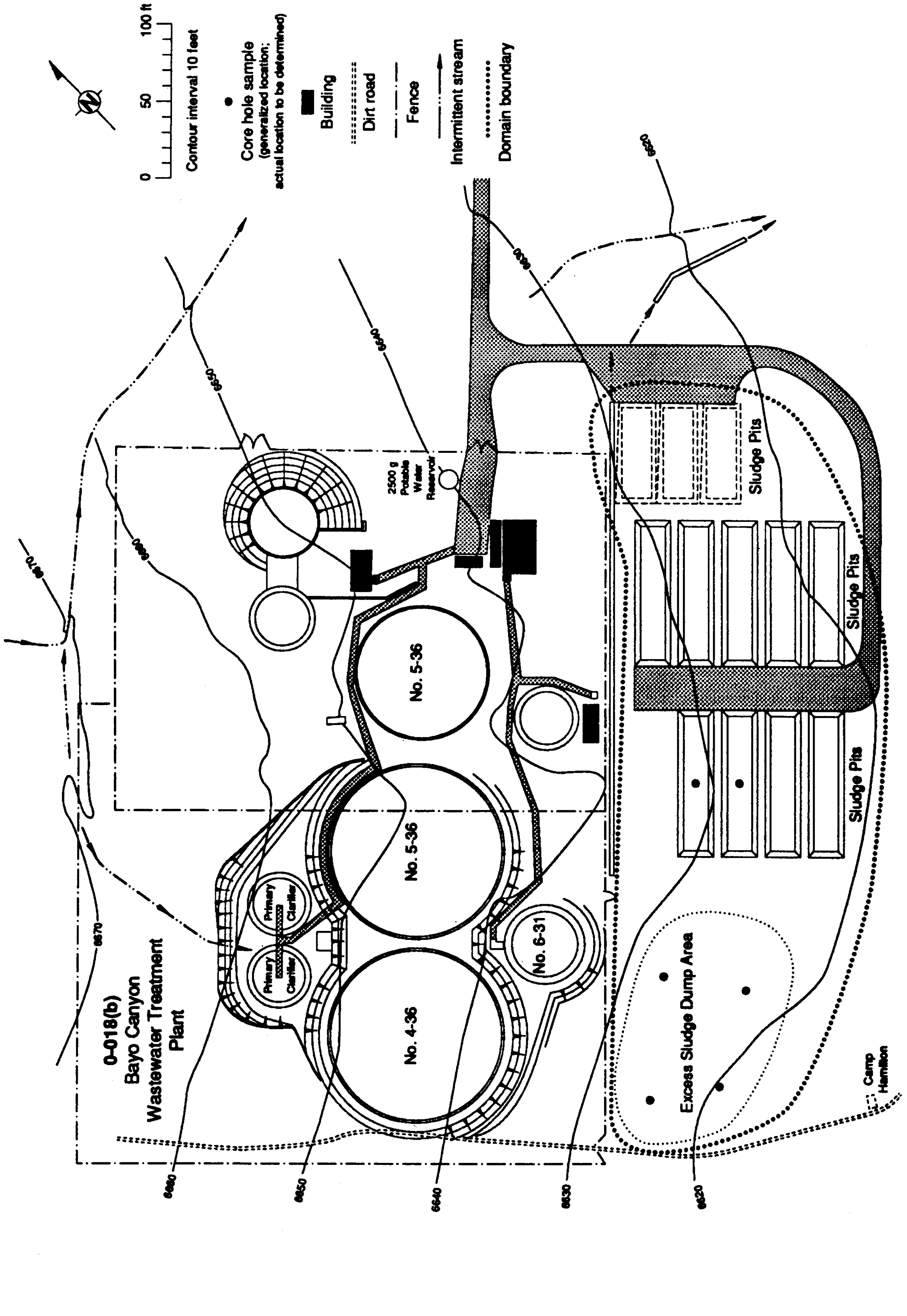


Figure 5-24. Sampling locations in SWMU 0-018(b) (Bayo Canyon Wastewater Treatment Plant).

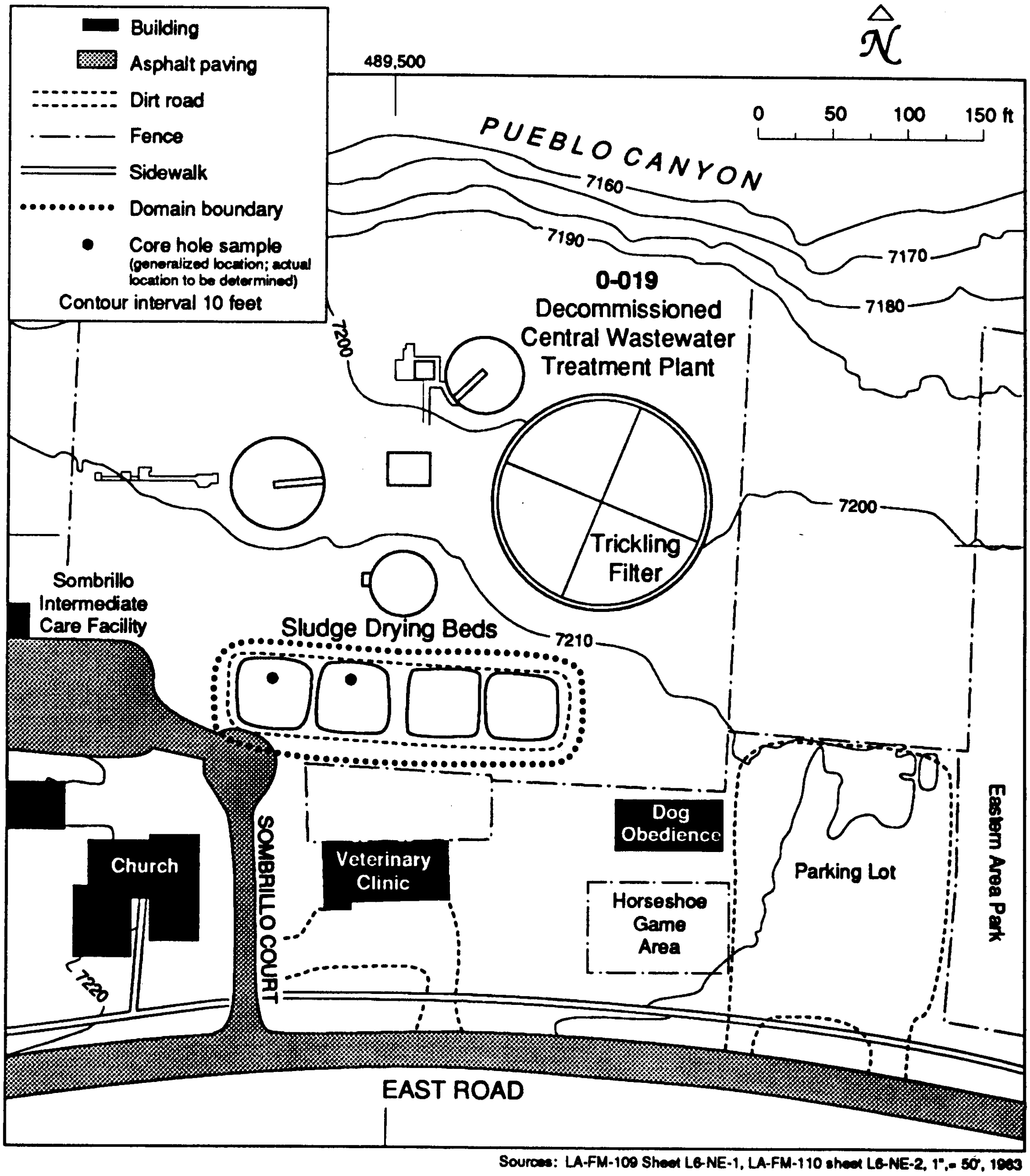


Figure 5-25. Sampling locations in SWMU 0-019 (Decommissioned Central Wastewater Treatment Plant).

- determining as accurately as possible the locations and boundaries of former and current sludge-drying beds, sludge storage areas, and sludge fill areas associated with SWMUs 0-018(a and b) and 0-019, using field surveys and Level I, data and

- using Level III/IV data to determine the presence or absence of and, if present, the nature and concentrations of, any contaminants in site media or potential release areas, including sludge material and tuff and/or alluvium beneath sludge-drying beds, sludge fill areas, or sludge storage areas.

The emphasis of the Phase I field sampling plan is to characterize the older sludge deposits because recent sludges have been subject to permit restrictions and analysis. A site survey will be used to help locate and define the boundaries of the current and former sludge-drying beds, fill, and storage areas. Subsurface core samples from the sludge areas will be screened for organic vapor and gross alpha, beta, and gamma radiation to determine whether organic or radionuclide contamination is present. All samples for which the screening results are above background and 50% of the remaining samples will be submitted for Level III/IV laboratory analysis. The laboratory data will be compared with conservative health-risk-based action levels at SWMU 0-019 and with current permit standards at SWMUs 0-018(a and b). If contaminant concentrations are at or below action levels, no further field investigations will be conducted.

If the results of laboratory analysis of samples collected in Phase I indicate that contaminant concentrations are above action levels, the necessity and possible scope of Phase II field sampling will be evaluated. Based on current knowledge of past activities at these SWMUs, it is not expected that contaminants will be encountered above action level concentrations. Accordingly, no detailed Phase II sampling plans have been developed. However, should Phase II investigations be necessary, the following types of data would be collected:

- data from additional source characterization to determine the lateral and vertical extent of contamination in soil, alluvium, tuff, channel sediments, and effluent discharge and run-off and

- transport characteristics of specific contaminants in soil, alluvium, tuff, and channel sediments.

These data, if collected, would be used to provide a complete characterization of the nature and extent of contaminant releases, to perform a baseline risk assessment, and, if necessary, to provide a data base for designing and implementing corrective measures.

5.6.5.2 Environmental Setting

No additional data are required to characterize the environmental setting of SWMU Group 0-2 in Phase I investigations.

5.6.5.3 Potential Receptors

No specific information regarding the activities, behavior, or location of actual receptors is required for the Phase I investigation. In the event that a Phase II investigation is required, the following information regarding the potential receptors identified in the conceptual model (Subsection 5.6.3) may be required:

- the frequency and duration of site visits,
- the location of on-site workers relative to source(s), and
- the type of housing (e.g., apartments, single-family houses) that might be built on the site (the site of the decommissioned Central Wastewater Treatment Plant only). In the event that the estimated risks to a future site resident are considered unacceptable, a more detailed demographic survey may be required.

5.6.6 Field Sampling Plan

The field work in Phase I, Stage I, investigations of the wastewater treatment plants (SWMU Group 0-2) will be completed in two tasks: field survey and subsurface sampling, which are described in the following subsections. All field work will be performed in accordance with applicable ER Program SOPs.

5.6.6.1 Task 1—Field Survey

5.6.6.1.1 Activity 1—Site Survey

A site survey will be conducted to locate the boundaries of the former and current sludge-drying areas and sludge storage and fill areas. Boundary locations will be determined by examining historic aerial photographs, reviewing records, including maps and engineering plans, and by performing visual inspection. A detailed site map will be prepared for each SWMU on a scale of 1:1000. Part of the mapping task will also include determining the relative ages of the sludge-drying beds and the order of filling in areas in which sludge was used as landfill.

5.6.6.2 Task 2—Subsurface Sampling

Task 2 will consist of coring sludge-drying beds and coring sludge fill areas.

5.6.6.2.1 Activity 1—Coring at Sludge-Drying Beds

Subsurface samples will be collected from cores drilled in the oldest sludge-drying beds at each treatment plant. One core hole will be drilled at each of the two oldest sludge-drying beds at each SWMU (Figures 5-23, 2-24, and 5-25). Each core will penetrate the fill material in these beds to the contact with native material (alluvium or tuff) and will be continuously screened for gross alpha, beta, and gamma radiation. Photoionization and flame ionization detectors will be used to screen organic vapor.

Four samples will be collected from each core hole: three at intervals in the sludge material and one from the uppermost layer of tuff and alluvium. Samples from the fill material will be collected at intervals at which field screening indicates the presence of organic vapors or radionuclides, if such exist, or else at three regularly spaced intervals. One sample will be collected in the uppermost layer of tuff and alluvium and screened. If field screening indicates the presence of organic vapors or radionuclides in this bottom sample, coring will continue into native material, field-screening samples at 5-ft intervals. At a point 5 ft below the last positive field screen response, a final sample will be collected. Cores will be drilled following the procedures described in LANL-ER-SOP-04.01, Drilling Methods and Drill Site Management. All samples, including one field duplicate, will be analyzed as indicated in Figure 5-26.

5.6.6.2.2 Activity 2—Coring at Sludge Fill Areas

At each treatment plant, subsurface samples will be collected from cores drilled in areas in which sludge has previously been stored or used as landfill. Four core holes will be drilled at regularly spaced locations in each sludge disposal site (Figures 5-23, 5-24, 5-25). Each core will penetrate the sludge material to the contact with native material (alluvium or tuff) and will be continuously screened for gross alpha, beta, and gamma radiation. Photoionization and flame ionization detectors will be used to screen organic vapor. Four samples will be collected from each core hole: three from intervals in the sludge and one from the uppermost tuff/alluvium interval. Samples from the sludge will be collected at intervals at which field screening indicates the presence of organic vapors or radionuclides, if such exists, or else at three regularly spaced intervals. One sample will be collected in the uppermost layer of tuff and alluvium and screened. If field screening indicates the presence of organic vapors or radionuclides in this bottom sample, coring will continue into native material, field screening samples at 5-ft intervals. At a point 5 ft below the last positive field screen response, a final sample will be collected. Cores will be drilled following the procedures described in LANL-ER-SOP-04.01, Drilling Methods and Drill Site Management. All samples that indicate a positive screen response and 50% of the remaining samples will be analyzed as indicated in Figure 5-26.

Sample Location	No. of Samples	Sample Description	Field Surveys				Field Screening (Level I)				Laboratory Analysis (Level III/IV) — Number of samples analyzed depends on results of field screening and/or field survey. * =50%, + =30%														
			Site Survey/Mapping	Geophysical Survey (Level I)	Soil Gas Survey (Level I/II)	Gross Alpha, Beta, Gamma (Level I)	Lithologic Logging	Combustible Gas/Oxygen	Organic Vapor	Gross Alpha, Beta, Gamma	Gamma Spectrometry	^{3}H	Total U (^{234}U, ^{236}U)	^{238}Pu, $^{239/240}Pu$	^{90}Sr	^{137}Cs	^{241}Am	^{60}Co	Volatile Organics (VOA) (SW 8240)	BTEX (SW 8020)	Semivolatile Organics (BNA) (SW 8270)	TPH(418.1)	Target Analyte List Metals	TCLP Metals	PCB and Pesticides (SW 8080)
0-018(a)	9-11	Core samples from sludge drying beds	●				●	●	●	●	●	●	●			●			●		●		●		●
0-018(a)	17-21	Core samples from sludge fill areas	●				●	●	●	●	*	*	*			*			*		*		*		*
0-018(b)	9-11	Core samples from sludge drying beds	●				●	●	●	●	●	●	●			●			●		●		●		●
0-018(b)	17-21	Core samples from sludge fill areas	●				●	●	●	●	*	*	*			*			*		*		*		*
0-019	9-11	Core samples from sludge drying beds	●				●	●	●	●	●	●	●			●			●		●		●		●

Figure 5-26. Screening and analysis for initial investigations at SWMU Group 0-2.

5.7 SWMU Aggregate 0-F (DP Road Storage Area)

SWMU Aggregate 0-F includes SWMU 0-027, DP Road storage area, and SWMU 0-030(a), septic tank. The SWMUs in Aggregate 0-F are located on private property (Figure 3-2).

5.7.1 Description and History

The former DP Road storage area (SWMU 0-027), located at the intersection of Trinity Drive and DP Road (currently the site of the Knights of Columbus Hall), was used as a tank farm and storage area for drums (LANL 1990, 0145). Engineering drawings indicate that the tank storage area was converted to a drum-staging area in 1948 and was used as such for an unknown period (The Zia Company 1948, 05-0134; The Zia Company 1948, 05-0135). Metal drums containing lubricants were staged in this area for redistribution to job sites and craft shops (Francis 1991, 05-0038).

The SWMU report (LANL 1990, 0145) states that

> The drum storage area consisted of 6 compartments, each about 38 feet wide, and separated by 2-foot high earthen dikes around the northern perimeter, and a concrete berm at the southern perimeter. The floors of the compartments were covered by 2 inches of gravel and were sloped to the north.

An iron drainpipe ran under the storage area. It is not known whether the drainpipe has been removed.

Aerial photographs and engineering drawings indicate that eight aboveground oil storage tanks and fill stations were located in this area before 1948. The oil storage tanks, which were probably used in conjunction with the fill stations, were decommissioned and removed before 1948 and before the construction of the drum-staging area (The Zia Company 1947, 05-0132; LANL 1990, 0145).

A septic tank [SWMU 0-030(a)] is located north of DP Road near its intersection with Trinity Drive in the vicinity of the Knights of Columbus Hall. The septic tank served the fuel dispatch office. A 4-in. VCP drained the waste from the building to the septic tank (The Zia Company 1948, 05-0134).

Information on environmental surveys for SWMU 0-027 is not available.

5.7.2 Nature and Extent of Contamination

5.7.2.1 Description and Contamination Levels

It is possible that petroleum products have contaminated the soil and tuff at SWMU Aggregate 0-F as the result of leakage from storage tanks, drums, or drainlines and that contaminants have been transported off the site via the drainlines. The SWMU aggregate also includes a septic system [SWMU 0-030(a)] intended for sanitary waste. The outfalls for the drainlines both in the drum storage area and the sanitary

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waste system apparently discharged into DP Canyon. No environmental surveys have been conducted in this area.

5.7.2.2 Potential Migration Pathways

As a result of releases from the sources listed in Subsection 5.7.2.1, contaminants may be present in the soil, tuff, and/or air. Contaminants in the soil may leach/disperse through the vadose zone, be entrained by surface water and transported downstream by surface water run-off, or be entrained by wind and transported off the site. Contaminants present in the tuff may leach/disperse through the vadose zone.

5.7.2.3 Potential Public Health and Environmental Impacts

Based on the migration pathways described in Subsection 5.7.2.2, contaminants may currently be present in SWMU Aggregate 0-F or may migrate to the soil or air. As a result, human exposure to contaminants may occur through inhalation of suspended particulates, through incidental ingestion, or through dermal contact with soil. Direct contact with soil on the mesatop could only occur through significant disturbance of the soil and asphalt (e.g., digging).

5.7.3 Conceptual Models

Figure 5-27 presents the conceptual model for potential contaminant releases from the septic system, drums, and fuel oil tanks and subsequent exposure to the potential receptors identified in Subsection 5.7.2.3. In Figure 5-27, "site visitors" refers to people who use the Knights of Columbus facility, "off-site workers" refers to people working in nearby buildings, and "on-site workers" refers to people who may be hired to do construction work on the site (which would disturb the soil and/or tuff) some time in the future.

5.7.4 Decisions, Domain, and Approach

This SWMU aggregate includes the area surrounding the former tank storage area and the associated drainpiping, a septic tank and drainline, the outfalls into DP Canyon, and the channels below (Figure 5-28). The sites are located on land now owned by the Knights of Columbus, and the goal of the RCRA process is to ensure that the property is suitable for unrestricted use. Remedial action will be proposed as necessary to clean the site to meet health-risk-based media cleanup standards for residential use.

Because there is no evidence of residual contamination within this domain, Phase I will consist of Stage I investigations to determine whether any source of contamination is present. The septic systems will be investigated according to the procedures outlined in Subsection 2.3.4. Further decisions will be based on analytical measurements from samples of soil and tuff from the excavation below the septic tank, from sediments in the channels below the outfalls, from cores in the former storage area, and from any other areas suggested by the results of a soil gas survey.

Stage I data will be compared with action levels for soils, sediments, and tuff to determine whether contamination is present at any of these sites. In the absence

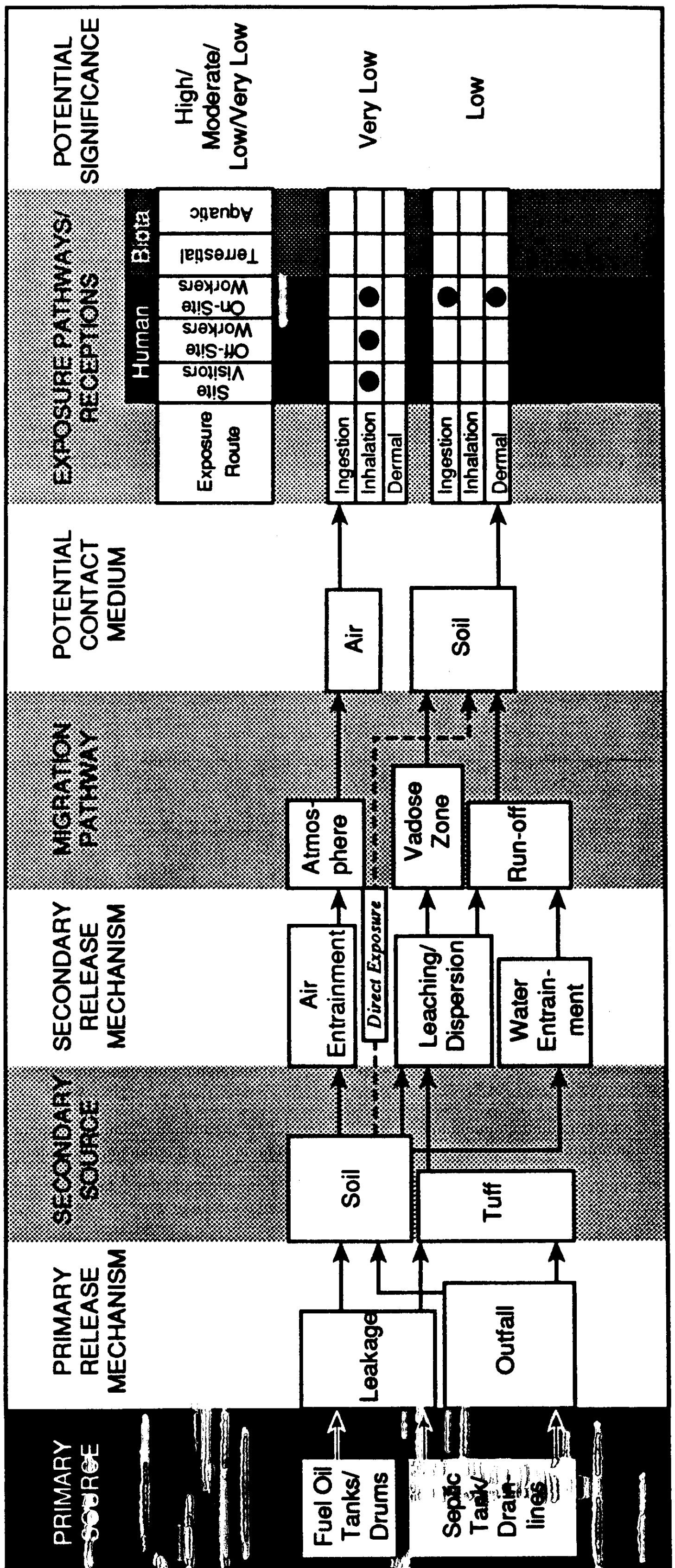


Figure 5-27. Conceptual model of SWMU Aggregate 0-F.

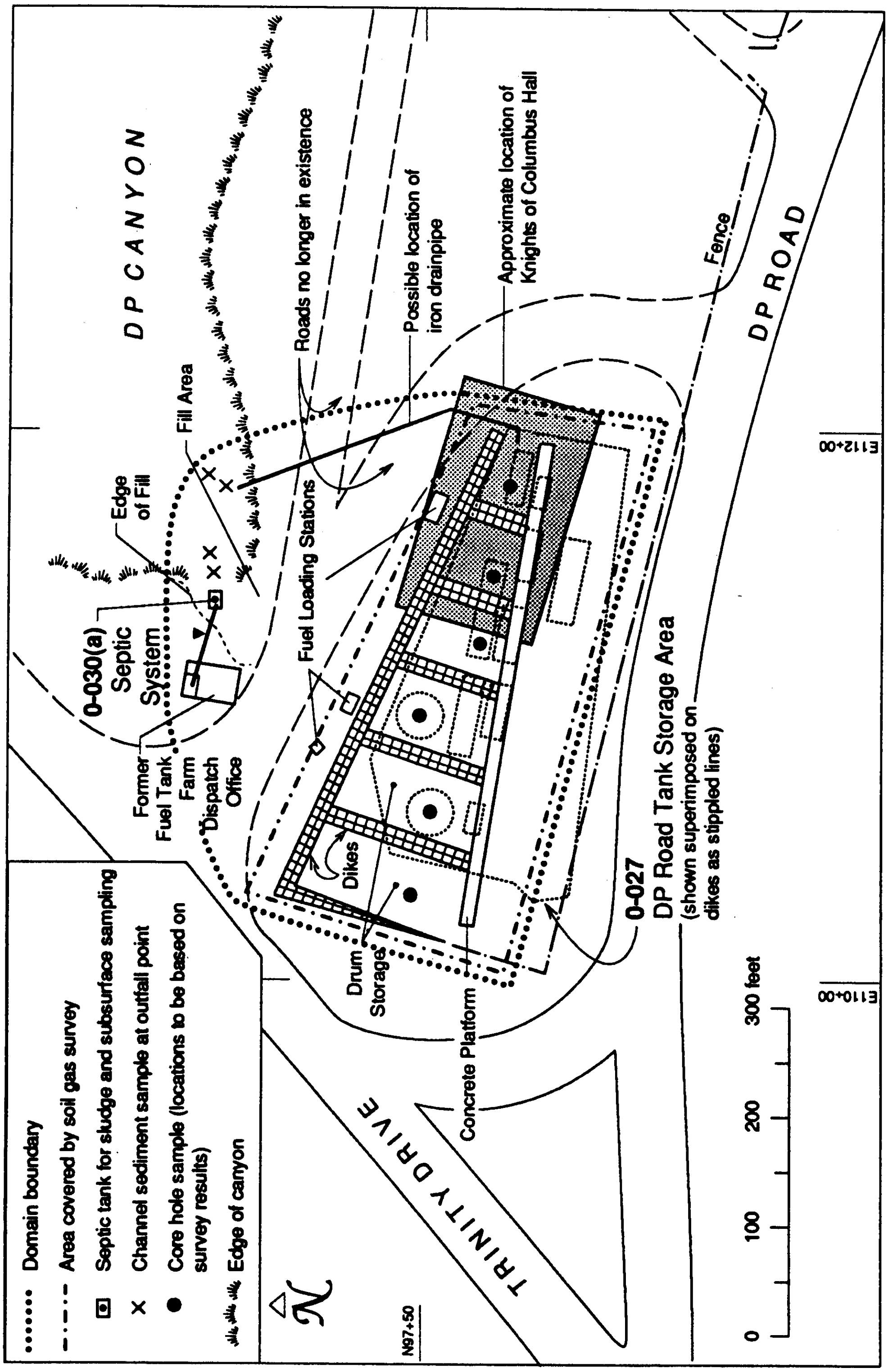


Figure 5-28. Sampling locations at DP Road Storage Area (SWMU Aggregate 0-F). Dikes enclose areas in which drums are stored.

of contamination, no further action will be proposed at SWMU Aggregate 0-F. If levels above action levels are observed, Phase II, Stage II, investigations may be required to support a baseline risk assessment and CMS.

5.7.5 Data Required

5.7.5.1 Source Characterization

Specific data requirements for source characterization in Phase I investigations include

- using field surveys and Level I data to determine as accurately as possible the locations, boundaries, or geometries of the septic system tank, drainline, and outfall point associated with SWMU 0-030(a) and of the iron drainpipe and outfall associated with SWMU 0-027;
- determining the presence or absence of vapor phase contaminants in the shallow soil or fill material at the former tank and drum storage area; and
- using Level III/IV data to determine the presence or absence of and, if present, the nature and concentrations of, any contaminants in site media or potential release areas, including material from the septic tank, channel sediments at the outfall points of the septic drain and storage area drain, and soil and/or tuff at the former tank and drum storage area.

Field surveys and field screening for organic vapors will play an integral role in the field investigation of this SWMU aggregate. Site and geophysical surveys will be used to help locate outfalls and buried structures. A soil gas survey will be used to determine whether elevated concentrations of benzene, toluene, ethylbenzene, and/or xylene (BTEX) are present in shallow soil or fill material at the former tank and drum storage area and to provide Level II/III data to guide selection of sampling sites. Field-screening samples will help determine the presence of contamination and which samples to submit for laboratory analysis. All samples with a positive field screen response and 50% of the remaining samples will be submitted for laboratory analysis.

If the results of Phase I sampling indicate that contaminant concentrations are above action levels, the necessity and possible scope of Phase II field sampling will be evaluated. Based on current knowledge of past activities at these SWMU sites, it is not expected that contaminants will be encountered above action level concentrations; accordingly, no detailed Phase II sampling plans have been developed. However, should Phase II investigations be necessary, additional site characterization data may be collected to determine the lateral and vertical extent of contamination, to perform a baseline risk assessment, and, if necessary, to provide a data base for designing and implementing corrective measures.

5.7.5.2 Environmental Setting

Data are required to adequately characterize the environmental setting of SWMU Aggregate 0-F. Specific data required in Phase I investigations include a map of the first-order stream channel(s), including sediment catchment sites, that originate at or transect the outfall point of the septic system and the outfall of the storage area drain (if any). The map will be limited to domain boundaries and will be used to select sites for sampling channel sediments.

A map of surface water drainages that originate at or transect outfall points is required so that sampling sites for channel sediments can be selected. If contaminants were present at and/or were released from the septic system or the storage area drain, it is probable that they will be detectable in sediments at the outfall points.

5.7.5.3 Potential Receptors

No specific information regarding the activities, behavior, or location of actual receptors is required for the Phase I investigation. In the event that a Phase II investigation is required, the following information regarding the potential receptors identified in the conceptual model (Figure 5-27) may be required:

- frequency and duration of site visits and
- location of workers, both on and off the site, relative to sources located in the SWMU aggregate.

5.7.6 Field Sampling Plan

The field work in the Phase I, Stage I, investigations of SWMU Aggregate 0-F will be completed in three tasks: field surveys, surface sampling, and subsurface sampling, which are described in the following subsections. All field work will be performed in accordance with applicable ER Program SOPs.

5.7.6.1 Task 1—Field Surveys

Four surveys will be performed in Task 1: (1) site survey, (2) geophysical surveys, (3) geomorphologic mapping, and (4) soil gas survey.

5.7.6.1.1 Activity 1—Site Survey

A site survey will be conducted to determine the locations of the buried structures associated with the septic system and storage area drainline and their outfall points. These locations will be determined by examining historic aerial photographs, by reviewing records, including maps and engineering plans, and by performing visual inspections.

5.7.6.1.2 Activity 2—Geophysical Surveys

If the site survey does not provide sufficiently detailed information on the location of buried structures, geophysical surveys will be conducted to more precisely define the boundaries and subsurface geometries of the septic tanks and drainlines. A magnetic survey will be performed with appropriate spacing to ensure full resolution of large metallic objects and metallic components in the tanks' construction. An EMC survey will be conducted to further define buried features. If necessary, ground-penetrating radar may be used to supplement the magnetic and EMC surveys. Once located, the sites will be marked in the field.

5.7.6.1.3 Activity 3—Geomorphologic Mapping

First-order stream channels within the domain of SWMU Aggregate 0-F originating at or transecting the drain outfall of SWMU 0-030(a) and the iron drainpipe of SWMU 0-027 will be located and mapped to determine sites for sampling channel sediments below the outfall points. This activity will locate all sediment catchment sites in the relevant drainages. Mapping will be completed on a scale of 1:2000.

5.7.6.1.4 Activity 4—Soil Gas Survey

A soil gas survey will be conducted on the mesatop in the vicinity of the tank and drum storage area (Figure 5-28). A 50-ft grid will be used over the entire domain, and a finer 25-ft grid will be used over the area enclosed by the berms. Soil gas samples will be collected at each grid node from a depth of 6 ft using a stainless steel sample tube driven into the soil or fill surface. In addition, soil gas samples will be taken at any location at which visual evidence (soil staining, odors, etc.) suggests that contamination exists. Analytes will include benzene, toluene, ethylbenzene, and xylene.

5.7.6.2 Task 2—Surface Sampling

Task 2 will consist of sampling channel sediments from catchments beneath outfall points.

5.7.6.2.1 Activity 1—Sampling Channel Sediments at Outfall Points

Three sediment samples will be taken from sediment catchments in first- or higher-order drainage channels that have developed downslope of the outfalls associated with the septic system drains and the tank and drum storage area drain. These samples will be taken as close to the outfall points as possible. If no distinct drainage channels are discernible, samples will be collected from likely sediment catchment areas adjacent to the outfall points, using the procedures described in LANL-ER-SOP-06.14, Sediment Material Collection. A total of seven channel sediment samples, including one field duplicate, will be screened and analyzed as indicated in Figure 5-29.

5.7.6.3 Task 3—Subsurface Sampling

Task 3 will consist of three activities: (1) sampling the septic tank system, including associated drainline(s); (2) sampling beneath the iron drainpipe in the storage area; and (3) coring in the tank and drum storage area at points of potential residual fuel contamination.

5.7.6.3.1 Activity 1—Sampling in the Septic Tank System Area

Sampling the septic tank system area will proceed as described in Subsection 2.3.4.1. Samples will be analyzed as indicated in Figure 5-29.

5.7.6.3.2 Activity 2—Sampling Beneath the Storage Area Drain

Preparing the area surrounding the storage area drainline for sampling will consist of excavating the overburden around the line. Three subsurface samples will be collected from the material lying beneath the drainpipe at joints or areas of obvious staining. The samples will be collected following the procedures described in LANL-ER-SOP-06.09, Space and Scoop Method for Collection of Soil Samples and will be screened and analyzed as indicated in Figure 5-29.

5.7.6.3.3 Activity 3—Coring at the Tank and Drum Storage Area

Subsurface samples will be collected from cores drilled in the tank and drum storage area at locations to be determined by the results of the site and soil gas surveys. Six core holes, one in each bermed compartment, will be drilled at the storage area. The cores will penetrate the soil or fill material to the contact with native tuff and will be continuously screened for organic vapor. Two samples will be collected from each core hole: one from an interval within the soil or fill and a second from the uppermost tuff layer. The samples from the overburden will be collected in an interval for which field screening indicates the presence of organic vapors, if such exists. If field screening indicates the presence of organic vapors in the uppermost tuff layer, coring will continue into the tuff with field screening of samples at 5-ft intervals. At a point 5 ft below the last positive field screen response, a final sample will be collected. If field-screening the sample from the uppermost layer of tuff does not indicate the presence of contamination, coring will be terminated. Cores will be drilled following the procedures described in LANL-ER-SOP-04.01, Drilling Methods and Drill Site Management. All samples that indicate a positive screen response and 50% of the remaining samples will be analyzed as indicated in Figure 5-29.

Sample Location	No. of Samples	Sample Description	Field Surveys: Site Survey/Mapping	Field Surveys: Geophysical Survey (Level I)	Field Surveys: Soil Gas Survey (LevelII/III)	Field Surveys: Gross Alpha, Beta, Gamma (Level I)	Field Screening (Level I): Lithologic Logging	Field Screening (Level I): Combustible Gas/Oxygen	Field Screening (Level I): Organic Vapor	Field Screening (Level I): Gross Alpha, Beta, Gamma	Laboratory Analysis (Level III/IV): Gamma Spectrometry	^{3}H	Total U (^{234}U, ^{236}U)	^{238}Pu, $^{239/240}Pu$	^{90}Sr	^{137}Cs	^{241}Am	^{60}Co	Volatile Organics (VOA) (SW 8240)	BTEX (SW 8020)	Semivolatile Organics (BNA) (SW 8270)	TPH(418.1)	Target Analyte List Metals	TCLP Metals	PCB and Pesticides (SW 8080)
0-027	3	Channel sediments below storage area drain outfall	•																•		•	•	•		•
0-030(a)	4	Channel sediments below septic drain outfall	•																•		•	•	•		•
0-030(a)	4	Tank sludge and subsurface materials below tank/line	•	•					•										•		•	•	•		•
0-027	3	Subsurface materials below iron drain pipe	•	•					•										•		•	•	•		•
0-027	12-18	Core samples from tank/drum storage area	•		•		•		•										*		*	*	*		*

Number of samples analyzed depends on results of field screening and/or field survey. * =50%, + =30%

Figure 5-29. Screening and analysis for initial investigations at SWMU Aggregate 0-F.

5.8 SWMU Aggregate 0-E (Los Alamos County Recreation Areas)

SWMU Aggregate 0-E includes SWMU 0-028(a), the Los Alamos County Golf Course, and SWMU 0-028(b), North Mesa athletic fields. The SWMUs in Aggregate 0-E are located on Los Alamos County property (Figure 3-4).

5.8.1 Description and History

The Los Alamos County Golf Course was irrigated with effluent from the former Central Wastewater Treatment Plant (SWMU 0-019) from 1948 until about 1964 and by the Pueblo Wastewater Treatment Plant [SWMU 0-018(b)] from June 1951 until the present (The Zia Company circa 1960, 05-0133; LANL 1990, 0145; IT Corporation 1991, 05-0149). The North Mesa ball fields may have been watered by effluent from the Pueblo plant beginning in about 1952 (The Zia Company circa 1960, 05-0133); however, there is no documentation to verify this possibility. Information on environmental surveys for SWMUs 0-028(a and b) is not available.

5.8.2 Nature and Extent of Contamination

5.8.2.1 Description and Contamination Levels

Although these plants were intended to handle only sanitary waste, small but detectable levels of radiation and chemical wastes have been observed in their effluents (Subsection 5.6.2.1). The contaminant concentrations in these effluents may constitute a release, particularly from the older effluent. No environmental surveys are known to have been conducted.

5.8.2.2 Potential Migration Pathways

Any contaminants in the effluent from the Pueblo Canyon and decommissioned Central wastewater treatment plants may have been released to the environment via percolation or run-off after the effluent was used as irrigation water at the golf course or the North Mesa athletic fields. As a result, contaminants may be present in the soil and/or tuff. Contaminants in the soil may leach/disperse through the vadose zone or be entrained by surface water and transported downstream by run-off. The contaminants present in tuff may leach/disperse through the vadose zone.

5.8.2.3 Potential Public Health and Environmental Impacts

Based on the migration pathways described in Subsection 5.8.2.2, it is possible that contaminants are currently present in or may migrate to the soil. As a result, human exposure to contaminants from this SWMU aggregate may occur through incidental ingestion or dermal contact with soil. Additionally, terrestrial animals may be exposed to site contaminants via incidental ingestion and dermal contact with the soil.

5.8.3 Conceptual Models

Figure 5-30 presents the conceptual model for potential contaminant releases from the golf course and North Mesa athletic fields and subsequent exposure to the potential receptors identified in Subsection 5.8.2.3. In Figure 5-30, "on-site workers" refers to employees at both recreational areas, and "site visitors" refers to people who may use one or both. Terrestrial animals in the vicinity of both recreational areas may also be impacted.

5.8.4 Decisions, Domain, and Approach

The domain of this SWMU aggregate includes the irrigated parts of the two recreational areas (Figures 5-31 and 5-32). The goal of the RCRA process is to ensure that these sites are suitable for unrestricted use. Remedial action will be proposed as necessary to clean the sites to meet health-risk-based media cleanup standards for visitors.

Because there is no evidence of residual contamination in this domain, Phase I will consist of Stage I investigations to determine whether any source of contamination is present. This decision will be based on analytical data from samples collected throughout the SWMU domain from the surface down to the soil/tuff interface. Contamination can be expected to be uniformly distributed in the area, although it may have concentrated in run-off channels or have percolated through the surface after years of irrigation. Because the use of effluent from the Central Wastewater Treatment Plant ended in the 1960s, any contaminants spread on the fields during irrigation of these recreation areas may now be well below the surface, making subsurface sampling necessary. Moreover, because the golf course was never watered all at once, it is possible that contaminants vary from one part of it to another. Therefore, not as many samples will be collected as would be collected if the entire golf course had been watered by effluent containing the same contaminants.

Stage I data will be compared with action levels for soils to determine whether contamination is present at any of these sites. In the absence of contamination, no further action will be proposed at SWMU Aggregate 0-E. If contamination exceeds action levels, Phase II investigations of the extent of contamination may be required to support a baseline risk assessment and CMS.

5.8.5 Data Required

5.8.5.1 Source Characterization

Specific data requirements for source characterization in Phase I investigations include

- using field surveys and Level I data to determine the location and construction of the former irrigation network, including sprinkler lines and heads, associated with the Central Wastewater Treatment Plant, and
- using Level III/IV data to determine the presence or absence of, and, if present, the nature and concentration levels of,

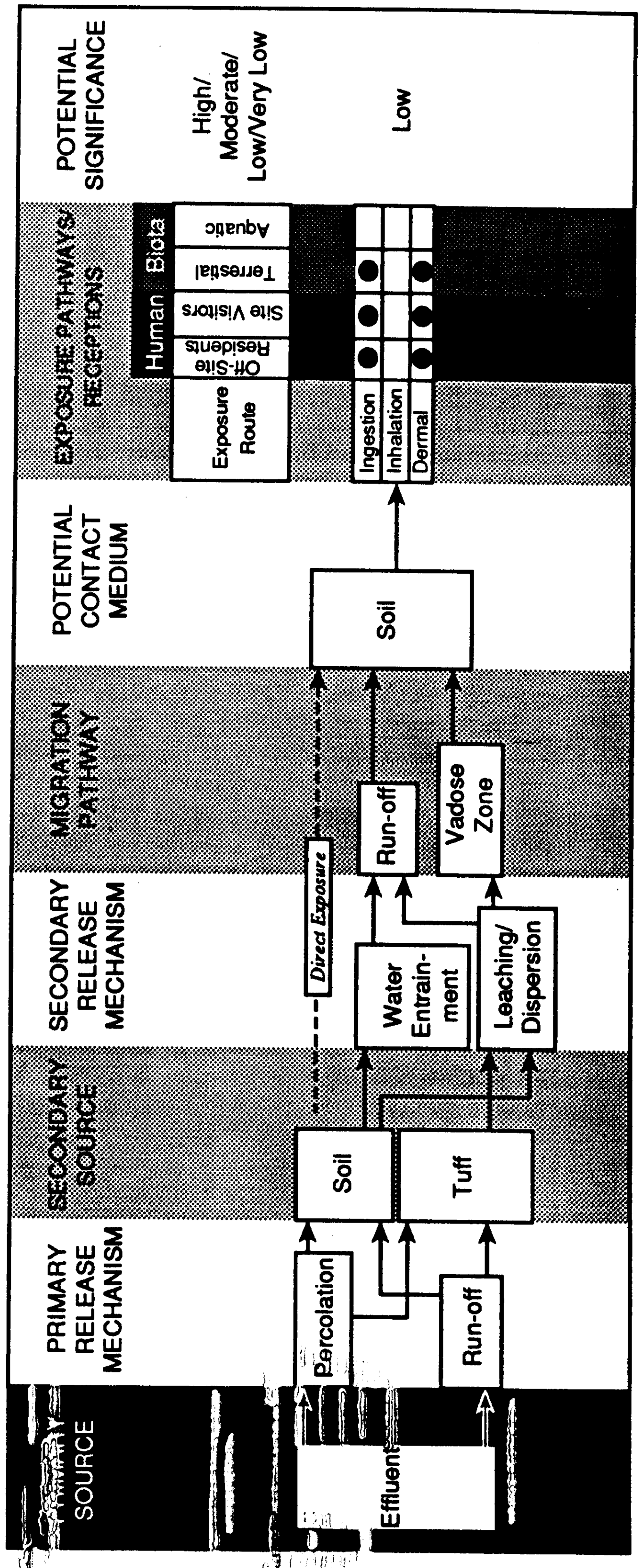
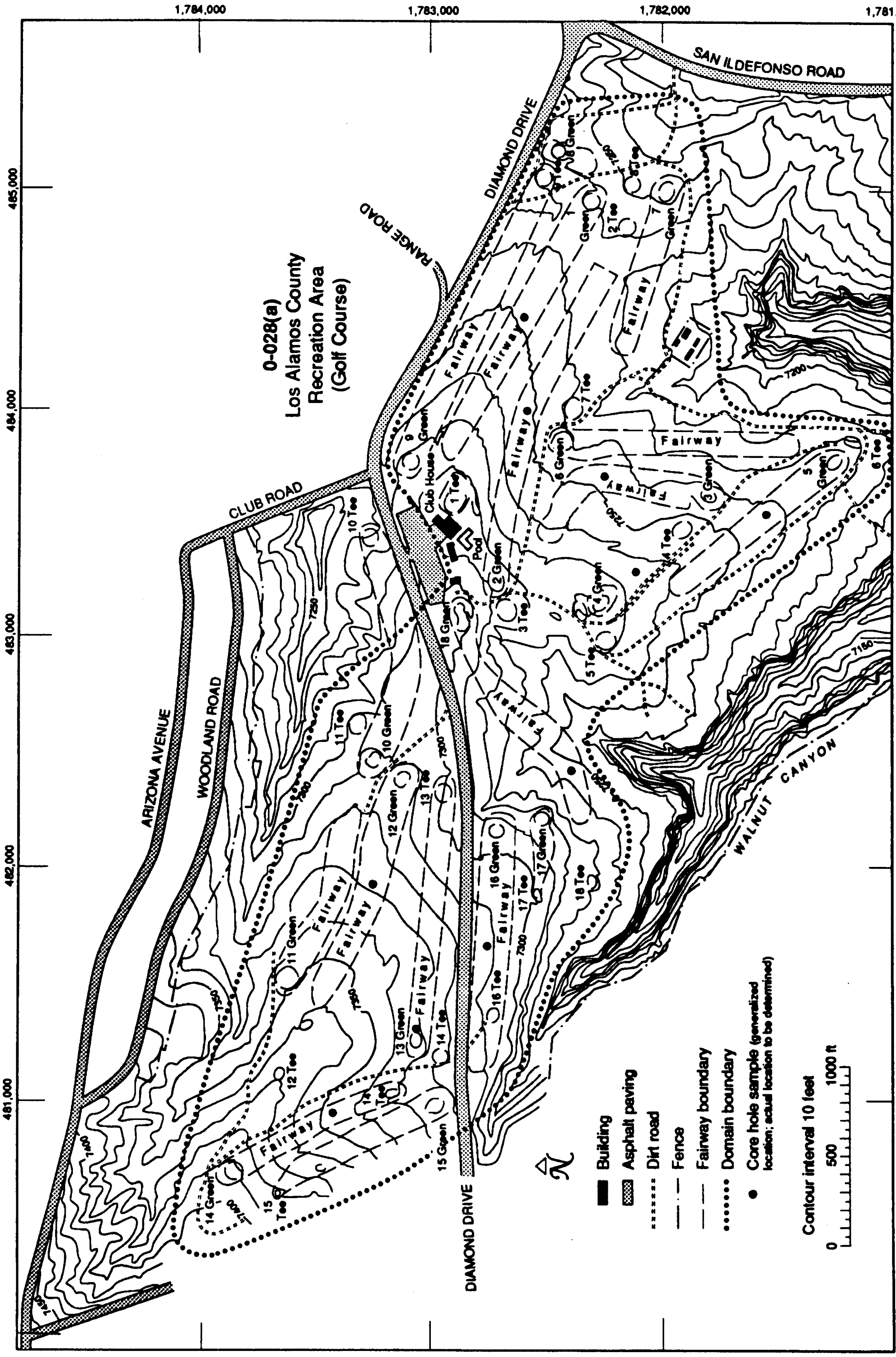
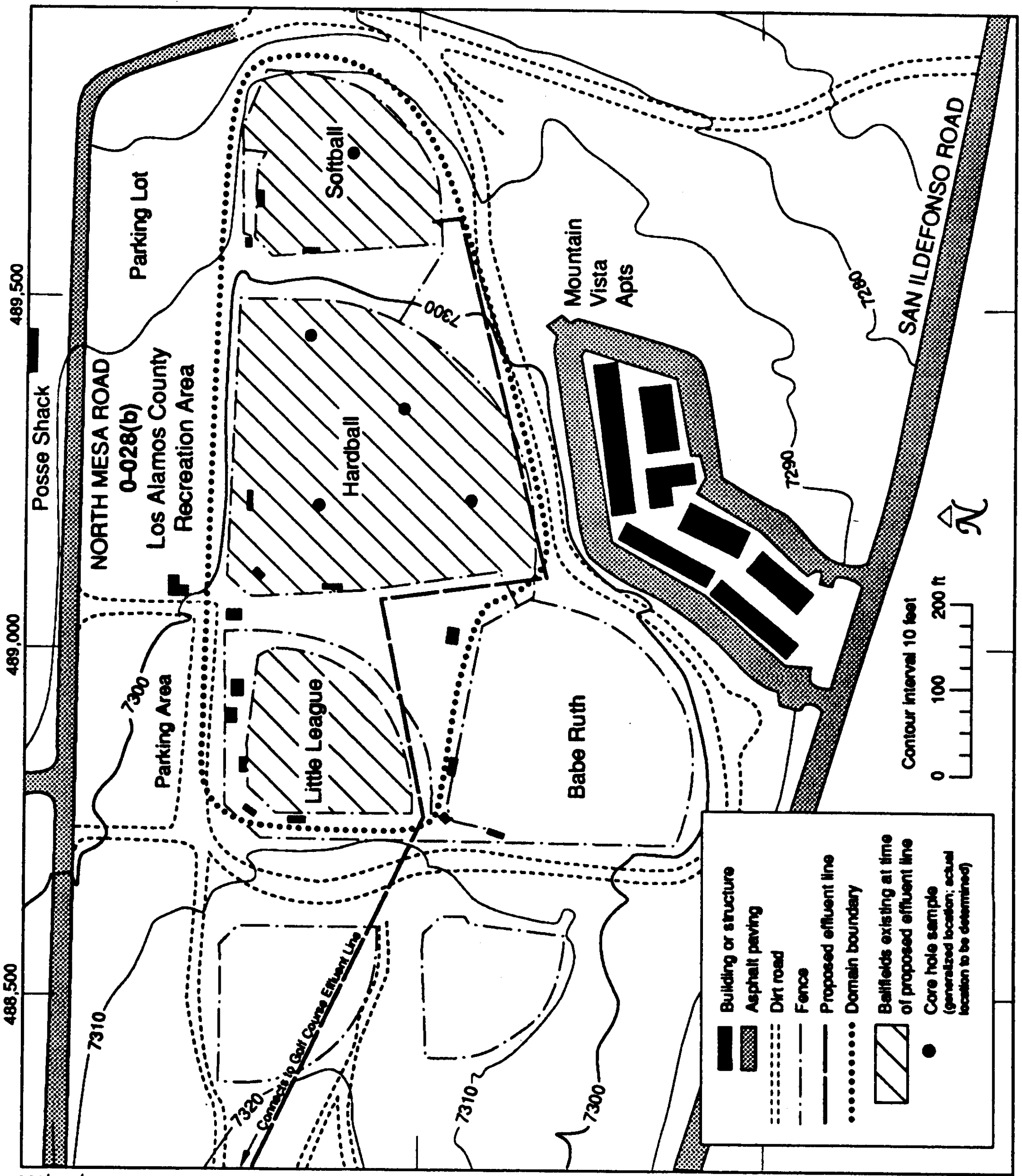


Figure 5-30. Conceptual model of SWMU Aggregate 0-E.



Sources: LA-FM-28 Sheet N5 NW, LA-FM-29 Sheet N5 NE, LA-FM-35 Sheet N5-SE, LA-FM-36 Sheet N6-SW, Scale 1" = 100', 1963

Figure 5-31. Sampling locations at Los Alamos County Golf Course [SWMU 0-028(a)].



Sources: Bohannan Huston, Inc., County of Los Alamos, New Mexico, Topographic Map 803, Scale 1" = 100' (1:1200), flown 1986; Zia Company, ca. 1952, Z-850 Proposed Effluent Water Line Alignment to Baseball Fields, N. Mesa

Figure 5-32. Sampling locations at North Mesa athletic fields [SWMU 0-028(b)].

contaminants present in site media or potential release areas, including irrigated soil and turf in irrigated areas.

It is expected that any residual metals or radionuclides that may exist at the recreation areas will be attenuated as they pass through the soil; accordingly Phase I, Stage I, sampling will concentrate on obtaining Level III/IV data from the surface and shallow subsurface material. All surface and subsurface samples will be screened for gross alpha, beta, and gamma radiation to determine whether radionuclides are present. All samples for which screening indicates that contamination is present above action levels and 30% of the remaining samples will be submitted for Level III/IV analysis of specific contaminants (Subsection 5.8.6). The laboratory data will be compared with action level concentrations, and if contaminants are at or below background, no further field investigations will be conducted.

If the Level III/IV results of Phase I sampling indicate that contaminant concentrations are above action levels, the necessity and possible scope of additional Phase II field sampling will be evaluated. Based on current knowledge of past activities at these SWMU sites, it is not expected that contaminants will be encountered above action level concentrations; accordingly, no detailed Phase II sampling plans have been developed. However, should Phase II investigations be necessary, additional source characterization data will be collected to determine the lateral and vertical extent of contamination, to perform a baseline risk assessment, and, if necessary, to provide a data base for designing and implementing corrective measures.

5.8.5.2 Environmental Setting

No additional data are required to characterize the environmental setting of SWMU Aggregate 0-E in Phase I investigations. If Phase II investigations are necessary, the information required may include detailed hydrogeologic and geologic characterization of subsurface soil and tuff and a detailed surface water and channel sediment study. These data, if collected, would be used to perform transport modeling and analysis of risk associated with release and migration of contaminants and to design and implement corrective measures.

5.8.5.3 Potential Receptors

No specific information regarding the activities, behavior, or location of actual receptors is required for the Phase I investigation. In the event that a Phase II investigation is required, the following information regarding the potential receptors identified in the conceptual model (Subsection 5.8.3) may be required:

- the location of site workers relative to source area(s) and
- the frequency and duration of visits to each recreational facility.

5.8.6 Field Sampling Plan

The field work in Phase I, Stage I, investigations of SWMU Aggregate 0-E will be completed in two tasks: a field survey and a surface/near-surface sampling program, which are described in the following subsections. All field work will be performed in accordance with applicable ER Program SOPs.

5.8.6.1 Task 1—Field Survey

5.8.6.1.1 Activity 1—Site Survey

A site survey will be conducted to delineate the sprinkler system network, including heads, lines, and joints, in existence between approximately 1948 and 1964, when the recreation areas were receiving effluent from the Central Wastewater Treatment Plant. The survey will include examining historic aerial photographs, reviewing records, including maps and engineering plans, and performing a visual inspection. Detailed site maps of the Los Alamos Golf Course and North Mesa Athletic Fields will be prepared on a scale of 1:1000, using a contour interval of 2 ft.

5.8.6.2 Task 2—Surface and Near-Surface Sampling

This task will examine the possibility that radionuclides and metal have contaminated surficial materials and will include sampling soil and tuff.

5.8.6.2.1 Activity 1—Surface and Near-Surface Sampling

Surface and near-surface samples will be collected from cores hand-augered at the golf course and athletic fields. Samples will be collected following the procedures described in LANL-ER-SOP-06.09, Spade and Scoop Method for Collection of Soil Samples. The purpose of this sampling is to confirm that no contamination is present in the soil; however, if field screening detects contamination during augering, additional samples will be collected to define the vertical extent of contamination.

Ten cores will be augered at the golf course and six at the ball fields (Figures 5-30 and 5-31). Core locations will be selected at random from the areas surrounding the sprinkler heads that received effluent from the Central Wastewater Treatment Plant. Each core will penetrate the surface material to the contact with native tuff and will be continuously screened for organic vapor and gross alpha, beta, and gamma radiation. Three samples will be collected from each core hole: one from the uppermost 6 in., a second from an interval midway through the soil or from an interval with a positive field screen response, and a third from the tuff contact. If field screening indicates the presence of organic vapors or radionuclides at the tuff contact, coring will continue into the tuff, field-screening samples at 5-ft intervals. At a point 5 ft below the last positive field screen response, a final sample will be collected. All samples that indicate a positive screen response and 30% of the remaining samples will be analyzed as indicated in Figure 5-33.

			Field Surveys				Field Screening (Level I)				Laboratory Analysis (Level III/IV)														
											Number of samples analyzed depends on results of field screening and/or field survey. * =50%, + =30%														
Sample Location	No. of Samples	Sample Description	Site Survey/Mapping	Geophysical Survey (Level I)	Soil Gas Survey (Level II/III)	Gross Alpha, Beta, Gamma (Level I)	Lithologic Logging	Combustible Gas/Oxygen	Organic Vapor	Gross Alpha, Beta, Gamma	Gamma Spectrometry	^{3}H	Total U (^{234}U, ^{238}U)	^{238}Pu, $^{239/240}Pu$	^{90}Sr	^{137}Cs	^{241}Am	^{60}Co	Volatile Organics (VOA) (SW 8240)	BTEX (SW 8020)	Semivolatile Organics (BNA) (SW 8270)	TPH(418.1)	Target Analyte List Metals	TCLP Metals	PCB and Pesticides (SW 8080)
0-028(a)	30	Surface and near-surface materials	•				•		•	•	+		+	+			+		+		+		+		+
0-028(b)	18	Surface and near-surface materials	•				•		•	•	+		+	+			+		+		+		+		+

Figure 5-33. Screening and analysis for initial investigations at SWMU Aggregate 0-E.

5.9 SWMU Aggregate 0-G (PCB Transformers)

SWMU Aggregate 0-G includes SWMU 0-029(a), Los Alamos Canyon Well #5; SWMU 0-029(b), Los Alamos Canyon Well #4; and SWMU 0-029(c), Guaje Canyon Well #1 (Figure 3-1). SWMUs 0-029(a and b) are located on the San Ildefonso Pueblo, and SWMU 0-029(c) is located on the Santa Fe National Forest (Figure 3-1).

5.9.1 Description and History

SWMU Aggregate 0-G consists of three former sites of polychlorinated biphenyl (PCB) transformers [SWMUs 0-029(a-c)] (Figure 3-1). Two of these sites are located in Los Alamos Canyon and the third in Guaje Canyon. PCB-contaminated oil from the transformers at these three sites may have been released to the environment (LANL 1990, 0145). SWMU 0-029(a) (Structure No. 00-1105) consisted of two transformers located adjacent to Los Alamos Canyon Well #5, east of the intersection of State Roads 4 and 502, just west of Totavi. Structure No. 00-1104 [SWMU 0-029(b)] consisted of three transformers located adjacent to Los Alamos Canyon Well #4, east of the intersection of State Roads 4 and 502. SWMU 0-029(c) (Structure No. 00-0234) consisted of a single transformer located near Guaje Canyon Well #1 (LANL 1989, 0445). The capacity of each of the six transformers was approximately 43 gal.

These transformers reportedly released some PCB-contaminated oil to the environment (LANL 1990, 0145). Oil samples from the transformers at Los Alamos Canyon Well #5 showed 162 and 292 ppm PCB. Oil samples containing 231, 206, and 362 ppm PCB were obtained from the three transformers located near Los Alamos Canyon Well #4. One transformer located near Guaje Canyon Well #1 yielded an oil sample that contained <50 ppm PCB (IT Corporation 1991, 05-0046). However, no data from surrounding media are available to confirm releases of PCB-contaminated oil to the environment.

Available records do not discuss the process used to decommission the transformers. The transformers located at SWMUs 0-029(a and b) were decommissioned on October 14, 1987, and SWMU 0-029(c) was decommissioned April 19, 1986 (LANL 1989, 0445; LANL 1990, 0145).

Los Alamos Well #4 was decommissioned in 1989, and the well house was removed (Aldrich 1991, 05-0157). Los Alamos Canyon Well #5 is no longer operational; its shaft has been removed. Its well house is scheduled for removal in 1992. Both wells will be capped and abandoned in 1993. The Guaje Canyon well is also slated for decommissioning in the next few years (Aldrich 1991, 05-0156).

5.9.2 Nature and Extent of Contamination

5.9.2.1 Description and Contamination Levels

Residual contamination may still be present at the well sites. The extent of possible contamination is unknown.

5.9.2.2 Potential Migration Pathways

PCBs may have been released to the environment as the result of leakage from the transformers at Guaje Canyon Well #1 and Los Alamos Canyon Wells #4 and #5; therefore, contaminants may be present in soil and/or channel sediments. Contaminants in soil and channel sediments may leach/disperse through the vadose zone or be entrained by surface water and transported downstream by surface water run-off.

5.9.2.3 Potential Public Health and Environmental Impacts

In the future-use scenario for this SWMU aggregate, LA Wells #4 and #5 will be plugged and abandoned, and the land will be returned to the San Ildefonso Pueblo. Guaje Well #1 will be decommissioned, and the land will be returned to the Forest Service. Based on the migration pathways described in Subsection 5.9.2.2, PCBs may be present in or may migrate to soil or channel sediments. As a result, human exposure to site contaminants may occur through incidental ingestion or dermal contact with soil and sediment. Additionally, terrestrial animals may be exposed to PCBs via incidental ingestion or dermal contact with both soil and channel sediments.

5.9.3 Conceptual Models

Figure 5-34 presents the conceptual model for potential contaminant releases from the former PCB transformers and subsequent exposure by the receptors identified in Subsection 5.9.2.3. In Figure 5-34, "off-site residents" refers to residents located in Totavi (likely closest downstream receptor), "site visitors" refers to people who may occasionally walk across the site(s), and "on-site workers" refers to workers who may need to enter the site(s) periodically to maintain the pump stations. Potential exposure of residents in Totavi to channel sediments will be addressed in the work plan for the canyons study (OU 1049). Terrestrial animals in the vicinity of and downstream from the former transformers may also be impacted.

5.9.4 Decisions, Domain, and Approach

The domains of this SWMU aggregate include the fenced areas around each of the three well sites (Figures 5-35 and 5-36). All of the transformers have been decommissioned, and the goal of the RCRA process is to ensure that residual contamination at these sites is, at a minimum, below action levels. Remedial action will be proposed as necessary to clean the sites to comply with regulatory standards and to meet the spirit of the pipeline easement agreement between the DOE and the San Ildefonso Pueblo. Because there is no evidence of residual contamination within the domains of this SWMU aggregate, Phase I will consist of Stage I investigations to determine whether any source of contamination is present. This decision will be based on analytical measurements of surface samples collected inside the fenced areas, including some samples from areas that are oil-stained, if any. If PCBs are observed above the action level, a Phase II investigation will obtain additional samples following sampling procedures in EPA's manual for grid sampling of PCB spill sites (EPA 1986, 0645) and from sediments in the channels below the sites for the purposes of characterizing the extent of the releases and supporting a CMS.

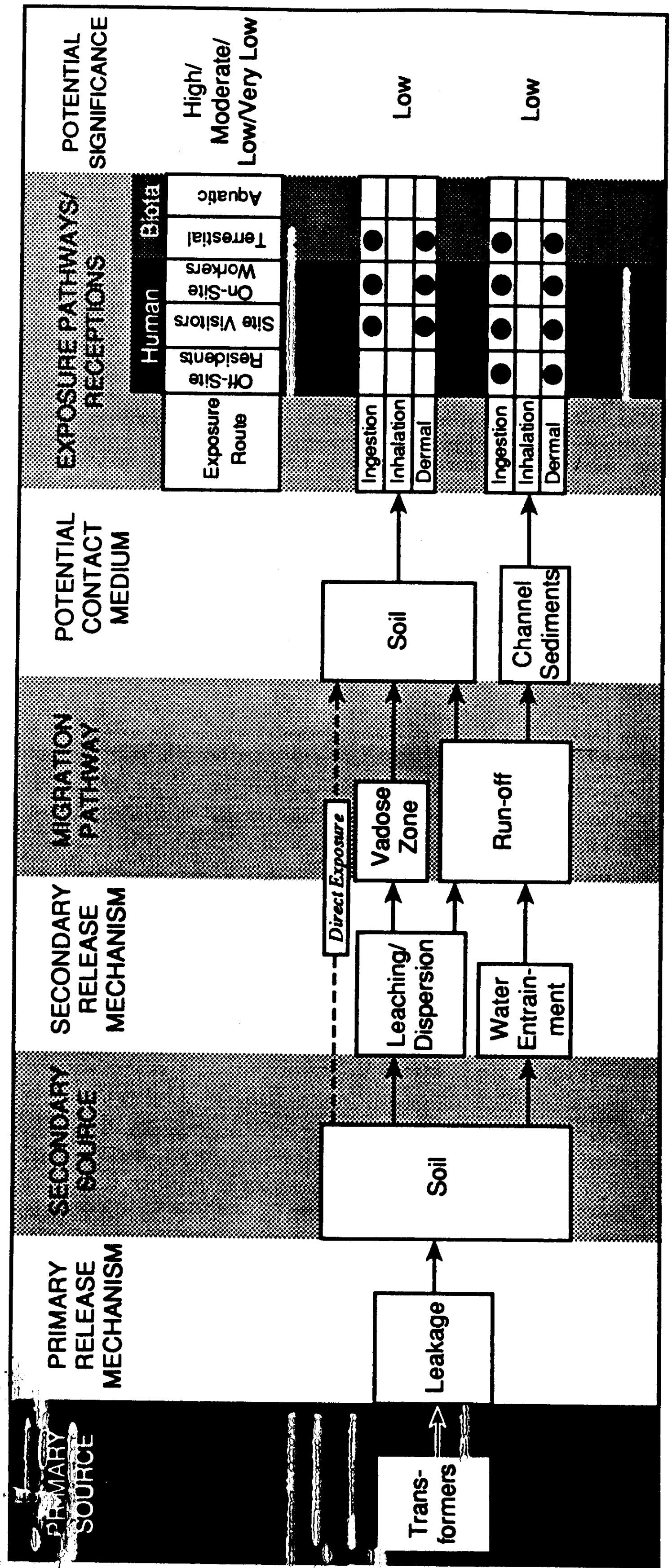


Figure 5-34. Conceptual model of SWMU Aggregate 0-G.

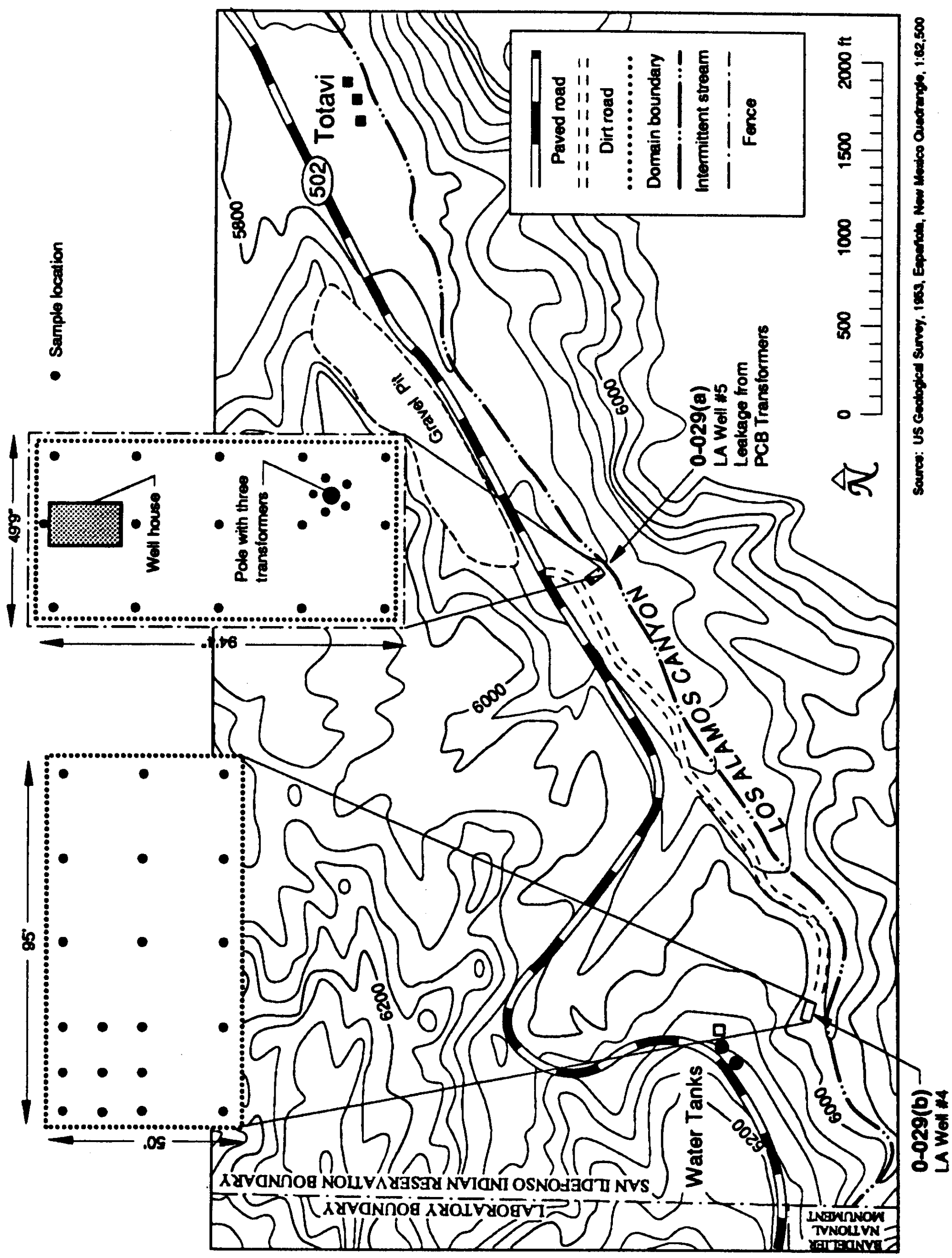


Figure 5-35. Sampling locations of SWMUs 0-029(a and b) (PCB Transformers).

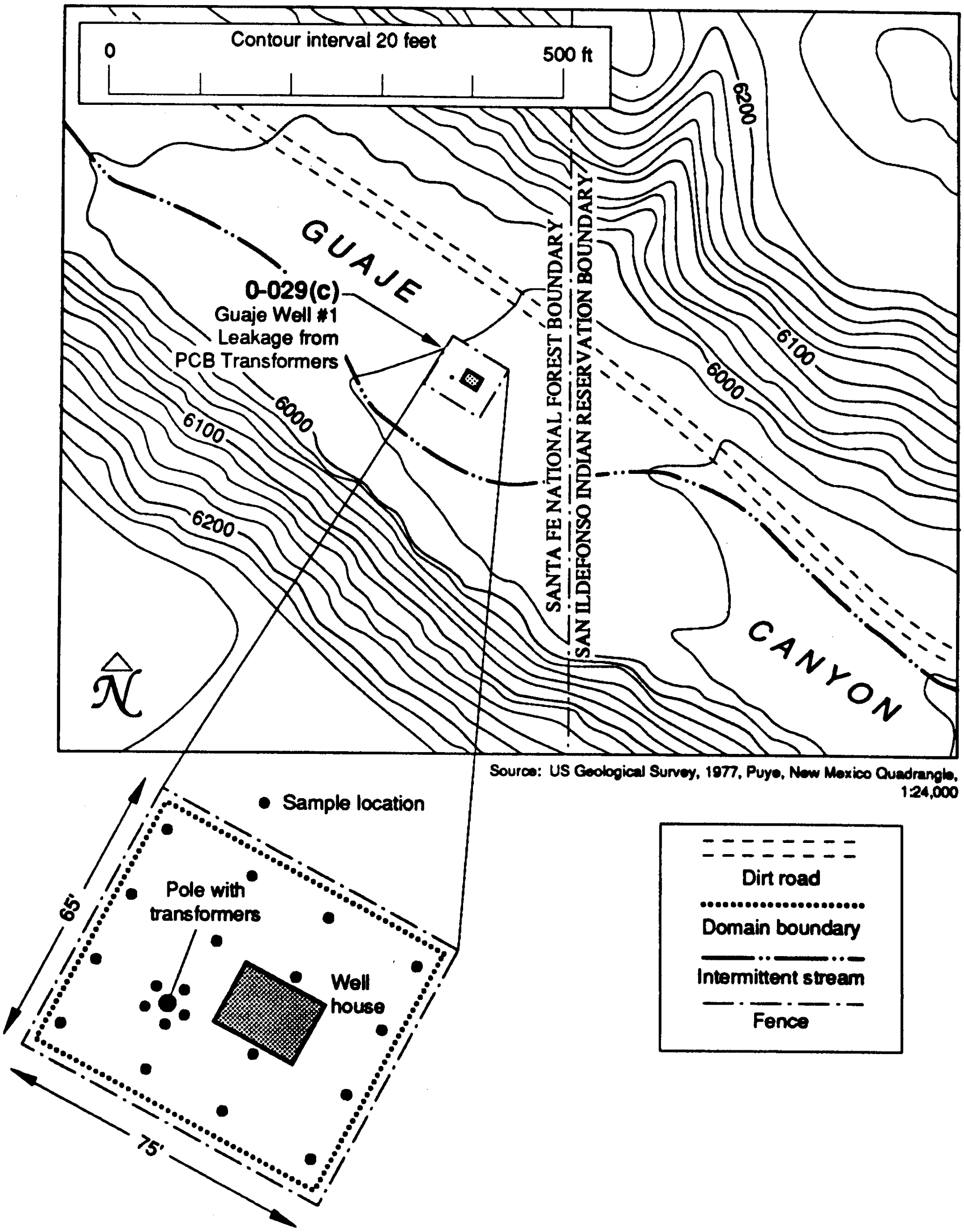


Figure 5-36. Sampling locations of SWMU 0-029(c) (PCB Transformers).

5.9.5 Data Required

5.9.5.1 Source Characterization

Specific data requirements for source characterization in Phase I investigations include

- determining as accurately as possible, using field surveys and Level I data, the locations and boundaries of the fenced areas surrounding the wells and the locations of the contaminated areas associated with the transformers at the former well sites and

- using Level III/IV data to determine the presence or absence of, and, if present, the concentrations and distribution of PCBs in site media and potential release areas, including surface and shallow subsurface soils beneath previously contaminated areas.

A site survey will be used to help define the boundaries of the former Los Alamos Well #4 and the location of the pole with the transformers from which leaks or spills may have occurred. Laboratory analysis will be obtained for surface samples collected on a 20-ft grid below the transformer poles. Because there is no information on whether or where any releases have occurred and because the future-use scenario calls for unrestricted access to the well sites, the investigators are taking this conservative approach to sampling. The data will be compared with the action level for PCBs, and, if contaminant concentrations are at or below this level, no further field investigations will be conducted.

If the results of Phase I sampling indicate that contaminant concentrations are above the action level for PCBs, the necessity for additional Phase II field sampling will be evaluated. Based on current knowledge of these SWMU sites, it is not expected that contaminants will be encountered above the action level; accordingly, no detailed Phase II sampling plans have been developed. However, should PCBs be found, Phase II sampling will follow.

5.9.5.2 Environmental Setting

No additional data are required to characterize the environment of SWMU Aggregate 0-G in Phase I investigations because existing data are adequate.

5.9.5.3 Potential Receptors

No specific information regarding the activities, behavior, or location of actual receptors is required for the Phase I investigation because it is unlikely that these wells are contaminated with PCBs. In the event that PCBs are found, a Phase II investigation will be necessary, and the following information regarding the potential receptors identified in Figure 5-34 may be required:

- the location of on-site workers relative to source area(s) and

- the frequency and duration of periods during which workers and visitors are present at the site.

5.9.6 Field Sampling Plan

The field work in Phase I, Stage I, investigations of SWMU Aggregate 0-G will be completed in two field tasks: field surveys, and surface sampling. All field work will be performed in accordance with applicable ER Program SOPs.

5.9.6.1 Task 1—Field Surveys

Task 1 will consist of a site survey of each SWMU.

5.9.6.1.1 Activity 1—Site Survey

A site survey will be conducted to locate the boundaries of former LA Well #4 and the location of the transformer pole from which oil leaks or spills may have occurred. The locations of the fence and pole will be determined by examining historic aerial photographs, reviewing records, including maps and engineering and site plans, and by performing visual inspections. Maps will be prepared of each well site on a scale of 1:500 with a contour interval of 2 ft. The maps will note the locations of transformer posts, stained soil, and areas in which vegetation is stressed or absent.

5.9.6.2 Task 2—Surface Sampling

Task 2 will consist of sampling surface soil.

5.9.6.2.1 Activity 1—Surface Sampling

Twenty samples of surficial materials will be collected from the top 6 in. of soil at each site. Up to six of these will be from around the poles that hold the transformers, from areas of stressed vegetation, or from areas indicated by other field indicators. Samples will be collected using the procedures described in LANL-ER-SOP-06.09, Spade and Scoop Method for Collection of Soil Samples. The samples will be screened and analyzed as shown in Figure 5-37.

			Field Surveys				Field Screening (Level I)				Laboratory Analysis (Level III/IV)														
											Number of samples analyzed depends on results of field screening and/or field survey. * =50%, + =30%														
Sample Location	No. of Samples	Sample Description	Site Survey/Mapping	Geophysical Survey (Level I)	Soil Gas Survey (Level II/III)	Gross Alpha, Beta, Gamma (Level I)	Lithologic Logging	Combustible Gas/Oxygen	Organic Vapor	Gross Alpha, Beta, Gamma	Gamma Spectrometry	^{3}H	Total U (^{234}U, ^{236}U)	^{238}Pu, $^{239/240}Pu$	^{90}Sr	^{137}Cs	^{241}Am	^{60}Co	Volatile Organics (VOA) (SW 8240)	BTEX (SW 8020)	Semivolatile Organics (BNA) (SW 8270)	TPH(418.1)	Target Analyte List Metals	TCLP Metals	PCB and Pesticides (SW 8080)
0-029(a)	20	Surface materials	•																						•
0-029(b)	20	Surface materials	•																						•
0-029(c)	20	Surface materials	•																						•

Figure 5-37. **Screening and analysis for initial investigations at SWMU Aggregate 0-G.**

5.10 SWMU Group 0-3 (Septic Systems)

SWMU Group 0-3 includes SWMUs 0-030 (c-k and n-q), sanitary septic systems. These SWMUs are located on private, Los Alamos County, and DOE properties (Figure 3-2).

5.10.1 Description and History

SWMU Group 0-3 consists of 13 septic systems (Figure 5-38). The septic tanks were installed during the early 1940s, and most remained in use until the Central Wastewater Treatment Plant (SWMU 0-019) was completed in late 1947 (LANL 1990, 0145). Engineering drawings of these tanks are incomplete; therefore, it is not possible to document all of the buildings served by each tank. Although some tanks served residences, they may have also served facilities in TA-1.

One document (LASL 1947, 05-0075) describes the "central area" of the septic system network as consisting of

> "61 manholes; 30,035 feet of 8-inch VCP and 7,265 feet of 6-inch VCP pipe for distribution lines; 3,796 feet of 8-inch VCP pipe and 23,091 feet of 6-inch or smaller VCP pipe for service lines; and approximately eight concrete septic tanks."

Septic Tank #1a [SWMU 0-030(c)] is located on private property north of Canyon Road near its intersection with Manhattan Loop (The Zia Company 1947, 05-0132; LANL 1990, 0145). Although information on the dimensions of the septic tanks, buildings served, and overflow is unavailable, the location of the tank suggests that it served residences.

Septic Tank #2 [SWMU 0-030(d)] is located on Los Alamos County property underneath the Pine Street cul-de-sac (The Zia Company 1947, 05-0132). Information on the dimensions of the septic tank, buildings served, and overflow is unavailable.

SWMU 0-030(e) consists of three tanks: two tanks, known collectively as Septic Tank #4 (located north of Canyon Road), and Septic Tank #4A (located south of Canyon Road) (The Zia Company 1947, 05-0132). These septic tanks served residences and may have been connected to TA-1 according to engineering drawings prepared in 1943 (US Engineer Office 1943, 05-0161). These septic tanks are located on private property.

SWMU 0-030(f), Septic Tank #5, consists of two tanks located south of Canyon Road (The Zia Company 1947, 05-0132) and north of Rose Street near the United Church. These tanks, labeled "Septic Tank #2" on a 1943 engineering drawing (US Engineer Office 1943, 05-0169), connected with sewer lines in the "Apartment Area" and may have connected with lines into TA-1.

SWMU 0-030(g), Septic Tank #6, is located on private and Los Alamos County property north of Canyon Road and west of the intersection with Central Avenue (The Zia Company 1947, 05-0132; The Zia Company 1947, 05-0170 and 05-0172). One document states that "most of the Tech Area sanitary sewage leaves the area by way of the 8-inch sanitary sewer, which passes just south of C-Shop and

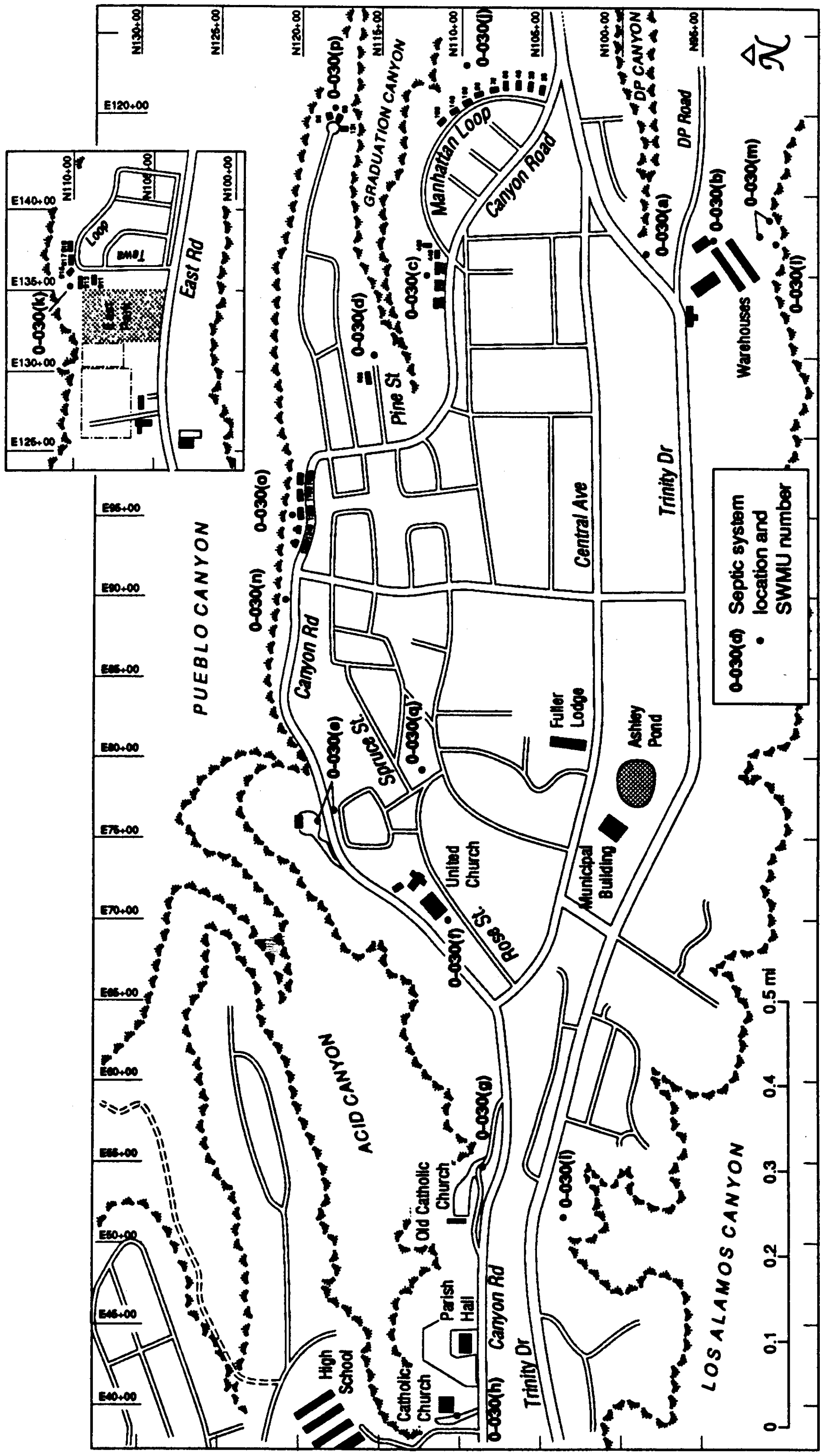


Figure 5-38. Locations of septic tanks in TA-0 (SWMU Group 0-3).

eventually discharges into Septic Tank #6" (Williams 1964, 05-0129). The septic tank is depicted on a 1943 engineering drawing as Septic Tank #5 and may have been connected to TA-1 (US Engineer Office 1943, 05-0173).

SWMU 0-030(h), Septic Tank #7, is located on private property north of Canyon Road (Kingsley 1947, 05-0174). According to an engineering drawing, this septic tank served residences and possibly TA-1 (US Engineer Office 1943, 05-0175).

SWMU 0-030(i), Septic Tank #8, is located on Los Alamos County property south of Trinity Drive, east of 35th Street (The Zia Company 1947, 05-0172 and 05-0171; LANL 1990, 0145). Information on the the buildings served by the tank and its outfall is unavailable; however, the location of the tank suggests that it served residences.

SWMU 0-030(j) is located north of East Road and west of the former Central Wastewater Treatment Plant on Los Alamos County property (The Zia Company 1947, 05-0132). Information on the dimensions of the septic tank, the buildings it served, and overflow is unavailable.

SWMU 0-030(k) is located on private property north of East Road and east of East Park (The Zia Company 1947, 05-0132). Information on the dimensions of the septic tank, the buildings it served, and overflow is unavailable.

SWMU 0-030(n) is located on Los Alamos County property west of 15th Street between Canyon Road and Pueblo Canyon (The Zia Company 1947, 05-0132). Information on the dimensions of the septic tank, the buildings it served, and overflow for the system is unavailable; however, the location of the tank suggests that it served residences.

SWMU 0-030(o) is located between Canyon Road and Pueblo Canyon according to a map prepared in 1947 (The Zia Company 1947, 05-0132). The septic tank, designated as #3 on the map, is located on private property. A 1943 engineering drawing shows that the septic system served residences (US Engineer Office 1943, 05-0162).

SWMU 0-030(p) is located on private property at the eastern end of the Rim Road cul-de-sac (The Zia Company 1947, 05-0132). Information on the dimensions of the septic tank, the buildings it served, and overflow is unavailable; however, the location of the tank suggests that it served residences.

SWMU 0-030(q) is located on private property east of Rose Street and north of Peach Street. A 1943 engineering drawing indicates that the tank served a residence and discharged to a sanitary waste line connected to Septic Tank #4 [SWMU 0-030(e)] (US Engineer Office 1943, 05-0161).

5.10.2 Nature and Extent of Contamination

5.10.2.1 Description and Levels of Contamination

The septic tanks in this SWMU group handled sanitary waste from the original townsite and from early laboratory operations. Old memoranda (Tribby 1946, 05-0119 and 05-0120) raise the question of radionuclide contamination of the sanitary system and outfalls into Pueblo Canyon [SWMUs 0-030(c-g and k)], Acid Canyon [SWMUs 0-030(h and n-q)], and Los Alamos Canyon [SWMUs 0-030(b, i, and j)].

Tribby's memos indicate that polonium and plutonium were present at nanogram levels in all these septic tanks, with no apparent relationship between the levels of these pollutants and the septic systems involved. Because ^{210}Pb was used in the early days of the Laboratory, ^{210}Po is an isotope of concern in the townsite. Should plutonium be present, it would add to the contamination in Pueblo and Los Alamos canyons, depending on the outfalls from the septic systems.

Recent surveillance reports indicate that no substantial amounts of plutonium have been detected that can be attributed to these septic tanks. Plutonium-bearing waste discharged at TA-45 would mask any previous low levels of plutonium in Pueblo Canyon. The outfall for SWMU 0-030(g), which served most of the Laboratory, was apparently upstream from TA-45 in Acid Canyon. The contaminant levels in this outfall may be considered representative of background for Acid Canyon. The conclusion is that low levels of plutonium are not precluded in the septic systems, but hard data are lacking. Migration is a concern because any plutonium in the effluent from these septic systems would be carried through Pueblo and Los Alamos canyons to the Rio Grande.

5.10.2.2 Potential Migration Pathways

As a result of releases from the sources listed in Subsection 5.10.2.1, contaminants may be present in the soil, tuff, and/or air. Contaminants in soil may leach/disperse through the vadose zone, be entrained by surface water and transported downstream by surface water run-off, or be entrained by wind and transported off the site. Contaminants present in tuff may leach/disperse through the vadose zone.

5.10.2.3 Potential Public Health and Environmental Impacts

Based on the migration pathways given in Subsection 5.10.2.2, contaminants may be present in or may migrate to soil or air. As a result, human exposure to site contaminants may occur through inhalation of suspended particulates, incidental ingestion, or dermal contact with soil. Direct human contact with the soil surrounding the septic systems could occur only through significant disturbance of the soil (e.g., digging). Additionally, terrestrial animals may be exposed to site contaminants via incidental ingestion, dermal contact with soil, or inhalation of suspended particulates.

5.10.3 Conceptual Models

Figure 5-39 presents the conceptual model for potential contaminant releases from the various septic systems and subsequent exposure by the receptors identified in Subsection 5.10.2.3. This model shows only those release mechanisms and pathways considered to be the most significant. In Figure 5-39, "on-site residents" refers to those residents living on property that either currently contains or formerly contained a septic system, "site visitors" refers to people who may occasionally walk through septic system sites located on public property, and "on-site workers" refers to people who may do construction work (i.e., work requiring disturbance of the soil or tuff) sometime in the future. Terrestrial animals in the vicinity of the septic systems, primarily in the canyon adjacent to the outfalls, may also be impacted.

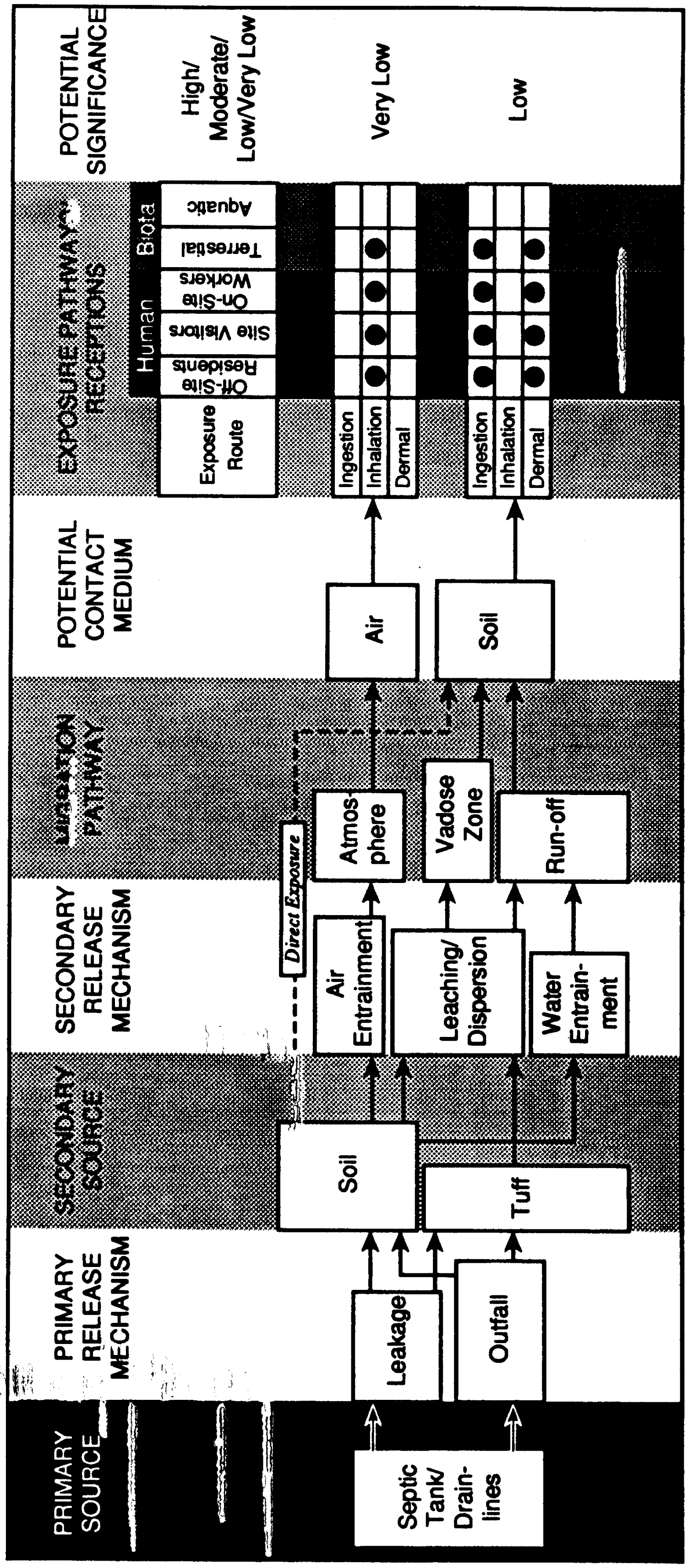


Figure 5-39. Conceptual model of SWMU Group 0-3.

5.10.4 Decisions, Domain, and Approach

Many of these sites are on or adjacent to privately owned property. The domains of these SWMUs include the septic tanks and associated drainlines and drain fields, the surrounding soil and tuff, and first-order drainages below outfalls (Figures 5-40 through 5-52). Remedial action will be proposed, if necessary, to clean the sites to meet health-risk-based cleanup standards for site residents.

Because there is no evidence of residual contamination at any of these sites, Stage I investigations are proposed, which will follow the procedures outlined in Subsection 2.3.4. In particular, any remaining structures will be removed as early as possible. Further site decisions will be based on analytical measurements of samples from the tanks themselves and from the excavations.

Observations from these Stage I investigations will be compared with action levels to determine whether contamination is present at any of these sites. In the absence of contamination, no further action will be proposed for the SWMUs in SWMU Group 0-3. If levels above action levels are observed and if the voluntary corrective actions outlined in Subsection 2.3.4 are insufficient to complete cleanup of the site, Phase II investigations may be required to support a baseline risk assessment and CMS.

5.10.5 Data Required

5.10.5.1 Source Characterization

Specific data requirements for source characterization in Phase I investigations include

- determining as accurately as possible the locations, boundaries, and geometries of each septic tank system, including associated drainlines and outfalls, using field surveys and Level I data; and

- using Level III/IV data to determine the presence or absence of, and, if present, the nature and concentrations of, any contaminants in site media or potential release areas, including subsurface soils beneath the septic tanks and associated drainlines and channel sediments in surface drainages originating at septic outfalls.

Site and geophysical surveys will be used to help locate and define the boundaries of the septic tank systems and to locate outfalls. Mapping surveys will locate sediment catchments adjacent to outfalls and will determine locations for sampling channel sediments. Because the sludge in a tank reflects only its late history (e.g., sanitary waste only) and not its earlier history (e.g., contaminated waste), it is necessary to sample the sediment catchments and soil beneath the tanks to determine whether the septic tank sites are clean. All surface and subsurface samples will be screened for organic vapor and gross alpha, beta, and gamma radiation to determine whether organic or radionuclide contamination is present. The Level III/IV data for each septic site will be compared with action levels, and, if

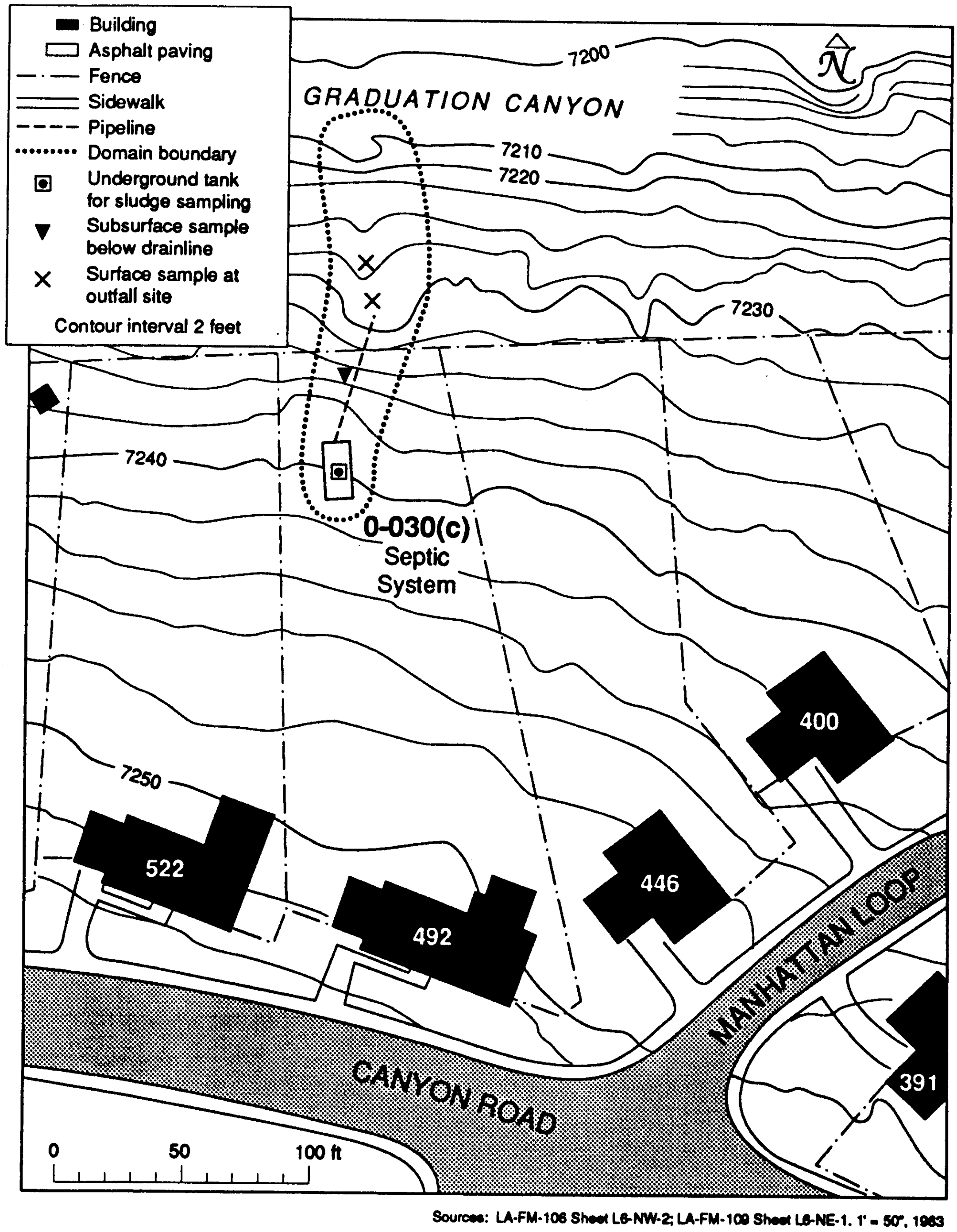
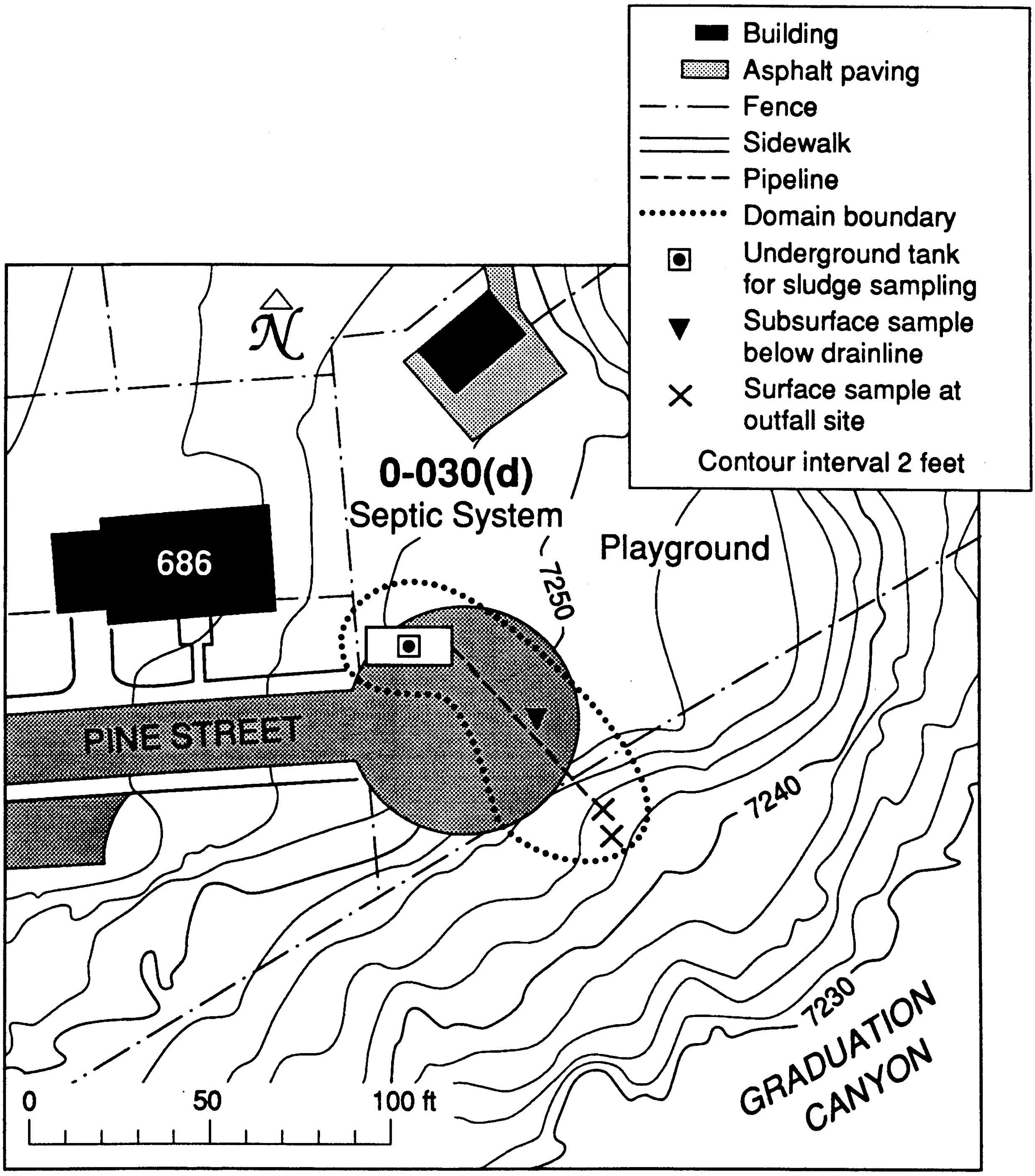


Figure 5-40. Sampling locations for SWMU 0-030(c).



Source: LA-FM-108 Sheet L6-NW-2 1" = 50'

Figure 5-41. Sampling locations for SWMU 0-030(d).

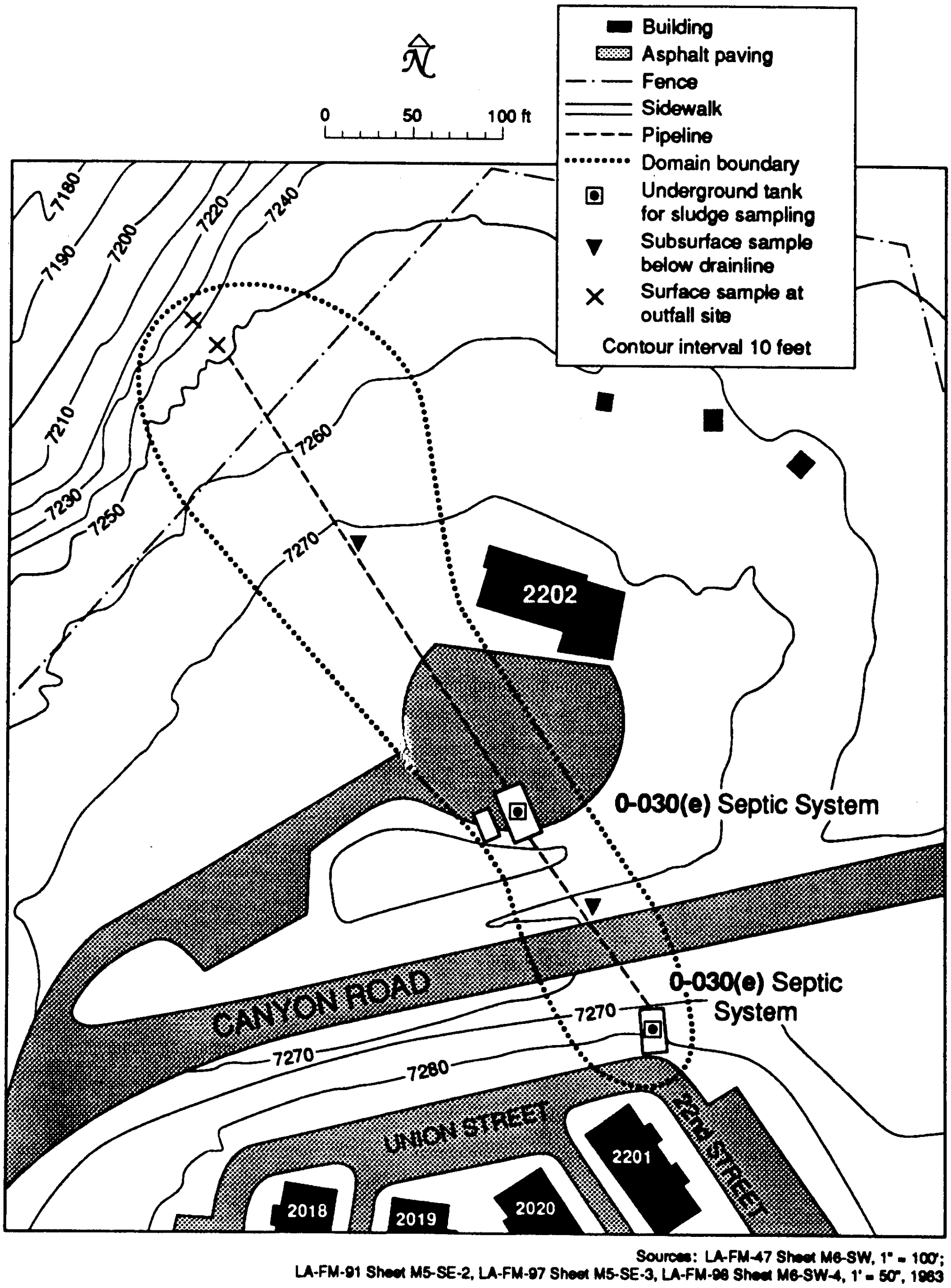
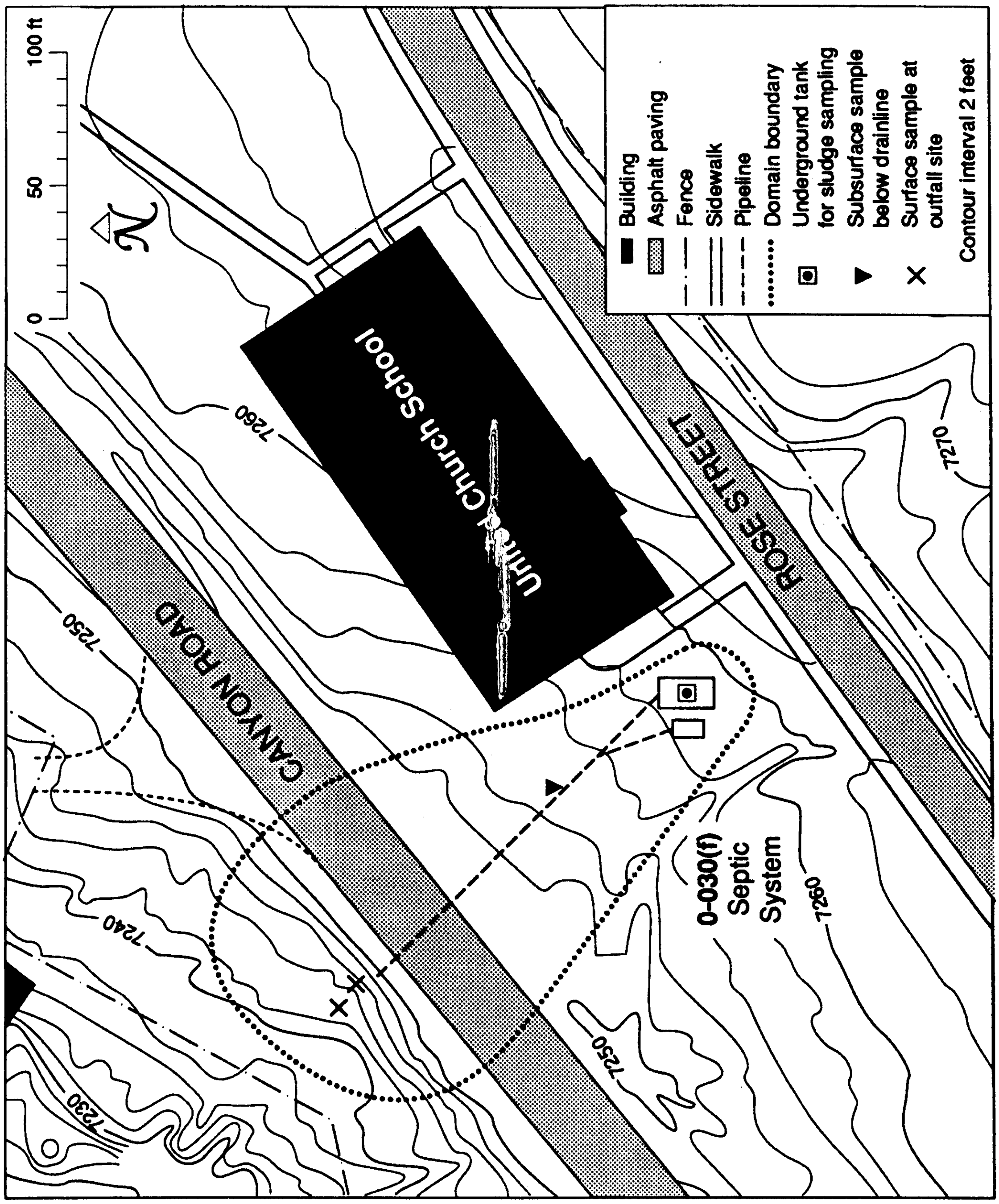
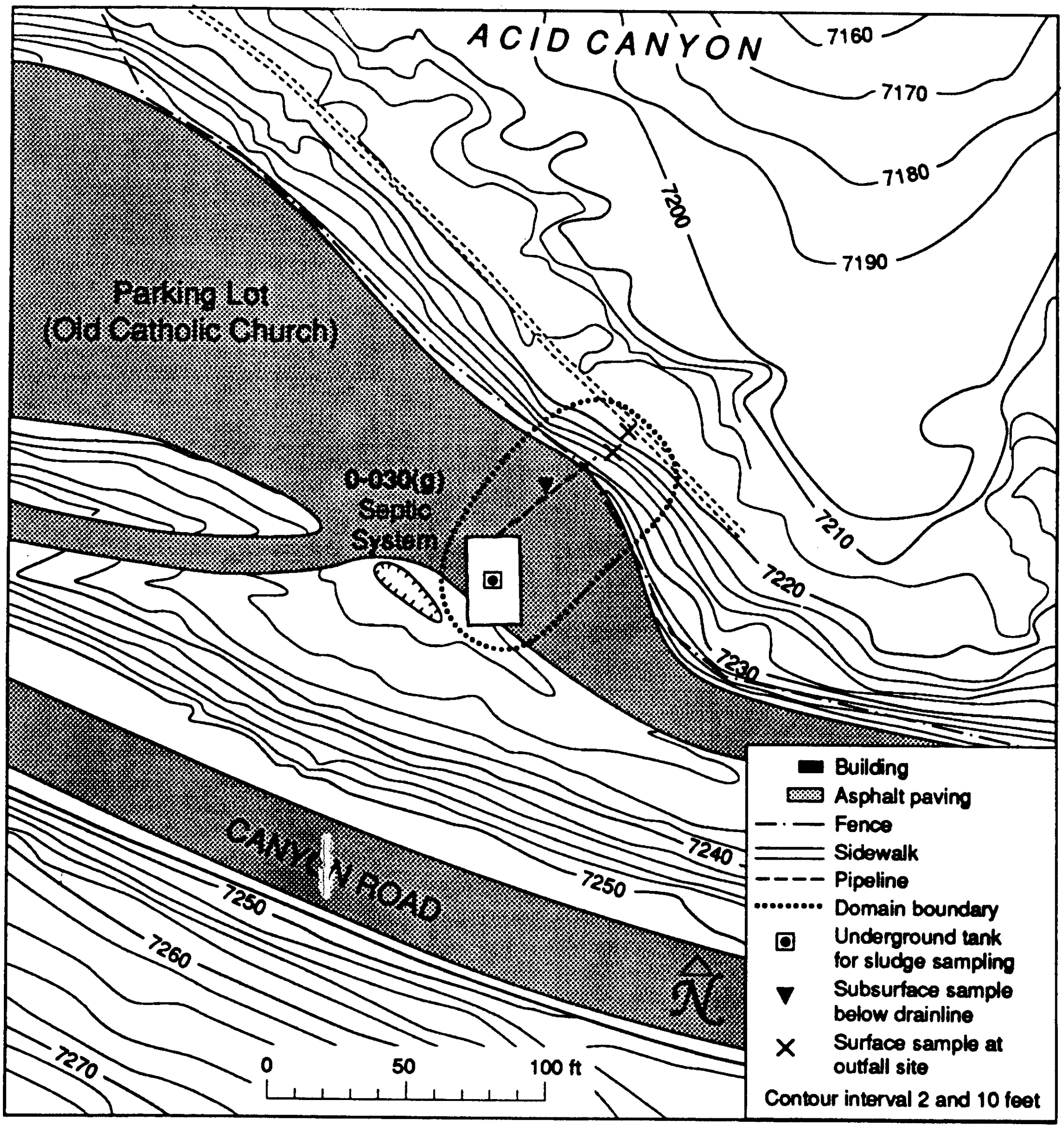


Figure 5-42. Sampling locations for SWMU 0-030(e).



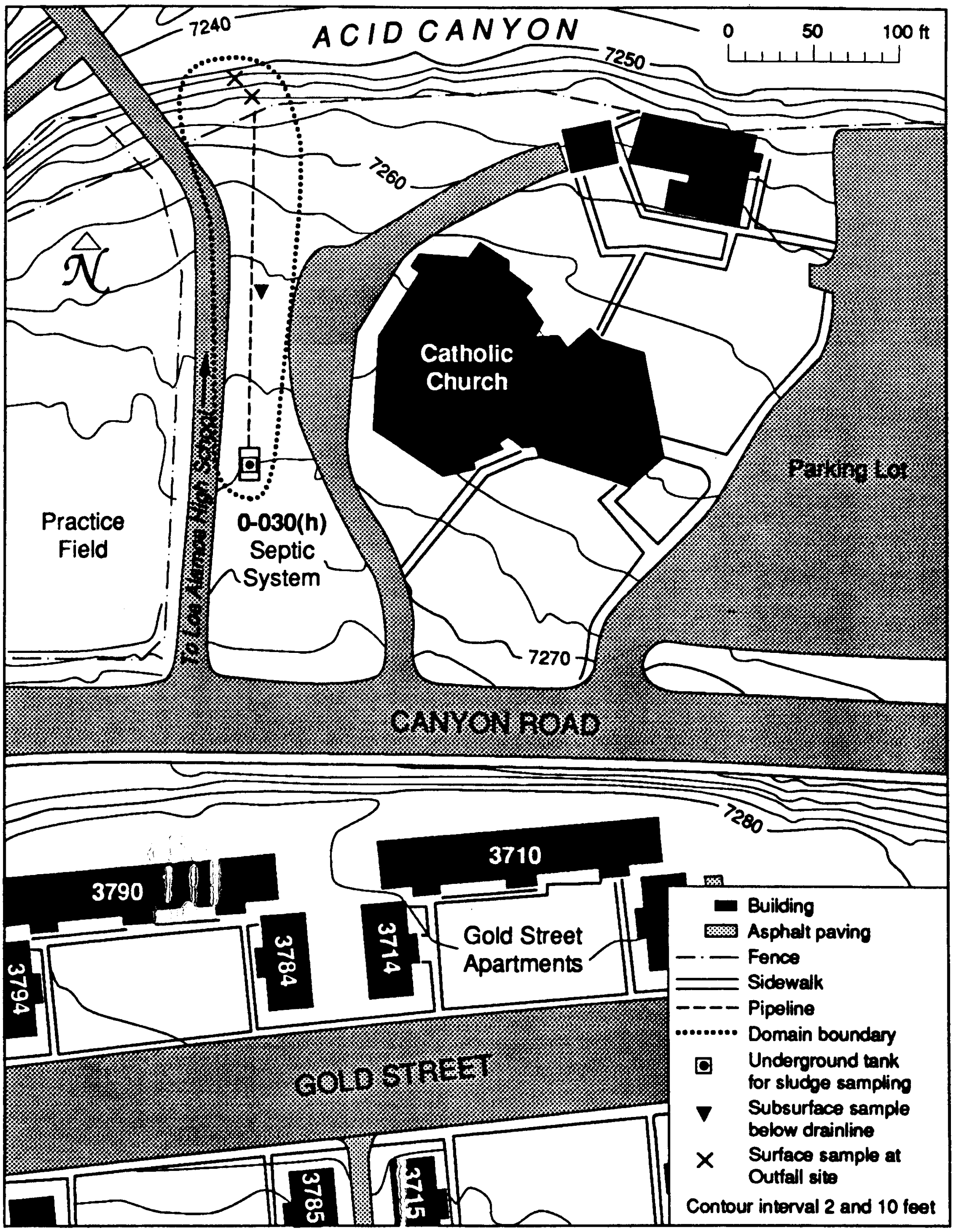
Sources: LA-FM-97 Sheet M5-SE-3; LA-FM-106 Sheet L5-NE-2, 1" = 50', 1963

Figure 5-43. Sampling locations for SWMU 0-030(f).



Source: LA-FM-105 Sheet L5-NE-1, 1" = 50', 1963

Figure 5-44. Sampling locations for SWMU 0-030(g).



Sources: LA-FM-95 Sheet M5-SW-3; LA-FM-104 Sheet L5-NW-2, 1" = 50', 1963; Bohannan Huston, Inc., County of Los Alamos, NM, Topographic Map 47, 1" = 100', 1986

Figure 5-45. Sampling locations for SWMU 0-030(h).

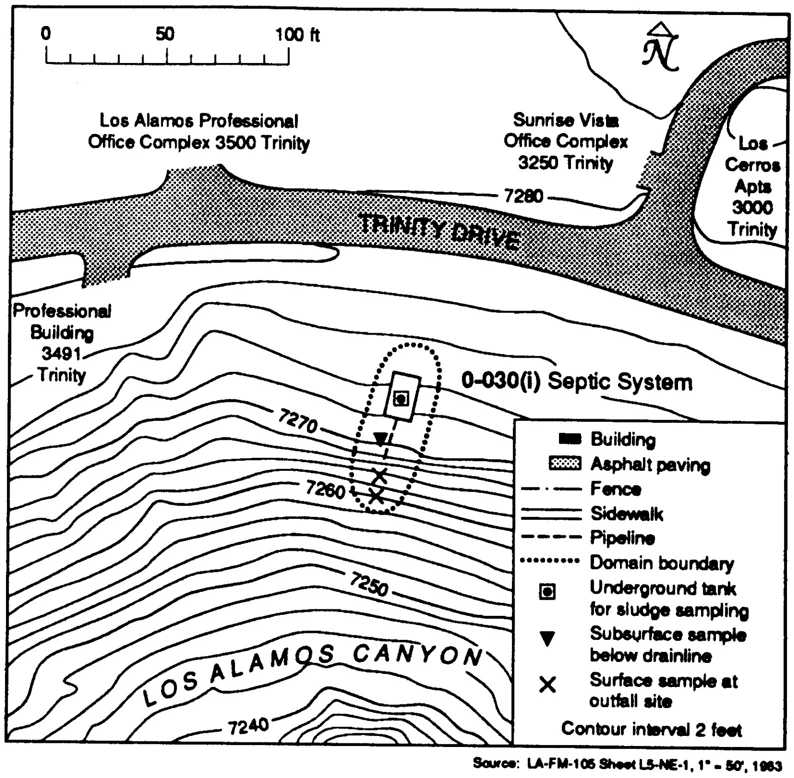


Figure 5-46. Sampling locations for SWMU 0-030(i).

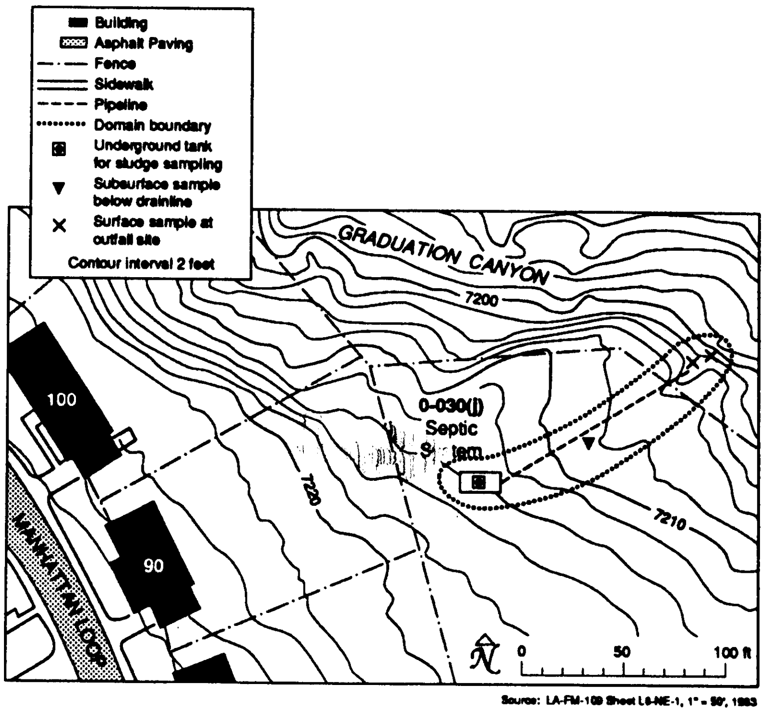


Figure 5-47. Sampling locations for SWMU 0-030(j).

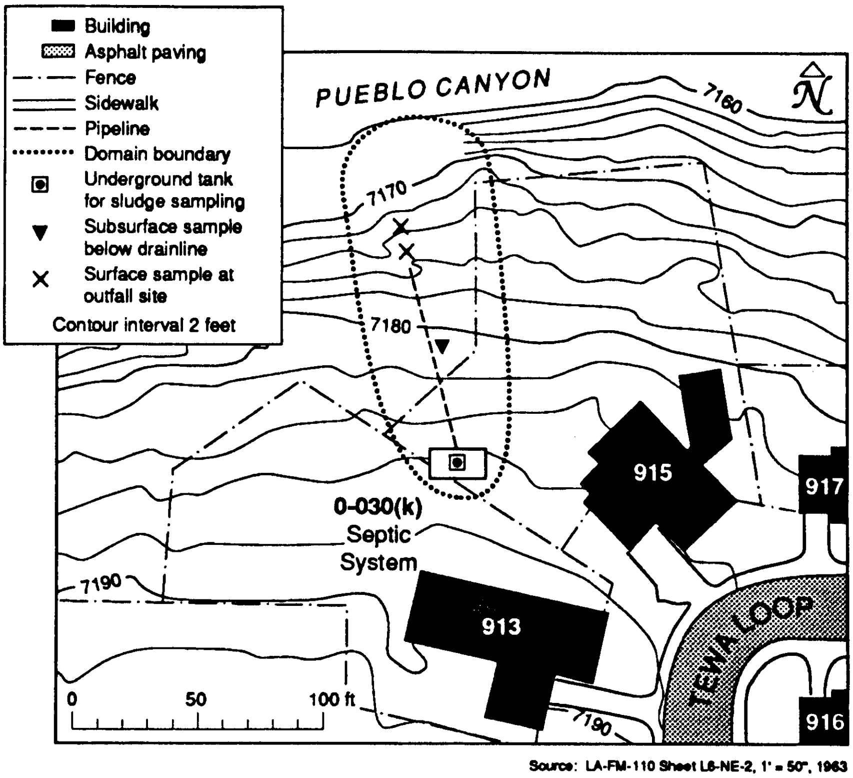


Figure 5-48. Sampling locations for SWMU 0-030(k).

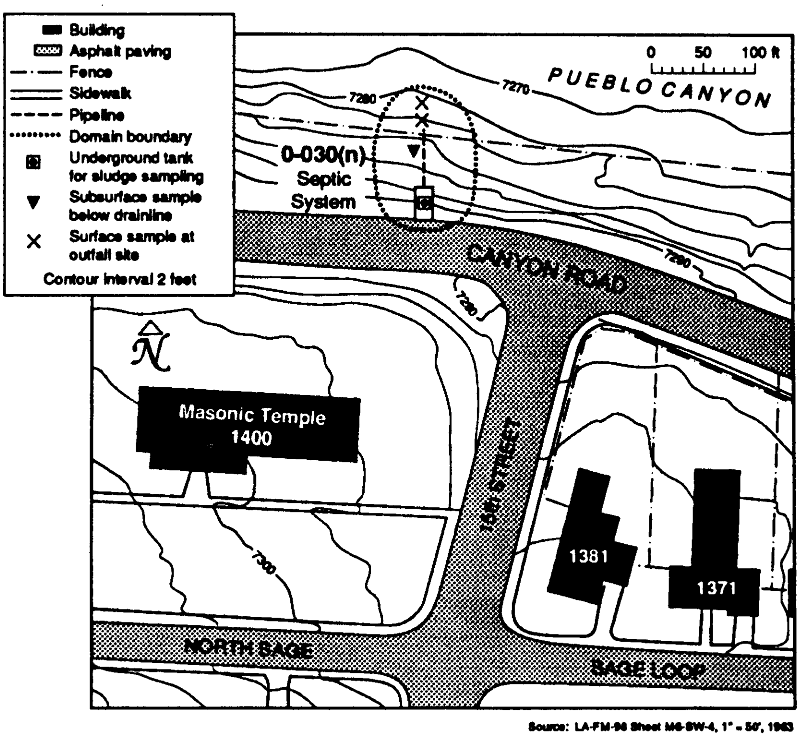
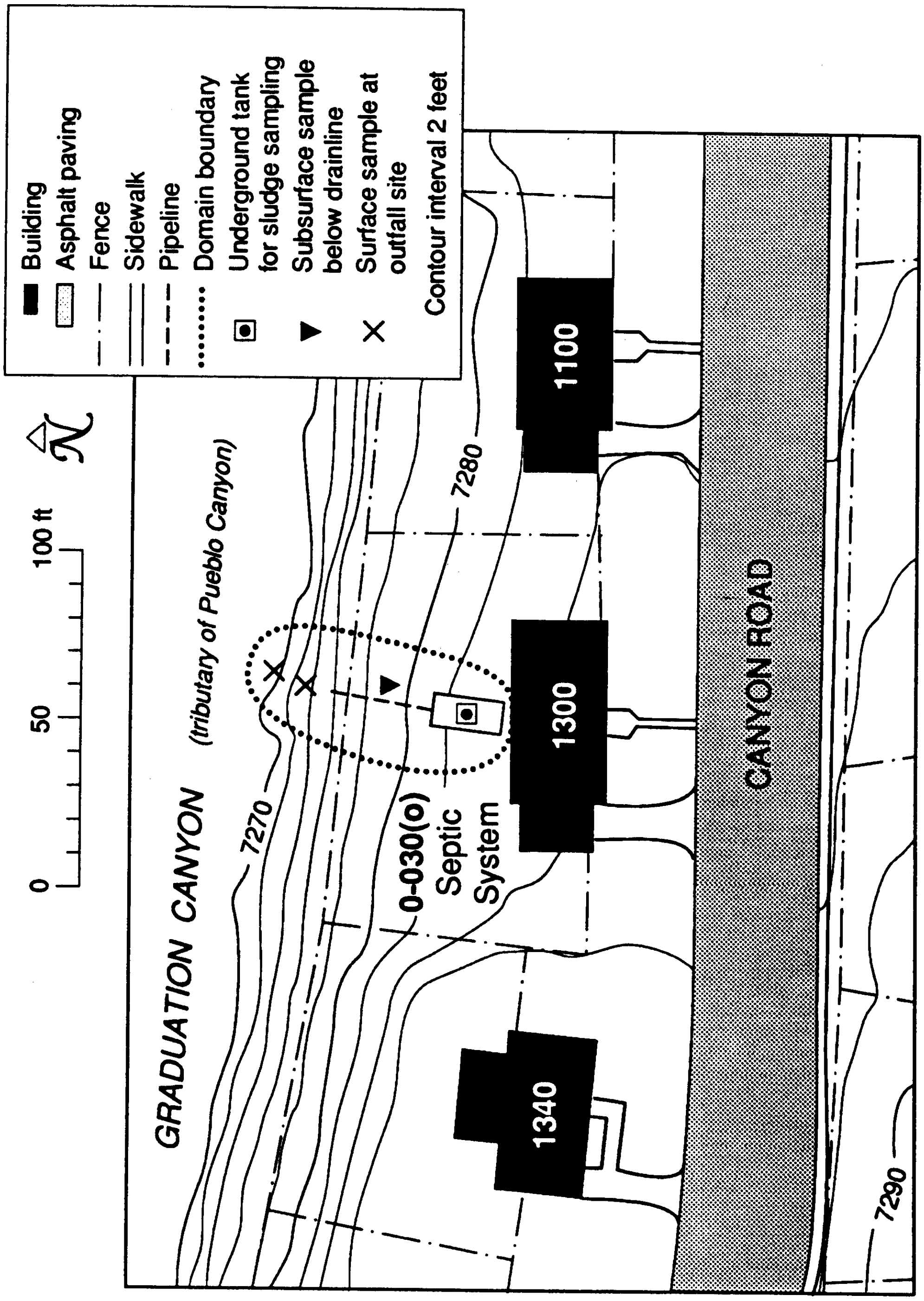
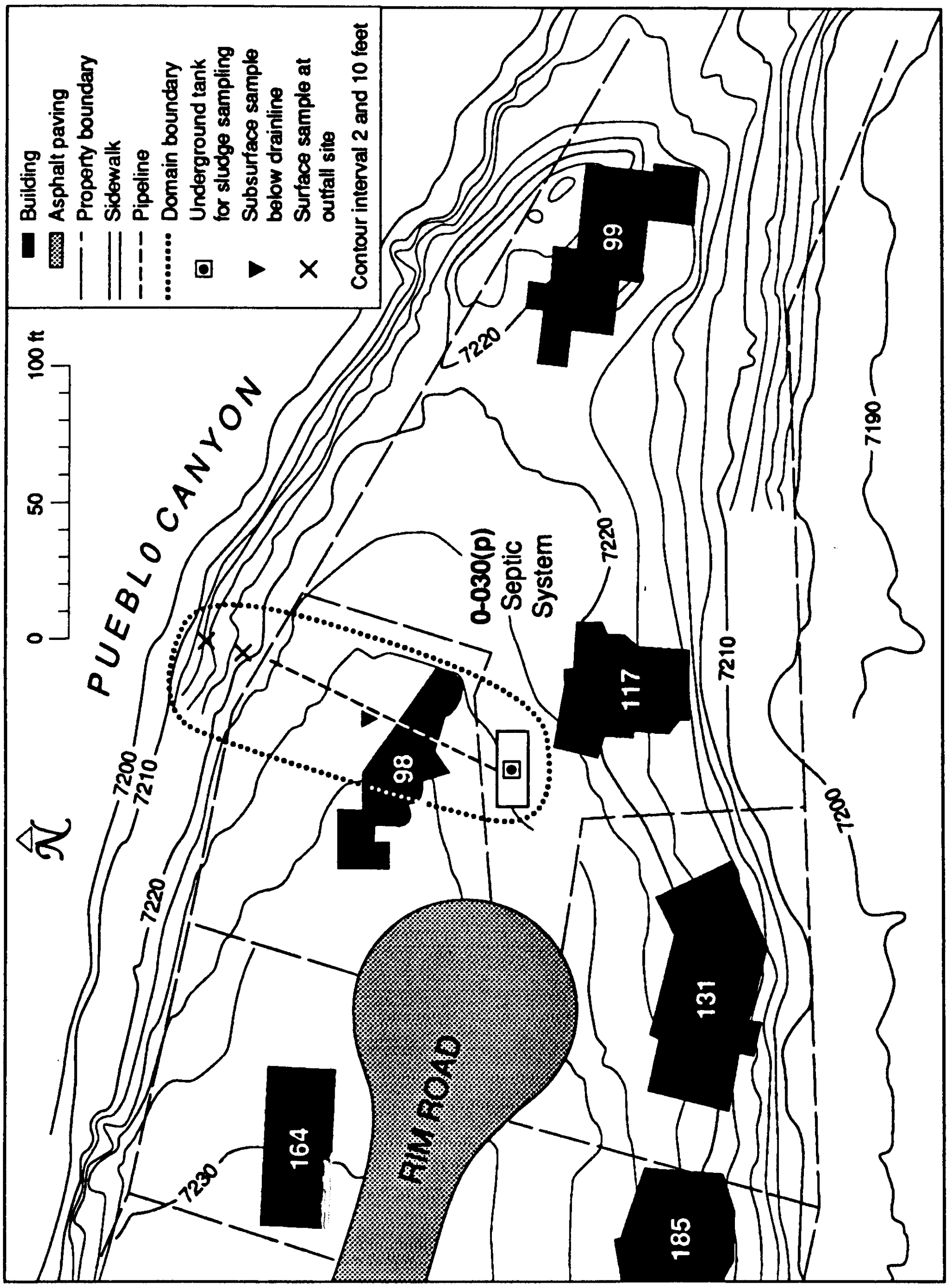


Figure 5-49. Sampling locations for SWMU 0-030(n).



Source: LA-FM-108 Sheet L6-NW-2, 1" = 50', 1963

Figure 5-50. Sampling locations for SWMU 0-030(o).



Source: LA-FM-100 Sheet M6-SE-4, 1" = 50', 1963

Figure 5-51. Sampling locations for SWMU 0-030(p).

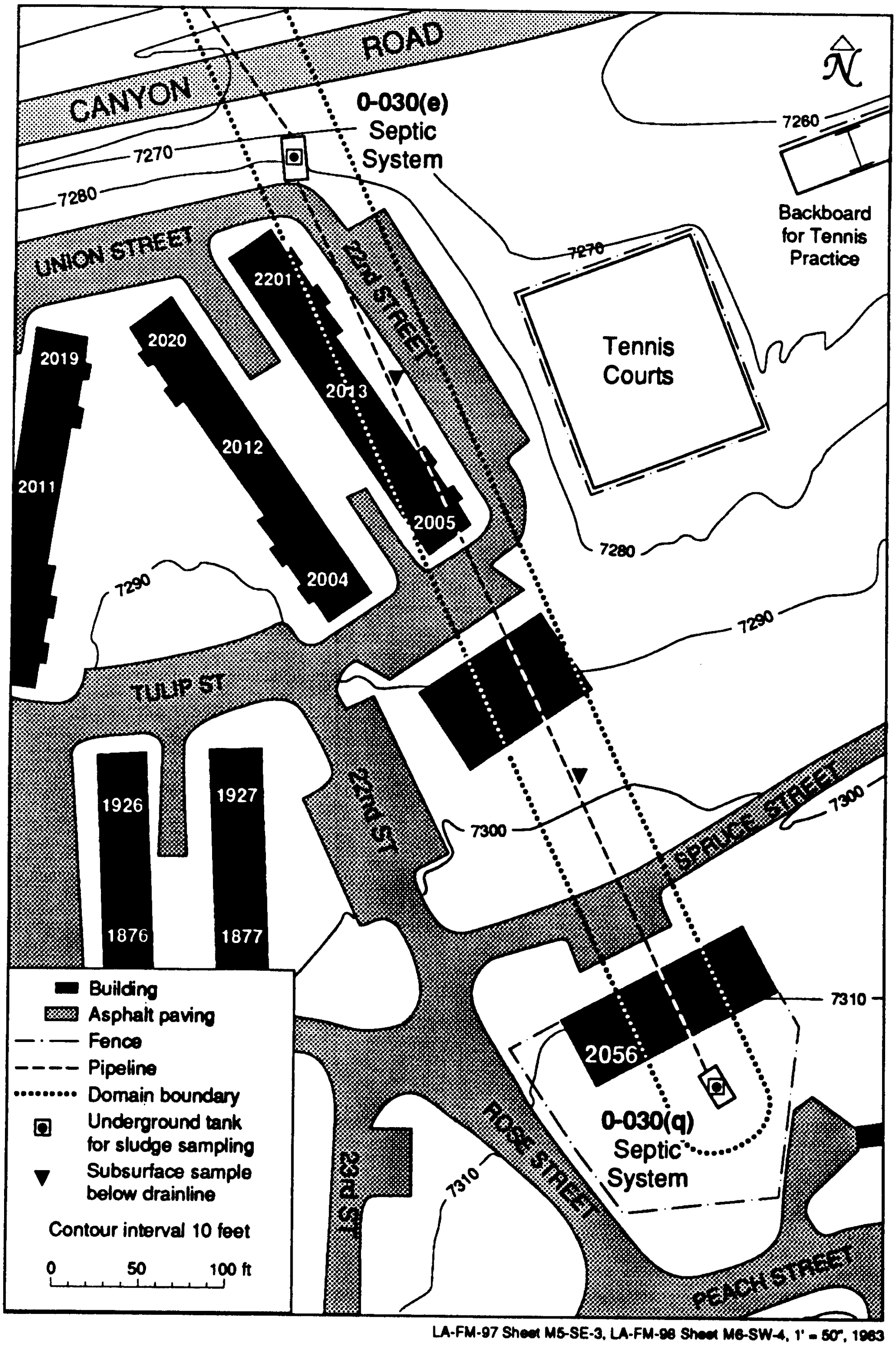


Figure 5-52. Sampling locations for SWMU 0-030(q).

contaminant concentrations are below these levels, no further field investigations will be conducted at that site.

If Level IV results of Phase I sampling from any specific septic tank location indicate that contaminant concentrations are above action levels, the necessity and possible scope of additional Phase II field sampling will be evaluated for that site. Based on current knowledge of past activities at these SWMU sites, it is not expected that contaminants will be encountered above action levels; accordingly, no detailed Phase II sampling plans have been developed. However, should Phase II investigations be necessary, additional source characterization data may be collected to determine the lateral and vertical extent of contamination, to perform a baseline risk assessment, and, if necessary, to provide a data base for designing and implementing corrective measures.

5.10.5.2 Environmental Setting

Data required in Phase I investigations include a map of first-order drainages, including sediment catchment sites originating at or transecting septic outfall points within the domain boundaries. The map will be used to select sites for sampling channel sediments.

If Phase II investigations are necessary, the information required may include detailed hydrogeologic and geologic data to characterize subsurface soil and tuff. These data, if collected, would be used to model contaminant transport, to analyze risk associated with release and migration of contaminants, and to design and implement corrective measures.

5.10.5.3 Potential Receptors

No specific information regarding the activities, behavior, or location of actual receptors is required for the Phase I investigation. In the event that a Phase II investigation is required, the following information regarding the type of housing (e.g., apartments, single family houses) at the sites may be needed. In the event that the estimated risks to an on-site resident are unacceptable, a more detailed demographic survey may be required.

5.10.6 Field Sampling Plan

The field work in Phase I, Stage I, investigations of SWMU Group 0-3 will be completed in three field tasks: field surveys, surface sampling, and subsurface sampling. The RFI field work and associated activities are described in the following subsections. All field work will be performed in accordance with applicable ER Program SOPs.

5.10.6.1 Task 1—Field Surveys

Three field surveys will be performed in Task 1: site survey, geophysical surveys, and geomorphologic mapping.

5.10.6.1.1 Activity 1—Site Surveys

Site surveys will be conducted to verify the locations of the septic tanks, drainlines, and outfall points. The locations will be determined by examining historic aerial photographs, by reviewing records, including maps and engineering plans, and by conducting visual inspection.

5.10.6.1.2 Activity 2—Geophysical Surveys

If the site surveys do not reveal the location of all buried structures in sufficient detail, geophysical surveys will be conducted to more precisely locate the septic tanks and drainlines. A magnetic survey will be performed with appropriate spacing to ensure full resolution of large metallic objects and metallic components in the tanks' construction. An EMC survey will be conducted to further define buried features. If necessary, ground-penetrating radar may be used to supplement the EMC survey. Once located, the sites will be marked in the field.

5.10.6.1.3 Activity 3—Geomorphologic Mapping

First-order stream channels that originate at or transect the outfall points will be located and mapped to determine sites for sampling channel sediments. This activity will locate all sediment catchments adjacent to, or as close as possible to, the outfall points. Samples will be collected using the procedures described in LANL-ER-SOP-06.14, Sediment Material Collection. Mapping will be completed on a scale of 1:2000.

5.10.6.2 Task 2—Surface Sampling

Surface sampling in Task 2 will consist of sampling channel sediments from catchments beneath the drainline outfall points.

5.10.6.2.1 Activity 1—Sampling Channel Sediment at Outfall Points

Samples of channel sediments will be collected from sediment catchments adjacent to or immediately downslope of septic drain outfall points (Figures 5-40 through 5-52). Two sediment samples will be collected as close as possible to the outfall points from sediment catchments in first- or higher-order drainage channels that have developed downslope of the septic drain outfalls. If no distinct channels are discernible adjacent to the outfall points, two samples will be collected from likely sediment catchment areas adjacent to the outfall points. Samples will be collected using the procedures described in LANL-ER-SOP-06.14, Sediment Material Collection. A total of 26 channel sediment samples will be screened and analyzed as shown in Figure 5-53.

5.10.6.3 Task 3—Subsurface Sampling

Subsurface sampling will consist of sampling septic tank systems, including the drainlines.

5.10.6.3.1 Activity 1—Sampling Septic Tank System Areas

Sampling the 13 septic tank systems will proceed as described in Subsection 2.3.4. A total of 4 samples will be collected from each site and will be screened and analyzed as indicated in Figure 5-53.

Sample Location	No. of Samples	Sample Description	Field Surveys: Site Survey/Mapping	Field Surveys: Geophysical Survey (Level I)	Field Surveys: Soil Gas Survey (Level II/III)	Field Surveys: Gross Alpha, Beta, Gamma (Level I)	Field Screening (Level I): Lithologic Logging	Field Screening (Level I): Combustible Gas/Oxygen	Field Screening (Level I): Organic Vapor	Field Screening (Level I): Gross Alpha, Beta, Gamma	Laboratory Analysis (Level III/IV): Gamma Spectrometry	^{3}H	Total U (^{234}U, ^{236}U)	^{238}Pu, $^{239/240}Pu$	^{90}Sr	^{137}Cs	^{241}Am	^{60}Co	Volatile Organics (VOA) (SW 8240)	BTEX (SW 8020)	Semivolatile Organics (BNA) (SW 8270)	TPH(418.1)	Target Analyte List Metals	TCLP Metals	PCB and Pesticides (SW 8080)
0-030(c-k,n-q)	26	Channel sediments below outfalls	•							•	•		•	•			•				•		•		•
0-030(c-k,n-q)	13	Septic tank sludge	•	•				•	•	•	•		•	•			•		•		•		•		•
0-030(c-k,n-q)	≥26	Subsurface materials below tanks	•	•			•	•	•	•	•		•	•			•		•		•		•		•
0-030(c-k,n-q)	≥26	Subsurface materials below drainlines	•	•			•	•	•	•	•		•	•			•		•		•		•		•

Laboratory Analysis note (radionuclide columns): Number of samples analyzed depends on results of field screening and/or field survey. * =50%, + =30%

Figure 5-53. Screening and analysis for initial investigations at SWMU Group 0-3.

5.11 SWMU 0-031(a) (Soil Contamination Beneath Former Service Station)

SWMU 0-031(a) consists of a former service station located on private property at Trinity Drive and 4th Street (Figure 3-2). The soil beneath the service station is potentially contaminated.

5.11.1 Description and History

The service station associated with SWMU 0-031(a) was operated by The Zia Company until the early 1960s, at which time it was transferred to private ownership (LANL 1990, 0145; The Zia Company 1962, 05-0144; The Zia Company circa 1960, 05-0133). The Hilltop House Motel is now located at the site of the former service station. Contrary to information provided in the SWMU report (LANL 1990, 0145), the current owner believes that the three 25,000-gal. (?) fuel tanks used by The Zia Company are still in the ground in the area immediately north of the motel lobby (Aldrich 1991, 05-0155).

Historically, the gas pumps were located east of what is now the motel lobby. During a 1988-1989 renovation of the Hilltop House, new gas pumps were installed at the north end of the motel, west of the assumed location of The Zia Company's fuel tanks. Three fiberglass tanks to support the new pumps have been installed northwest of motel.

5.11.2 Nature and Extent of Contamination

5.11.2.1 Description and Contamination Levels

Solid and hazardous wastes resulted from the operations at this service station, which may have contaminated the soil at both fuel tank areas. Leaded gasoline was the primary source of contaminants (hydrocarbons) at this facility, although solvents, oils, and greases may also be present. No releases are known to have occurred; however, neither do any surveys appear to have been conducted. Any contaminants would have migrated to the southeast toward Los Alamos Canyon.

5.11.2.2 Potential Migration Pathways

Contaminants associated with the former service station may have been released to the environment as the result of leakage from the underground fuel tanks. As a result, contaminants may be present in soil, tuff, and/or air. Contaminants in soil or tuff may leach/disperse through the vadose zone or migrate upward through vapor phase diffusion and enter the atmosphere.

5.11.2.3 Potential Public Health and Environmental Impacts

Based on the migration pathways identified in Subsection 5.11.2.2, contaminants may be present in or may migrate to soil or air. As a result, human exposure to site contaminants may occur through inhalation of vapors, incidental ingestion, or dermal contact with soil. Direct contact with soil could only occur through significant disturbance of the soil and asphalt (e.g., digging).

5.11.3 Conceptual Models

Figure 5-54 presents the conceptual model for potential contaminant releases from the former service station and subsequent exposure by the receptors identified in Subsection 5.11.2.3. In Figure 5-54, "off-site residents" refers to residents located in the vicinity of Central Avenue (likely closest downwind receptor), "site visitors" refers to people who stay at the Hilltop House, and "on-site workers" refers to employees of the Hilltop House (inhalation exposure only) and to people who may be hired to do construction work (i.e., work that disturbs the soil or tuff) sometime in the future.

5.11.4 Decisions, Domain, and Approach

The domain of this SWMU is the former service area just east of the Hilltop House, which is privately owned commercial property (Figure 5-55). The inactive USTs will be removed. Additional remediation will comply with NMED requirements for USTs.

Because there are no existing data to indicate that fuel oils have contaminated the ground at this site, a Stage I investigation will be implemented during Phase I of the field work. At the end of Phase I, which includes removing the tanks, a decision will be made to pursue one of two options: (1) to proceed with Stage II investigations in a second phase of site characterization or (2) to proceed immediately to appropriate remedial action such as removal of small amounts of contaminated material. This decision will be based on analytical measurements of samples from cores beneath the tanks.

Phase II investigations, if implemented, will be designed to determine the extent of residual contamination in the soil and tuff underlying the fuel tanks. These data will be used to complete a baseline risk assessment for the site and to evaluate further corrective measures.

5.11.5 Data Required

5.11.5.1 Source Characterization

Specific data requirements for site characterization in Phase I investigations include

- determining the precise locations of the underground fuel tanks by means of a geophysical survey and
- obtaining Level III/IV data to determine the presence or absence of, and, if present, the nature and concentrations of, any contaminants in subsurface soil and/or tuff beneath the USTs.

Field surveys for vapor phase benzene, toluene, ethylbenzene, and BTEX will be used to determine whether gaseous contaminants are present in surface or shallow subsurface material and to help guide selection of subsurface sampling locations. Because radioactive materials were not used at this site, screening for radiological contaminants will not be performed. All subsurface samples will be screened for

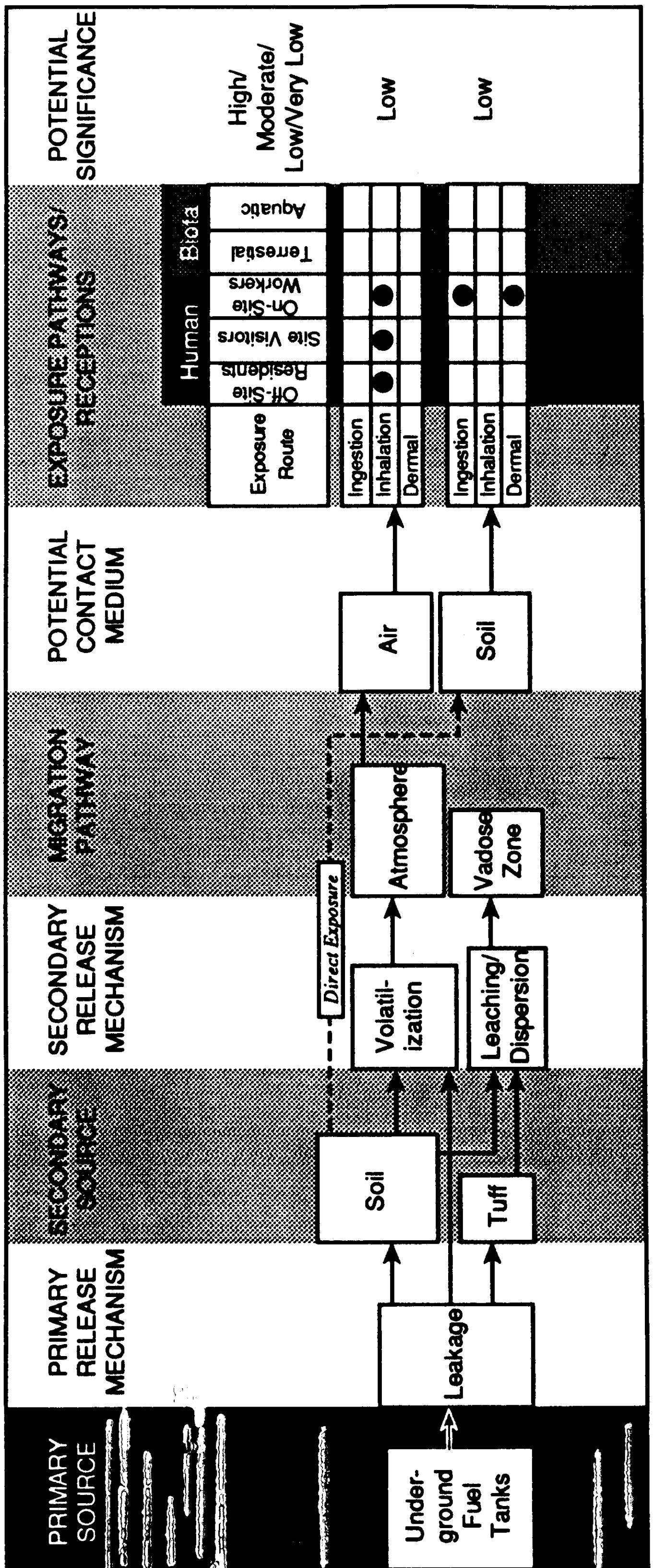


Figure 5-54. Conceptual model of SWMU 0-031(a).

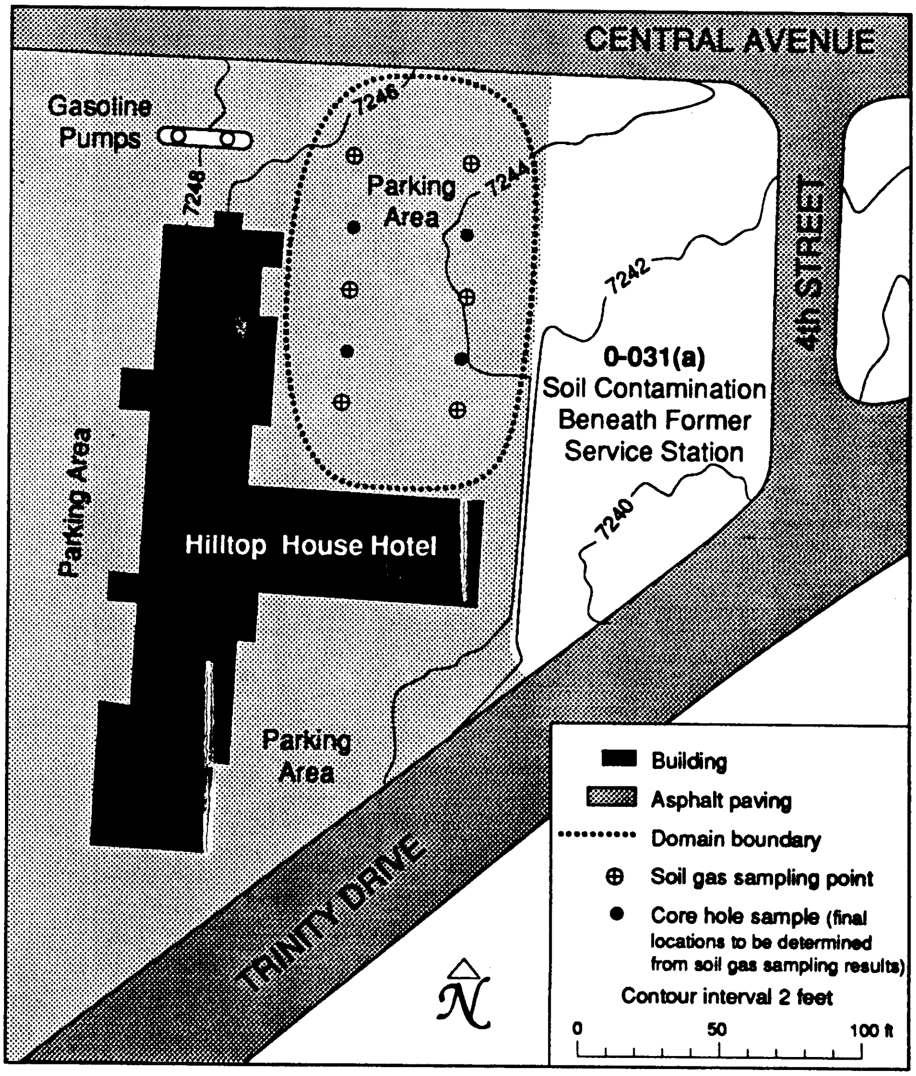


Figure 5-55. Sampling locations at former service station [SWMU 0-031(a)].

BTEX. All samples with positive screening results and 50% of the remaining samples will be submitted for Level III/IV laboratory analysis for BTEX. The Level III/IV data will be compared with action levels, and if contaminant concentrations are at or below these levels, no further field investigations will be conducted.

If the Level IV results of Phase I sampling indicate that contaminant concentrations are above action levels, the necessity and possible scope of Phase II field sampling will be evaluated. Based on current knowledge of past activities at this SWMU, it is not expected that contaminants will be encountered above background concentrations; accordingly, no detailed Phase II sampling plans have been developed. However, should Phase II investigations be necessary, additional source characterization data may be collected to determine the lateral and vertical extent of contamination, to perform a baseline risk assessment, and, if necessary, to provide a data base for designing and implementing corrective measures.

5.11.5.2 Environmental Setting

No additional data are required to characterize the environment of SWMU 0-031(a) in Phase I investigations.

5.11.5.3 Potential Receptors

No specific information regarding the activities, behavior, or location of actual receptors is required for the Phase I investigation. In the event that a Phase II investigation is required, the following information regarding the potential receptors identified in Figure 5-54 may be required:

- the frequency and duration of site visits,
- location of on-site workers relative to source area(s), and
- location of nearest downwind resident. In the event that the estimated risks to this receptor are considered unacceptable, a more detailed demographic survey may be required.

5.11.6 Field Sampling Plan

The field sampling in Phase I, Stage II, investigations of SWMU 0-031(a) will be completed in two field tasks: field surveys and subsurface sampling. The laboratory analyses for all samples will address BTEX, total petroleum hydrocarbons, and lead. The RFI field work and associated activities are described in the following subsections. All field work will be performed in accordance with applicable ER Program SOPs.

5.11.6.1 Task 1—Field Surveys

5.11.6.1.1 Activity 1—Geophysical Survey

Magnetic, electromagnetic, and possibly ground-penetrating radar surveys will be conducted to verify the locations of the underground fuel tanks and service pipes associated with the service station at the Hilltop House. A site map will be produced showing accurate locations of all relevant features on a scale of 1:300.

5.11.6.1.2 Activity 2—Soil Gas Survey

A soil gas survey will be conducted at the location of the underground fuel tanks to investigate the possibility of soil contamination (Figure 5-56). The soil gas survey will focus on the immediate vicinity of the fuel tanks to avoid the possibility of obtaining readings influenced by tanks at the currently operating gasoline service station adjacent to the SWMU boundary. A minimum of six soil gas samples will be collected at regularly spaced intervals above the fuel tank area at a depth of 6 ft, using a stainless steel sample tube driven or drilled through the asphalt or concrete surface. The locations of service piping to the UST will be avoided during sampling. The samples will be analyzed for BTEX.

5.11.6.2 Task 2—Subsurface Sampling

5.11.6.2.1 Activity 1—Assessment of UST Areas

Assessment of the underground fuel tank areas will proceed in three steps: (1) preparing and excavating the site, (2) inspecting and removing the tanks, and (3) sampling subsurface material in the vicinity of the tanks. All activities will be conducted in accordance with NMED regulations and guidelines on UST closure or UST assessment (whichever applies based on the status of the tanks as determined by NMED). The applicable regulatory requirements concerning notification of closure and/or release will be followed.

Site preparation will consist of disconnecting and removing all piping, removing any fluids and/or vapors in the tanks, monitoring to determine levels of hazardous vapor, and carefully excavating the fill material around each fuel tank to expose it for removal. The fuel tanks will be inspected for evidence of leakage and corrosion, and the subsurface material surrounding and underlying the tanks will be field-screened for organic vapors, using headspace analysis of spot samples. Two or three soil samples will be collected from beneath each tank, at sites where soil staining is observed, when a positive field screening response for organic vapors is obtained, and/or beneath inlet and outlet joints. If the extent of soil staining or positive field screening is limited, the excavation will continue as far as practicable, depending on structural and cost constraints, until apparently clean soils are encountered, at which point a confirmatory sample(s) will be collected. All samples and one field duplicate will be submitted for laboratory analyses as indicated in Figure 5-56. The closure of SWMU 0-031(a) will then proceed in accordance with NMED regulations. If the analytical results from the samples do not permit the extent of soil contamination to be defined adequately, additional assessment work may be required to comply with NMED UST regulations.

			Field Surveys				Field Screening (Level I)				Laboratory Analysis (Level III/IV)														
											Number of samples analyzed depends on results of field screening and/or field survey. * =50%, + =30%														
Sample Location	No. of Samples	Sample Description	Site Survey/Mapping	Geophysical Survey (Level I)	Soil Gas Survey (LevelII/III)	Gross Alpha, Beta, Gamma (Level I)	Lithologic Logging	Combustible Gas/Oxygen	Organic Vapor	Gross Alpha, Beta, Gamma	Gamma Spectrometry	^{3}H	Total U (^{234}U, ^{236}U)	^{238}Pu, $^{239/240}Pu$	^{90}Sr	^{137}Cs	^{241}Am	^{60}Co	Volatile Organics (VOA) (SW 8240)	BTEX (SW 8020)	Semivolatile Organics (BNA) (SW 8270)	TPH(418.1)	Lead and Chromium	TCLP Metals	PCB and Pesticides (SW 8080)
0-031(a)	2-4	Core samples from UST area	•		•		•	•	•											•		•	•		
0-031(a)	7-13	Samples from excavation	•		•		•	•	•											•		•	•		

Figure 5-56. Screening and analysis for initial investigations at SWMU 0-031(a).

5.11.6.2.2 Activity 2—Coring

If soil contamination occurs adjacent to the tanks and/or the soil gas survey detects BTEX, cores will be drilled. Cores will be drilled following the procedures described in LANL-ER-SOP-06.10, Hand Auger and Thin-Wall Tube Sampler, or LANL-ER-SOP-04.01, Drilling Methods and Drill Site Management. If the soil gas survey does not detect BTEX, the cores will be located in the center of the fuel tank area (Figure 5-55). The cores will penetrate the top of the tuff and will be continuously field-screened for BTEX and examined for staining or other evidence of contamination. A sample will be collected from each core at the interval with the highest BTEX/ organic screen reading or with visible staining or contamination. The cores will penetrate to a point 5 ft below the last positive field screen response, where a second sample will be collected. If no indication of contamination is observed, drilling will terminate at a nominal depth of 15 ft, and one sample will be collected. All samples will be analyzed as shown in Figure 5-56.

5.12 SWMU Group 0-4 (Former Motorpool Facility)

SWMU Group 0-4 includes SWMU 0-031(b), service station; and SWMU 0-032, The Zia Company motorpool facility. The SWMUs in Group 0-4 are located on private property (Figure 3-2).

5.12.1 Description and History

The Zia Company motorpool facility (SWMU 0-032), located east of 15th Street between Trinity Drive and Central Avenue, consisted of an automotive maintenance hangar and three buildings labeled Buildings 1, 2, and 3 (The Zia Company 1958, 05-0140) (Figure 5-57). Currently, numerous private retail establishments are located at Buildings 1, 2, and 3 (LANL 1990, 0145).

The former automotive maintenance hangar contained a variety of offices and maintenance facilities, including three grease pits, which provided maintenance personnel easy access to the undercarriage of the vehicles. In 1958, a storm sewer was constructed between the automotive maintenance hangar and Building 1. The inlet drains for the storm sewer connected to 15-in.-diameter corrugated metal pipes and drained to the curb along Trinity Drive (The Zia Company 1958, 05-0140). According to the property owner, the current storm drain outfall is in a small canyon to the east. The sanitary waste from the motorpool was treated by the Central Wastewater Treatment Plant from approximately 1947 to 1964 (The Zia Company 1958, 05-0140; LANL 1990, 0145).

In 1962, the automotive maintenance hangar was removed and its services were moved to other buildings. Building 1 housed the superintendent's office, lubrication section, vehicle wash, carburation and ignition section, parts issue, radiator repair, battery repair, chassis repair, and body and paint shops. The vehicle-washing area contained four drain pits approximately 3 by 5 ft whose drainlines lay on gravel fill and metal grating at floor level. Drawings indicate that the pits served primarily to drain vehicle wash water (The Zia Company 1950, 05-0139). The building also contained two grease pits. Building 2 housed the materials control office, machine tools, welding shop, and equipment repair bays. Building 3 housed the front end and wheel shop and, in 1959, was converted to a service station (The Zia Company 1959, 05-0141). The building contained two vehicle-greasing pits, and a waste oil pit was located at the northeast corner of the building. Building 4 housed the tire repair shop and administrative offices (The Zia Company 1962, 05-0144; LANL 1990, 0145).

The SWMU report (LANL 1990, 0145) states that in 1959 a service station [SWMU 0-031(b)] was constructed next to the police station on Trinity Drive; however, neither an aerial photograph taken in 1960 (Limbaugh Engineering & Aerial Services, Inc., 1960, 05-0168) nor a topographic map dated 1963 (Limbaugh Engineering & Aerial Services, Inc., 1963, 05-0160) shows a service station next to the police station. It is inferred that Building 3 is the service station in question because the date of construction (1959) is close to the dates on the photograph and map and the building is near the former police station. Building 3 has three underground storage tanks, located east of the service station, which are no longer is use.

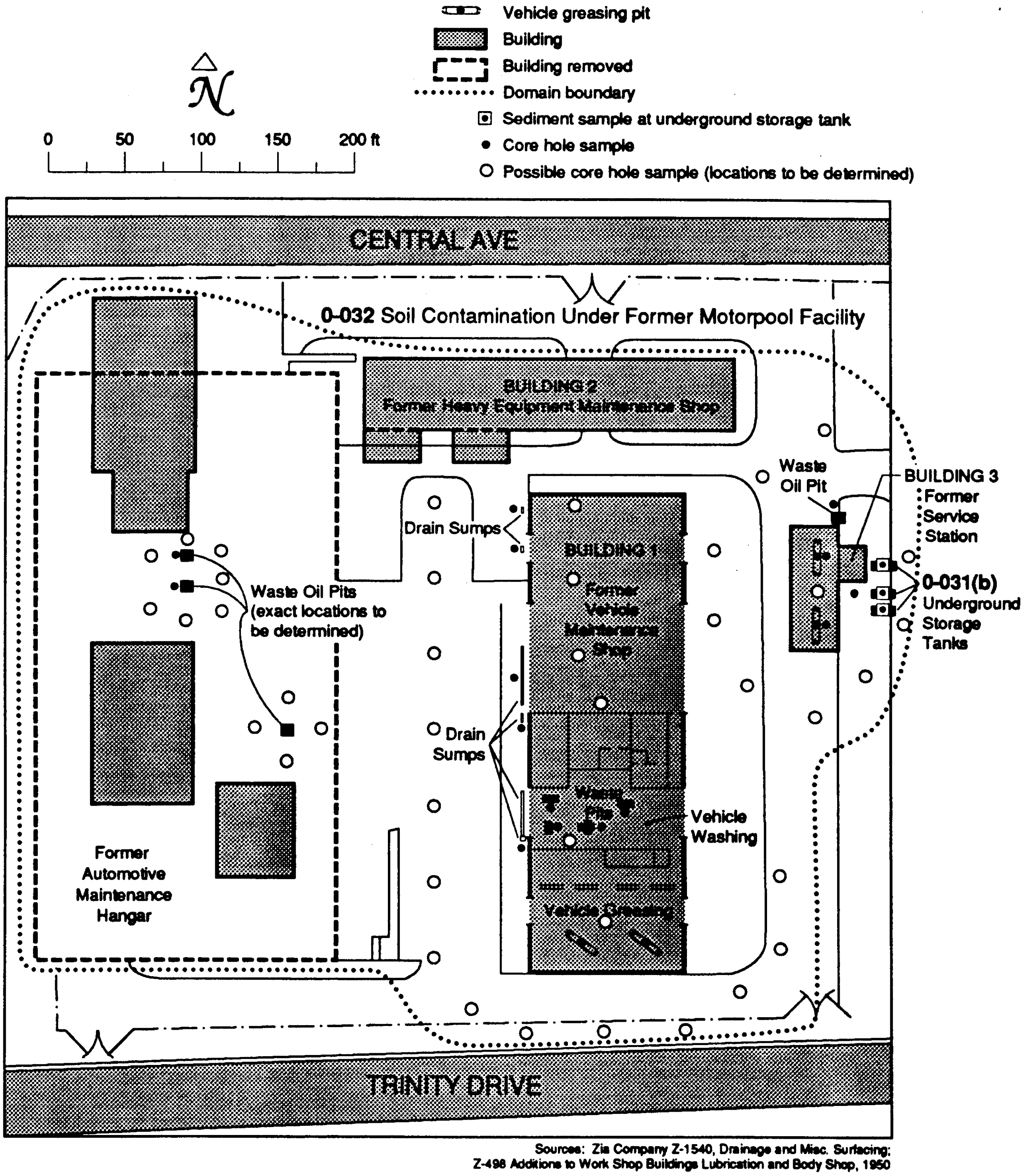


Figure 5-57. Sampling locations at the former motor pool facility (SWMU Group 0-4).

5.12.2 Nature and Extent of Contamination

5.12.2.1 Description and Contamination Levels

The waste oil pits, vehicle-greasing pits, and storm drains in and around the buildings of the former motorpool facility suggest that contaminants, including fuel, oil, solvents, and detergents, may be present. Although there are no known releases, contamination of the soil and tuff around the pits and drains, as well as run-off into the storm drains, seems likely. Any contaminants would travel in the storm sewer to the outfall in Los Alamos Canyon, and any underground plume would move to the southeast.

5.12.2.2 Potential Migration Pathways

Contaminants associated with the former motorpool facility may have been released to the environment in leakage from the grease and wash water pits, underground fuel tanks, and/or waste oil pits. As a result, contaminants may be present in the soil, tuff, and/or air. Any contaminants in the soil or tuff would leach/disperse through the vadose zone, migrate upward through vapor phase diffusion, and enter the atmosphere.

5.12.2.3 Potential Public Health and Environmental Impacts

Based on the migration pathways listed in Subsection 5.12.2.2, contaminants may be present in or may migrate to the soil and air. As a result, human exposure to site contaminants could occur through inhalation of vapors or suspended particulates, incidental ingestion, or dermal contact with soil. Direct contact with the soil could occur only through significant disturbance of the soil and asphalt (e.g., digging).

5.12.3 Conceptual Models

Figure 5-58 presents the conceptual model for potential contaminant releases from the grease, wash water, and oil pits; underground fuel tanks; and subsequent exposure by the receptors identified in Subsection 5.12.2.3. In Figure 5-58, "off-site residents" refers to residents located in the vicinity of the former motorpool, "site visitors" refers to people who may walk across the site, and "on-site workers" refers to employees of the various private businesses that currently occupy the facility.

5.12.4 Decisions, Domain, and Approach

The domain of this SWMU group is an area between Central Avenue and Trinity Drive that includes three existing buildings in the eastern half of the site and the former automotive maintenance hangar to the west (Figure 5-57). These sites are located on privately owned commercial property, and the goal of the RCRA process, given the property's central location, is to ensure that the property is suitable for unrestricted use. The underground fuel tanks [SWMU 0-031(b)] are no longer in use and will be removed. Other remedial action will be proposed, if necessary, to clean the site to meet health-risk-based media cleanup standards for residential use.

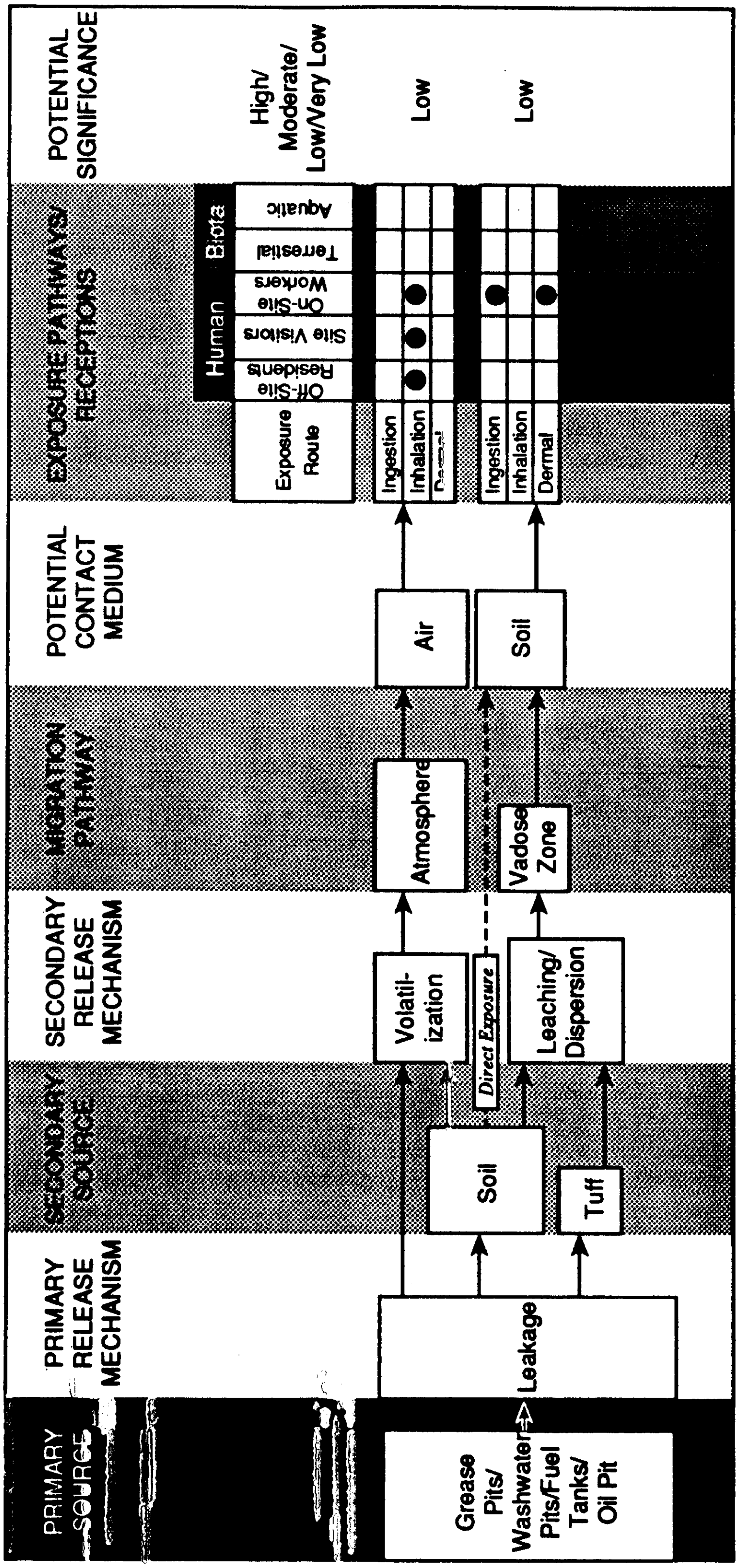


Figure 5-58. Conceptual model of SWMU Group 0-4.

Because numerous waste oil pits, greasing pits, and drain sumps may have caused subsurface contamination (petroleum products and solvents) beneath the pavement, Phase I at these sites will involve a Stage II investigation to determine the level and extent of this contamination so that a baseline risk assessment can be completed. Cores will be drilled around the service pits to determine the distribution of any contamination. The domain of these Phase I investigations potentially includes the entire SWMU group domain; however, sequential drilling will begin near the pits, sumps, and drains. The preliminary geophysical survey may locate other underground tanks and pipes, which could have been sources of contamination. Soil and tuff samples will also be collected around and beneath the underground fuel tanks. It is not expected that additional data will be needed before implementing corrective measures.

5.12.5 Data Required

5.12.5.1 Source Characterization

Specific data requirements for source characterization in Phase I, Stage II, investigations include

- determining as accurately as possible the locations, boundaries, and geometries of the waste pits and drainlines associated with the former automotive maintenance hangar, the waste pits, the drains and sumps in Building 1, the outfalls associated with the sumps, and the underground fuel tanks at the former service station, using field surveys and Level I data and

- using Level III/IV data to determine the nature, concentrations, and lateral and vertical extent of contaminants present in site media in the potential release areas, including sediment or gravel fill in the former waste pits, channel sediments adjacent to outfall points, and subsurface material beneath and adjacent to the waste pits, sumps, drains, and underground fuel tanks.

To adequately define the lateral extent of contaminant migration, Phase I, Stage II, investigations will be conducted using an iterative coring approach. In the first round of sampling, the following samples will be collected: samples from the surface drainage area around Building 1 (from the bottom of sumps and outfall channels), soil and tuff beneath the waste pits, and samples from drains and sumps associated with the automotive maintenance hangar and other buildings. The results from these samples, together with the results of the soil gas survey, should provide enough information to bound the lateral extent of contamination, but more detail on vertical extent may eventually be required.

Field surveys and field screening for organic vapors will play an integral role in the field investigation of this SWMU group. Site and geophysical surveys will be used to help locate buried structures. Field-screening samples will help define the extent of contamination and will be used to determine which samples to submit for laboratory analysis. Because radioactive materials were not used at this site, screening for radiological contaminants will not be performed. All samples with a positive field screen response will be submitted for laboratory analysis. When sample screening indicates that contamination is not present above action levels, as in confirmatory samples, a percentage of the samples will be submitted for Level III/IV laboratory analysis (Subsection 5.12.6). Level III/IV data will be compared with action level criteria, and, if contaminants are at or below action levels in all samples, no further field investigations will be conducted.

If the analytical results of Phase I, Stage II, sampling indicate that contaminant concentrations are above action levels, the need for a CMS will be evaluated by a complete baseline risk assessment. It is expected that the results of the Phase I, Stage II, investigation will provide sufficient data for this purpose.

5.12.5.2 Environmental Setting

No additional data are required to characterize the environmental setting of SWMU Group 0-4 in Phase I investigations.

5.12.5.3 Potential Receptors

Action levels (i.e., health-based levels of contaminant concentrations for specific media) will be used in the Phase I investigation as the initial basis for determining whether there is a potential for adverse human health effects associated with the grease, wash water, oil pits, or underground fuel tanks. These action levels were established assuming constant on-site exposure and making conservative assumptions of human behavior; thus, no specific information regarding the activities, behavior, or location of actual receptors is required for this initial assessment. In the event that measured contaminant concentrations exceed action levels, a site-specific baseline risk assessment may be conducted to support a decision for no further action at the site. Information that may be required regarding the potential receptors identified in Subsection 5.12.3 includes

- frequency and duration of site visits,
- location of on-site workers relative to source area(s), and
- location of nearest downwind resident. In the event that the estimated risks to this receptor are considered unacceptable, a more detailed demographic survey may be required.

5.12.6 Field Sampling Plan

The field work in Phase I, Stage II, investigations of SWMU Group 0-4 will be completed in three field tasks: field surveys, surface sampling, and subsurface sampling. The RFI field work and associated activities are summarized in the following subsections. All field work will be performed in accordance with applicable ER Program SOPs.

5.12.6.1 Task 1—Field Surveys

Two surveys will be performed in Task 1: (1) site survey and (2) geophysical survey.

5.12.6.1.1 Activity 1—Site Survey

A site survey will be conducted to determine the locations of the waste pits, vehicle-greasing pits, sumps, associated drainlines, outfall points, and USTs. The locations will be determined by examining historic aerial photographs, by reviewing records, including maps and engineering plans, and by conducting visual inspections. A site map will be produced showing accurate locations of all relevant features on a scale of 1:300.

5.12.6.1.2 Activity 2—Geophysical Surveys

Geophysical surveys will be conducted to confirm the locations and subsurface geometries of the waste pits, the underground fuel tanks, and associated lines and to help define areas of contaminated tuff. A magnetic survey and an EMC survey will be conducted, and, if necessary, ground-penetrating radar will be used to supplement the magnetic and EMC surveys. Once located, the sites will be marked in the field.

5.12.6.2 Task 2—Surface Sampling

Task 2 will consist of sampling channel sediments at the two outfall points associated with the sump drains.

5.12.6.2.1 Activity 1—Outfall Point Sampling

Channel sediments will be sampled at outfall points associated with the sump drains from Building 1. In first- or higher-order drainage channels that have developed downslope of these outfalls, two samples of channel sediments will be taken from sediment catchments as close to the outfall points as possible. If no distinct drainage channels are discernible, two samples will be collected from likely sediment catchments adjacent to the outfall points. Samples will be collected using the procedures described in LANL-ER-SOP-06.14, Sediment Material Collection. A total of four channel sediment samples will be screened and analyzed as indicated in Figure 5-59.

5.12.6.3 Task 3—Subsurface Sampling

Task 3 will consist of four activities: (1) assessment of the underground fuel tank area; (2) coring and sampling the waste pits at the former automotive maintenance hangar; (3) coring and sampling the waste pits, sumps, and drains at Building 1; and (4) coring and sampling the waste pit at the former service station.

5.12.6.3.1 Activity 1—Assessment of Underground Fuel Tank Areas

Assessment of the three underground fuel tank areas (Figure 5-57) will proceed as described in Subsection 2.3.4.2. All activities will be conducted in accordance with NMED regulations and guidelines on UST closure or UST assessment (whichever applies, based on the status of the tanks as determined by NMED). The applicable regulatory requirements concerning notification of closure and/or release will be

Sample Location	No. of Samples	Sample Description	Field Surveys: Site Survey/Mapping	Field Surveys: Geophysical Survey (Level I)	Field Surveys: Soil Gas Survey (Level/II)	Field Surveys: Gross Alpha, Beta, Gamma (Level I)	Field Screening (Level I): Lithologic Logging	Field Screening (Level I): Combustible Gas/Oxygen	Field Screening (Level I): Organic Vapor	Field Screening (Level I): Gross Alpha, Beta, Gamma	Laboratory Analysis (Level III/IV): Gamma Spectrometry	^3H	Total U (^{234}U, ^{235}U)	^{238}Pu, $^{239/240}Pu$	^{90}Sr	^{137}Cs	^{241}Am	^{60}Co	Volatile Organics (VOA) (SW 8240)	BTEX (SW 8020)	Semivolatile Organics (BNA) (SW 8270)	TPH(418.1)	Lead and Chromium	TCLP Metals	PCB and Pesticides (SW 8080)
0-032	2	Channel sediments below outfall points	•																*		*		*		
0-031(b)	<16	Subsurface materials beneath USTs	•	•				•	•											•		•			
0-032	6-20	Core samples from AMH waste pits	•	•			•	•	•										*	*	*	*	*		
0-032	10-30	Core, waste pit, and sump samples from Building 1	•	•			•	•	•										*	*	*	*	*		
0-031(b)	3-12	Core samples from Building 3	•	•			•	•	•										*	*	*	*	*		
0-031(b) 0-032	≤40	Additional core samples from Stage IIb	•	•			•	•	•										*	*	*	*	*		

Laboratory Analysis note: Number of samples analyzed depends on results of field screening and/or field survey. * =50%, + =30%

° AMH = Automotive Maintenance Hangar

Figure 5-59. Screening and analysis for initial investigations at SWMU Group 0-4.

followed. Six samples, two from beneath each tank, will be submitted for laboratory analysis (Figure 5-59).

5.12.6.3.2 Activity 2—Coring at Waste Pits at Automotive Maintenance Hangar

Cores will be drilled at the waste oil pits associated with the automotive maintenance hangar to determine whether residual contamination exists and/or to determine the extent of contaminant migration (Figure 5-57). A minimum of five cores will be drilled in the area surrounding the pits; additional cores may be added after the exact locations of the pits have been determined. The cores will be continuously field-screened for organic vapor and will be examined for staining or other evidence of contamination. Samples will be collected from the core interval with the highest organic screen reading and from areas that are visibly stained or contaminated. The core will penetrate to a point 5 ft below the last positive field screen response, and a final sample will be collected. If no indication of contamination is observed, drilling will terminate at a nominal depth of 15 ft, where one confirmatory sample will be collected. Cores will be drilled following the procedures described in LANL-ER-SOP-04.01, Drilling Methods and Drill Site Management. All samples that indicate a positive screen response and 50% of the remaining samples, plus one field duplicate, will be analyzed as indicated in Figure 5-59.

5.12.6.3.3 Activity 3—Coring at Building 1

Cores will be drilled at the waste oil pits, the vehicle-greasing pits, and the sumps and drains associated with Building 1 to determine whether residual contamination exists and/or to determine the extent of contaminant migration (Figure 5-57). Up to eight cores will be drilled through the sumps around the perimeter of Building 1. Six cores will be drilled inside the building at the waste pits and vehicle-greasing pits. The cores will be continuously field-screened for organic vapor and will be examined for staining or other evidence of contamination. Samples will be collected from the core interval with the highest organic screen reading and from areas that are visibly stained or contaminated. Each core will penetrate to a point 5 ft below the last positive field screen response, and a final sample will be collected. If no indication of contamination is observed, drilling will terminate at a nominal depth of 15 ft, and one confirmatory sample will be collected. A sample will be collected from the top 6 in. of each sump core. Cores will be drilled following the procedures described in LANL-ER-SOP-04.01, Drilling Methods and Drill Site Management. All samples that indicate a positive screen response and 50% of the remaining samples will be analyzed as indicated in Figure 5-59.

5.12.6.3.4 Activity 4—Coring at the Former Service Station

Cores will be drilled at the waste oil pits associated with the former service station to determine whether residual contamination exists and/or to determine the extent of contaminant migration (Figure 5-57). One core will be located in the waste oil pit at the northeast corner of the building. Three cores will be drilled inside the building in and between the vehicle-greasing pits. The cores will be continuously field-screened for organic vapor and will be examined for staining or other evidence of contamination. A sample will be collected from the core interval with the highest organic screen reading and from areas that are visibly stained or contaminated. Each core will penetrate to a point 5 ft below the last positive field screen response, and a second, confirmatory sample will be collected. If no indication of contamination is observed, drilling will terminate at a nominal depth of 15 ft, and one confirmatory sample will be collected. Cores will be drilled following the procedures described in LANL-ER-SOP-04.01, Drilling Methods and Drill Site Management. All samples that indicate a positive screen response and 50% of the remaining samples will be analyzed as indicated in Figure 5-59.

5.12.6.3.5 Additional Coring

If the first round of coring in Stage II does not adequately delineate the nature and extent of contamination, a second round of coring will be conducted based on the results of the soil gas survey and the results of the first round. The cores will be taken outboard from contaminated cores, and screening and sampling will proceed as in the first round of coring. Possible core locations are shown in Figure 5-57.

5.13 SWMU Group 0-5 ("Trenches/Landfills")

SWMU Group 0-5 includes SWMU 0-034(a), Nambe Place Trench (Figure 3-2), and SWMU 0-034(b), Western Area Pit (Figure 3-3).

5.13.1 Description and History

A trench [SWMU 0-034(a)] and pit [SWMU 0-034(b)] have been identified from aerial photographs taken in 1946. The trench is located between Nambe Place and Pueblo Canyon, and the pit is located between Trinity Drive and Fairway Drive to the east of 43rd Street. SWMU 0-034(a) is located on Los Alamos County property; SWMU 0-034(b) is located on privately owned property.

5.13.2 Nature and Extent of Contamination

5.13.2.1 Description and Contamination Levels

There is no documentation of the existence of the trench or pit; therefore, it is not known what types of waste, if any, they contain.

5.13.2.2 Potential Migration Pathways

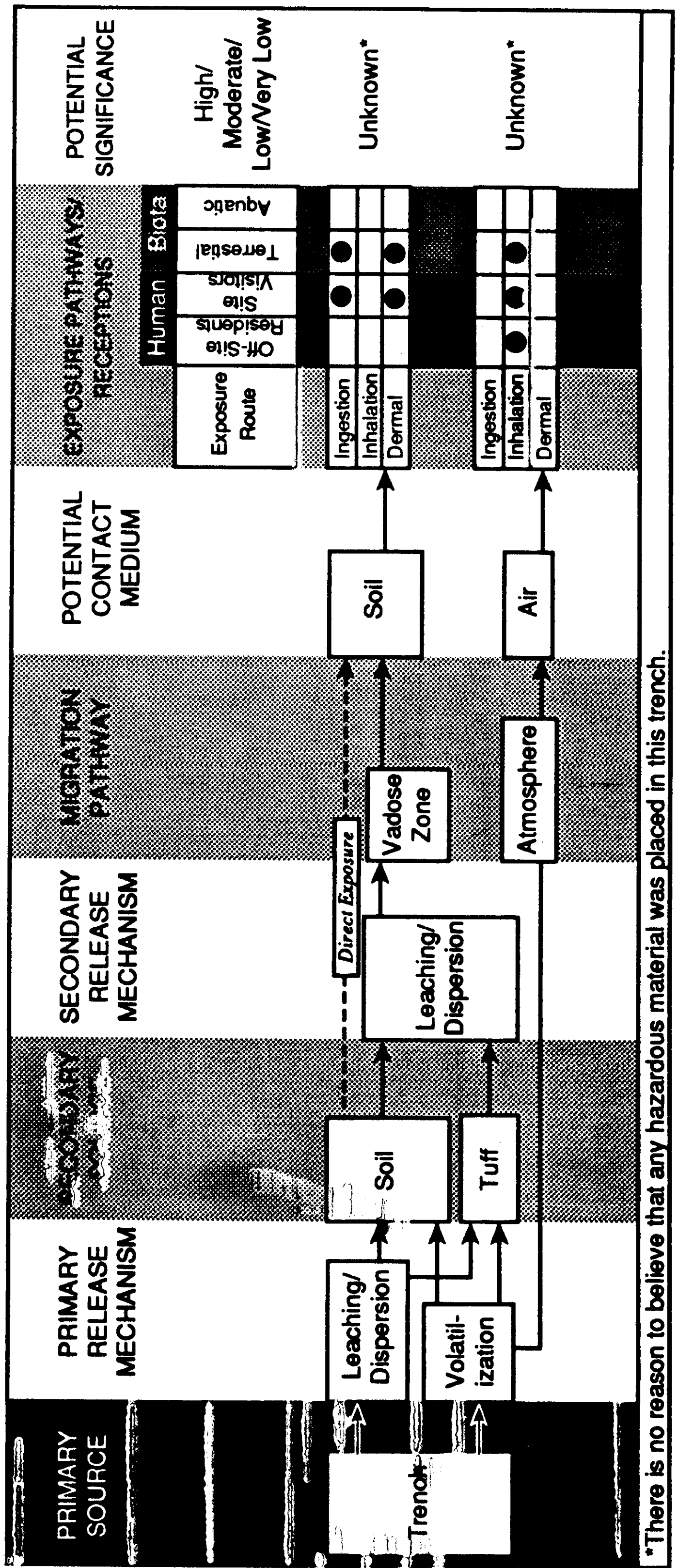
Contaminants from materials that may have been disposed in the trench at Nambe Place or in the Western Area pit may have been released into the environment as a result of leaching/dispersion or volatilization. As a result, contaminants may be present in soil, tuff, and/or air. Inasmuch as the trenches at these locations have been filled and the area has been vegetated, dispersion of contaminants by wind is unlikely occur. Contaminants in soil or tuff may leach/disperse through the vadose zone or migrate upward through vapor phase diffusion and enter the atmosphere. However, there is no evidence that any hazardous material was placed in either the trench or the pit.

5.13.2.3 Potential Public Health and Environmental Impacts

Based on the migration pathways given in Subsection 5.13.2.2, contaminants may be present in or may migrate to soil or air. As a result, human exposure to site contaminants may occur through inhalation of vapors or suspended particulates, incidental ingestion, or dermal contact with soil. Direct contact with soil could only occur through significant disturbance of the soil (e.g., digging). Additionally, terrestrial animals may be exposed to site contaminants via incidental ingestion or dermal contact with soil, or inhalation of vapors or suspended particulates.

5.13.3 Conceptual Models

Figures 5-60 and 5-61 present the conceptual models for potential contaminant releases from the trench at Nambe Place and the pit in Western Area and subsequent exposure by the receptors identified in Subsection 5.13.2.3. In Figure 5-60, "off-site residents" refers to residents located in the vicinity of the Nambe Place



*There is no reason to believe that any hazardous material was placed in this trench.

Figure 5-60. Conceptual model of SWMU 0-034(a).

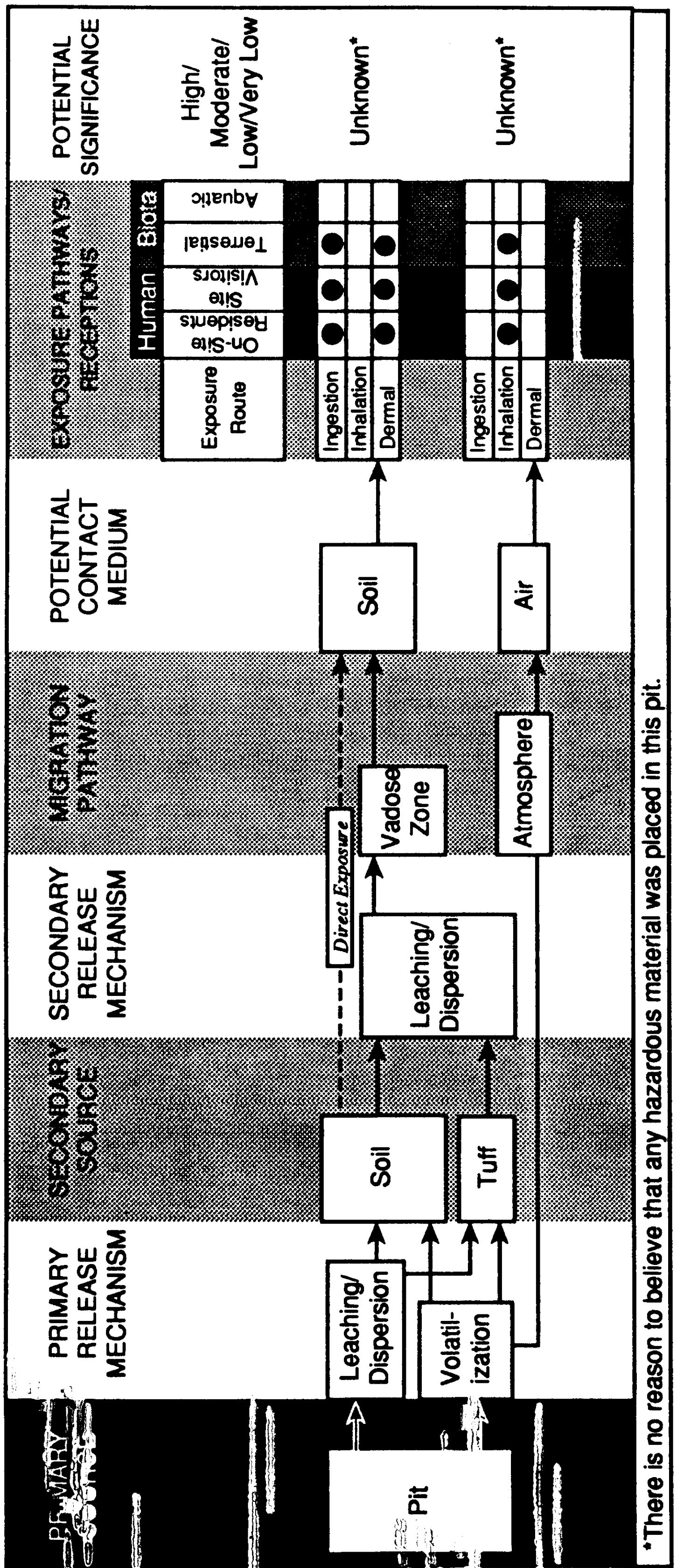


Figure 5-61. Conceptual model of SWMU 0-034(b).

trench (likely closest downwind receptor), and "site visitors" refers to people who may occasionally walk across the site near Nambe Place. Because the site is adjacent to the Los Alamos Airport, the future-use scenario assumes no change in use. In Figure 5-61, "on-site residents" refers to residents located on the four lots (4259 and 4201 Trinity and 4234 and 4026 Fairway) that are either partially or completely within the assumed boundaries of the pit. Terrestrial animals in the vicinity of the Nambe Place trench and Western Area pit may also be impacted.

5.13.4 Decisions, Domain, and Approach

The domains of these SWMUs include the pits themselves and the immediately surrounding soil and tuff (Figures 5-62 and 5-63). These sites are on or adjacent to residential property. No contamination is expected to be found at either site; however, if necessary, remedial action will be proposed to clean the sites to meet health-risk-based media cleanup standards for site residents.

Because there is no evidence of contamination at either site, Phase I will consist of Stage I investigations to determine whether any source of contamination is present. This decision will be based on analytical measurements of samples from cores through the trenches, including samples from surface soils, fill materials, and underlying tuff.

Stage I data will be compared with action levels for soil and tuff to determine whether contamination is present at either of these sites. In the absence of contamination, no further action will be proposed for the SWMUs in SWMU Group 0-5. If levels above action levels are observed, Phase II investigations may be required to support a baseline risk assessment and CMS.

5.13.5 Data Required

5.13.5.1 Source Characterization

Specific data requirements for source characterization in Phase I investigations include

- using field surveys and Level I data to determine as accurately as possible the locations, boundaries, and subsurface geometries of the trench and pit [SWMUs 0-034(a and b)];
- using a soil gas survey and Level II/III data to determine the presence or absence of vapor phase contaminants in the shallow fill material at the trench and pit;
- using Level III/IV data to determine the presence above action levels or absence of radioactive contaminants in surficial material at the trench and pit; and
- using Level III/IV data to determine the presence or absence of, and, if present, the nature and concentrations of, any contaminants in potential release areas or site media, includ-

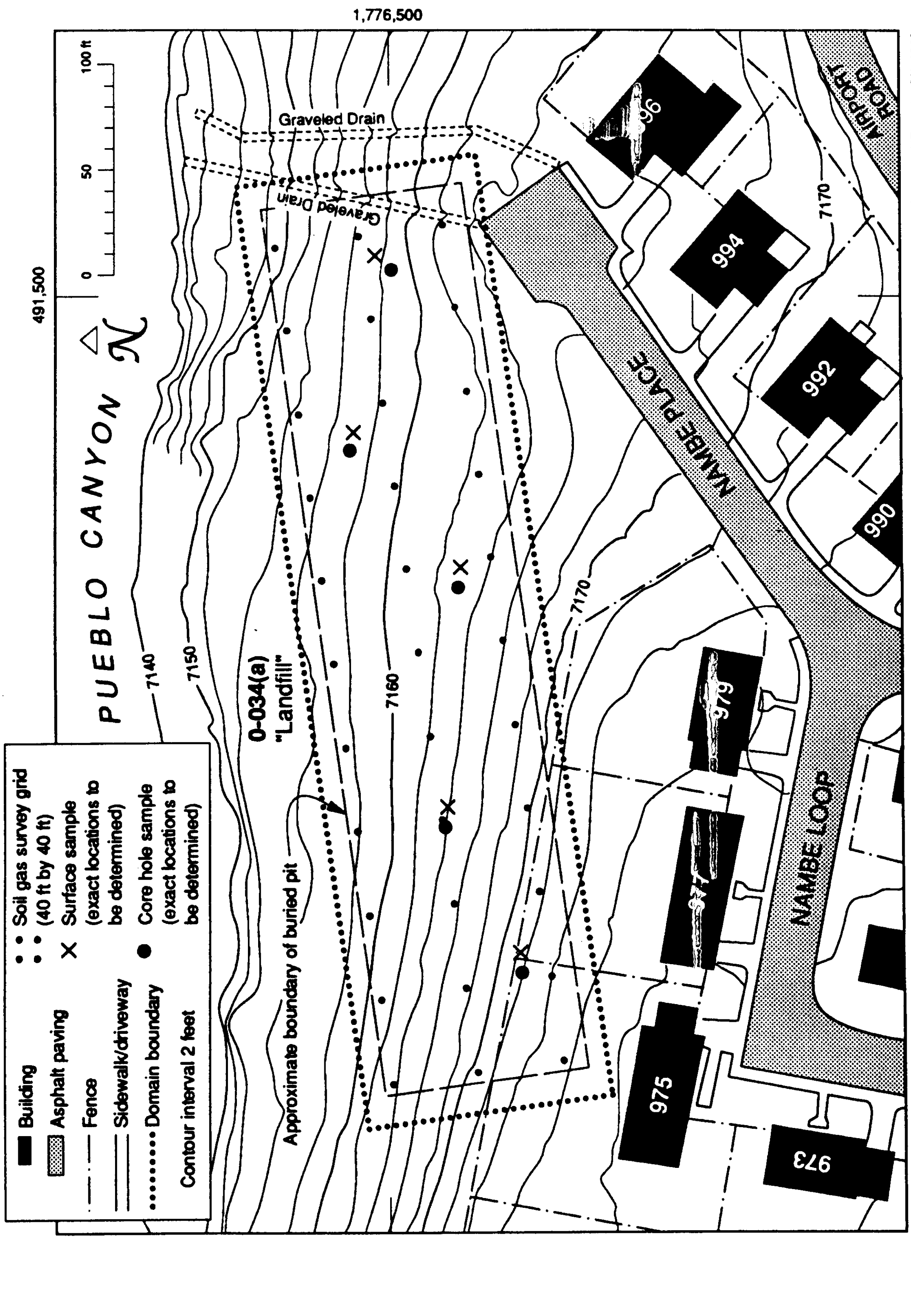


Figure 5-62. Sampling locations at the Nambe Place trench [SWMU 0-034(a)].

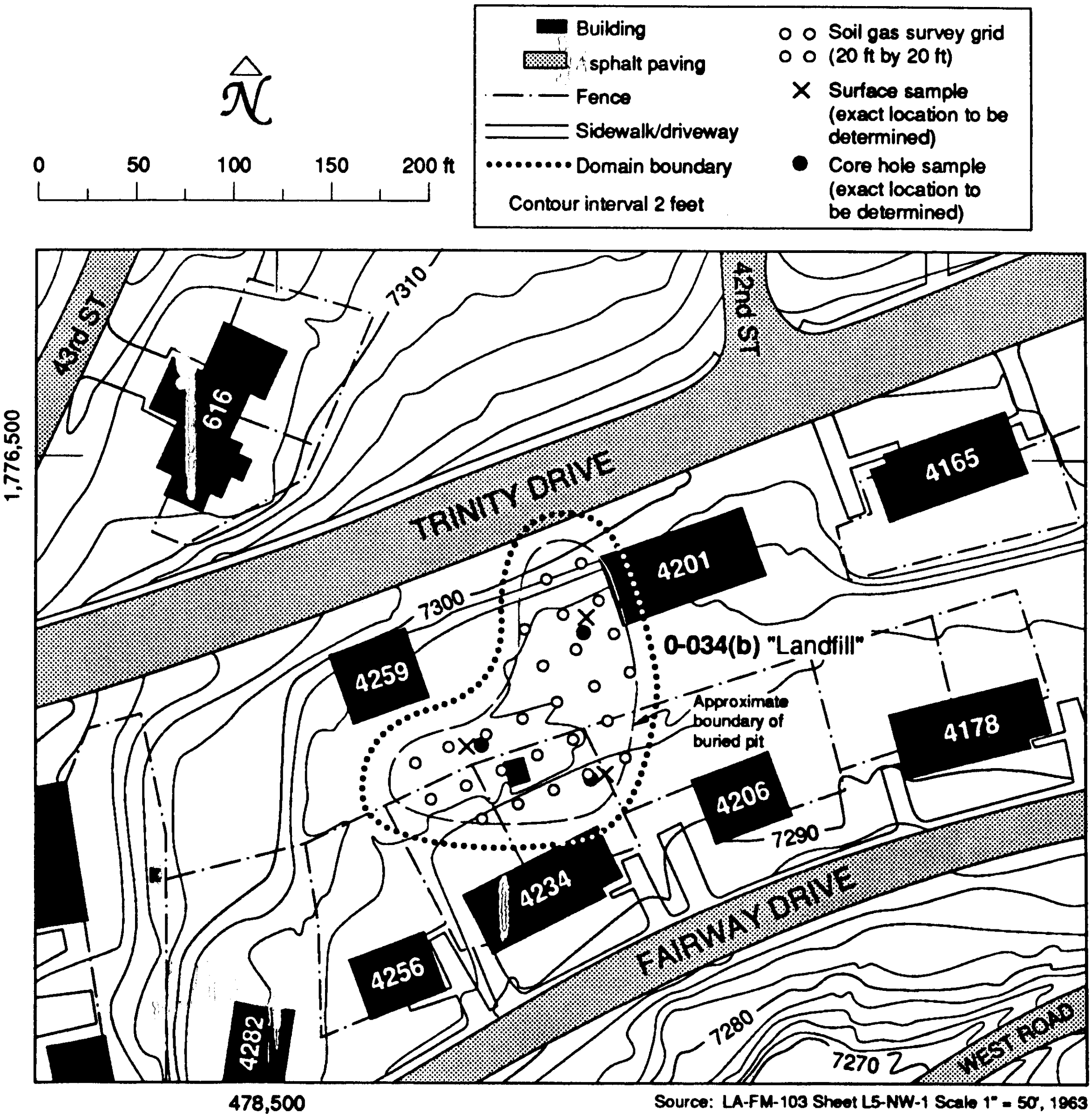


Figure 5-63. Sampling locations at the Western Area pit [SWMU 0-034(b)].

ing surface material, fill material, and tuff beneath the trench and pit.

An engineering site survey will be used to help locate and define the boundaries of the trench and pit. Geophysical surveys will be useful to locate the boundaries of the trench if objects were buried in it and/or if the fill material differs appreciably from the tuff. Field surveys for organic vapors and radionuclides will be used to determine whether vapor phase or radioactive contaminants are present in surficial or shallow fill material, and, if positive screen responses are obtained, these data will guide selection of surface and subsurface sampling locations. All surface and subsurface samples will be screened for organic vapor and gross alpha, beta, and gamma radiation to determine whether organic or radionuclide contamination is present. If screening the samples indicates that contamination is not present above action levels, 50% of the surface and subsurface samples will be submitted for laboratory analysis. All samples for which screening indicates that contamination is present above background will be submitted for Level III/IV analysis of specific contaminants (Subsection 5.13.6). The Level III/IV data will be compared with action level concentrations, and if contaminant concentrations are at or below these levels, no further field investigations will be conducted.

If the Level III/IV results of Phase I sampling indicate that contaminant concentrations are above action levels, the necessity and possible scope of Phase II field sampling will be evaluated. Based on current knowledge of past activities at these SWMU sites, it is not expected that contaminants will be encountered above action level concentrations; accordingly, no detailed Phase II sampling plans have been developed. However, should Phase II investigations be necessary, additional source characterization data may be collected to determine the lateral and vertical extent of contamination, to perform a baseline risk assessment, and, if necessary, to provide a data base for designing and implementing corrective measures.

5.13.5.2 Environmental Setting

No additional data are required to characterize the environmental setting of SWMU Group 0-5 in Phase I investigations.

5.13.5.3 Potential Receptors

No specific information regarding the activities, behavior, or location of actual receptors is required for the Phase I investigation.

5.13.6 Field Sampling Plan

The field work in Phase I, Stage I, investigations of SWMU Group 0-5 will be completed in three tasks: field surveys, surface sampling, and subsurface sampling. The RFI field work and associated activities are described in the following subsections. All field work will be performed in accordance with applicable ER Program SOPs.

5.13.6.1 Task 1—Field Surveys

Four field surveys will be performed in Task 1: (1) site survey, (2) geophysical surveys, (3) radiological survey, and (4) soil gas survey.

5.13.6.1.1 Activity 1—Site Survey

A site survey will be conducted to locate the boundaries of the trench and pit. Boundary locations will be determined by examining historic aerial photographs, by reviewing records, including maps and engineering plans, and by conducting visual inspections.

5.13.6.1.2 Activity 2—Geophysical Surveys

If the site survey does not reveal the boundaries of the trench and pit in sufficient detail, geophysical surveys will be conducted to more precisely define the boundaries and subsurface geometries of the trench and pit and to obtain preliminary information about the contents. A magnetic survey and an EMC survey will be conducted, and, if necessary, ground-penetrating radar may also be used to supplement the magnetic and EMC surveys.

5.13.6.1.3 Activity 3—Soil Gas Survey

Soil gas surveys will be conducted on 30- to 40-ft grids at the Nambe Place trench (Figure 5-62) and the Western Area pit (Figure 5-63). Soil gas samples will be taken at each grid node at a depth of 6 ft using a stainless steel sample tube driven into the fill surface. Analytes will include methane, benzene, toluene, xylene, trichloroethylene, 1,1-dichloroethylene, vinyl chloride, freon 113, and dichlorobenzene.

5.13.6.1.4 Activity 4—Radiological Survey

A field survey for gross alpha, beta, and gamma radiation will be conducted over the surface of the trench and pit to determine whether areas exist in which radiation is above action levels. This survey will help guide the selection of sampling locations. In addition, all excavated material and samples will be screened for radioactivity for health and safety purposes and to help determine which samples to submit for Level III/IV laboratory analysis.

5.13.6.2 Task 2—Surface Sampling

Task 2 will consist of sampling surficial material, including locations where the soil gas and radiological surveys indicate organic vapor or radioactivity is present above background.

5.13.6.2.1 Activity 1— Surface Sampling

Samples of surficial material will be collected at the Nambe Place trench (Figure 5-62) and the Western Area pit (Figure 5-63) at any hot spots determined by the soil gas and radiological surveys. In addition, three samples will be collected at each site from the tops of the cores, as described in Task 3 (Subsection 5.13.6.3). Samples will be collected from the uppermost 6 in. of soil at each site and will be screened and analyzed as indicated in Figure 5-64. Surficial material will be collected following the procedures described in LANL-ER-SOP-06.09, Spade and Scoop Method for Collection of Soil Samples.

5.13.6.3 Task 3—Subsurface Sampling

Subsurface samples will be collected from cores drilled in the trench and pit areas. A minimum of three cores will be drilled in each area (Figure 5-62), and three cores will be drilled in the pit (Figure 5-63). One core hole will be located in the deepest part of each site, as suggested by the results of the geophysical survey. The remaining cores will be located at hot spots as delineated by the soil gas and radiological surveys. If no hot spots are recognized from the field surveys, the remaining core holes will be located at regularly spaced intervals across each site.

Each core will penetrate the fill material to the fill/tuff interface and will be continuously screened for organic vapor and gross alpha, beta, and gamma radiation. Four samples will be collected from each core hole: three from intervals in the fill material and one from the uppermost tuff. Samples from the fill material will be collected at 5-ft intervals and at depths for which field screening indicates the presence of organic vapors or radionuclides. If screening procedures do not indicate the presence of contaminants, samples will be collected at three regularly spaced intervals. The fourth sample will be collected in the uppermost tuff and screened. If field screening of this sample indicates the presence of organic vapors or radionuclides, coring will continue with field screening of samples at 5-ft intervals. At a point 5 ft below the last positive field screen response, a second, confirmatory sample will be collected. If field screening the first tuff sample does not indicate contamination, coring will be terminated. Cores will be drilled following the procedures described in LANL ER-SOP-04.01, Drilling Methods and Drill Site Management. All samples that indicate a positive screen response and 50% of the remaining samples will be analyzed as indicated in Figure 5-64.

Sample Location	No. of Samples	Sample Description	Field Surveys: Site Survey/Mapping	Field Surveys: Geophysical Survey (Level I)	Field Surveys: Soil Gas Survey (Level I/II)	Field Surveys: Gross Alpha, Beta, Gamma (Level I)	Field Screening (Level I): Lithologic Logging	Field Screening (Level I): Combustible Gas/Oxygen	Field Screening (Level I): Organic Vapor	Field Screening (Level I): Gross Alpha, Beta, Gamma	Laboratory Analysis (Level III/IV): Gamma Spectrometry	^{3}H	Total U (^{234}U, ^{235}U)	^{238}Pu, $^{239/240}Pu$	^{90}Sr	^{137}Cs	^{241}Am	^{60}Co	Volatile Organics (VOA) (SW 8240)	BTEX (SW 8020)	Semivolatile Organics (BNA) (SW 8270)	TPH(418.1)	Target Analyte List Metals	TCLP Metals	PCB and Pesticides (SW 8080)
0-034(a)	7	Surface samples from Nambe Place trench	●	●	●	●			●	●	●								●		●		●		●
0-034(b)	7	Surface samples from Western Area pit			●	●			●	●	●								●		●		●		●
0-034(a)	13-20	Core samples from Nambe Place trench			●	●	●	●	●	●	*								*		*		*		*
0-034(b)	13-20	Core samples from Western Area pit			●	●	●	●	●	●	*								*		*		*		*

Laboratory Analysis note: Number of samples analyzed depends on results of field screening and/or field survey. * =50%, + =30%

Figure 5-64. Screening and analysis for initial investigations at SWMU Group 0-5.

5.14 SWMU Group 19-1 (East Gate Laboratory)

SWMU Group 19-1 (Figure 5-65) is composed of SWMU 19-002, surface disposal; an area of concern, C-19-001, potential soil contamination beneath former buildings; and SWMU Aggregate 19-A, which includes SWMU 19-001, septic system, and SWMU 19-003, sewer drainline and outfall. DOE owns the land on which all of these sites are located (Figure 1-3).

5.14.1 Description and History

5.14.1.1 SWMU 19-002 (Surface Disposal Area)

The surface disposal area (SWMU 19-002) covers a 100- by 10-ft area in Pueblo Canyon north of TA-19. Building debris from decommissioned TA-19 structures and numerous old batteries are present on the north-facing wall of Pueblo Canyon immediately north of the technical area (Figure 5-65).

5.14.1.2 Area of Concern C-19-001 (Potential Soil Contamination Beneath Former Buildings)

An area of concern identified as C-19-001 in Appendix C of the SWMU report (LANL 1990, 0145) contains possibly contaminated soil located beneath the former laboratory, battery, guard house, latrine, retreat building, and instrument buildings (TA-19-1, -2, -3, -4, -5, and -7).

5.14.1.3 SWMU Aggregate 19-A

5.14.1.3.1 SWMU 19-001 (Septic System)

The septic system (SWMU 19-001) consisted of a tank (TA-19-6), the outfall from the tank, and associated piping. The system was operated from about 1957 until about 1974 and is thought to have handled sanitary waste from the retreat building. Because this system handled only sanitary waste, no hazardous or radioactive contamination is suspected (Garde 1974, 05-0041). Although a 1981 document lists the tank as scheduled for removal (Gonzales 1981, 05-0042), the tank was reported to be still in place during the 1986 CEARP field survey (DOE 1987, 0264). The documentation does not verify removal of the tank.

5.14.1.3.2 SWMU 19-003 (Sewer Drainline and Outfall)

A sewer drainline and outfall (SWMU 19-003) apparently handled sanitary waste from the laboratory building (TA-19-1). Wastes were discharged through the sewer drainline to an outfall in Pueblo Canyon. This system was probably used from 1944 until the laboratory building was decommissioned in 1974. It is possible that radioactive and hazardous materials used in this building were disposed through the sewer system and discharged to the outfall.

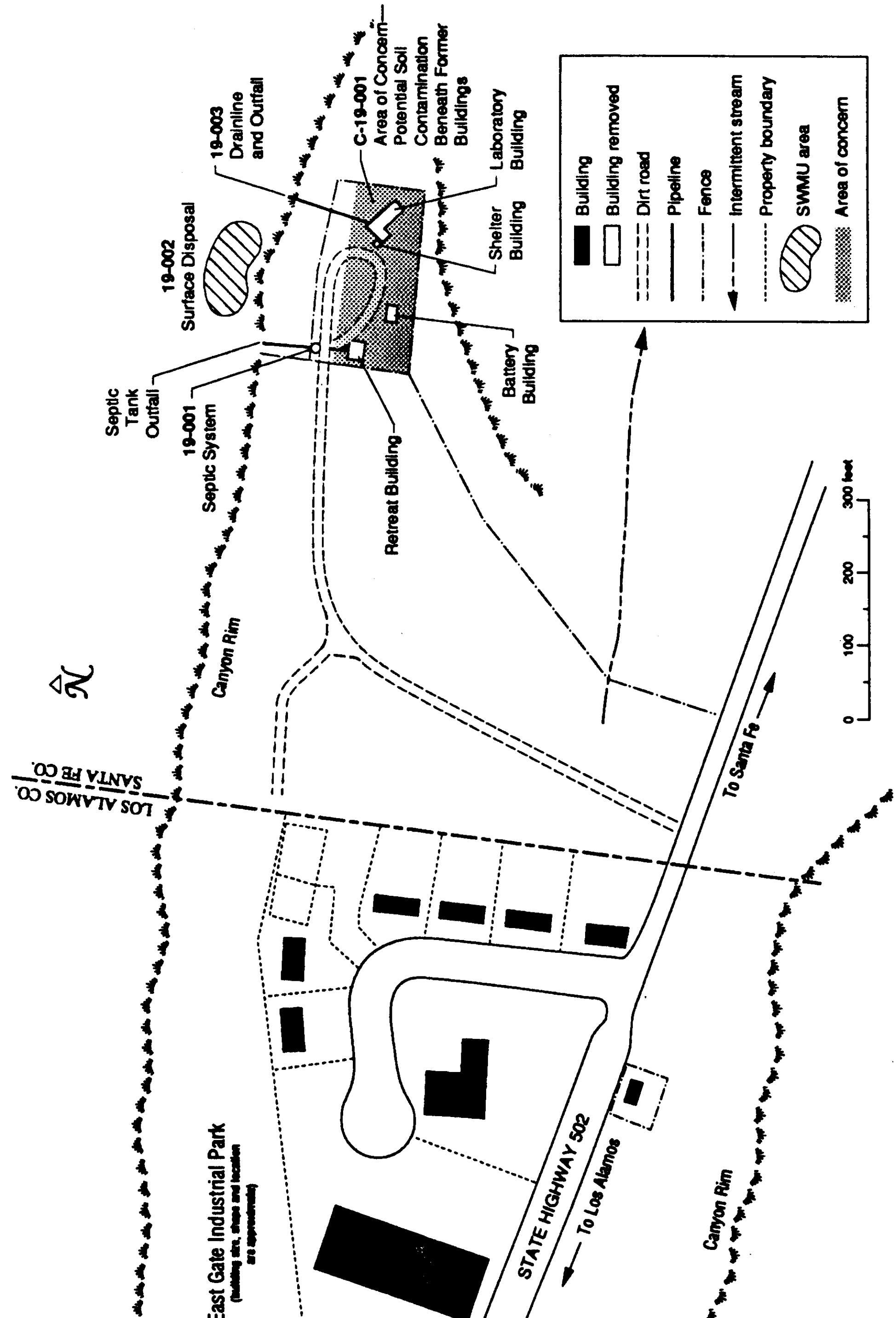


Figure 5-65. SWMU Group 19-1 (East Gate Laboratory).

5.14.2 Nature and Extent of Contamination

5.14.2.1 Description and Contamination Levels

The site of the former East Gate Laboratory (SWMU Group 19-1) is potentially contaminated by radioactive, hazardous, sanitary, and solid waste. Radioactive materials handled at the site were of at least three types: (1) actinides, used in microgram quantities (Charles 1992, 05-0158) for spontaneous fission experiments; (2) a ^{60}Co, 300-Ci source, used for irradiation as late as 1961, (^{60}Co has a 5.27-yr half-life); and (3) a radioactive lanthanum source used in irradiation experiments. This source probably used ^{140}La derived from ^{140}Ba, both of which have very short half-lives (40 hr and 12 days, respectively).

Sanitary waste may have emanated from the guard house and from the septic system and outfall from the laboratory building. Certification dated October 11, 1972, indicates that the septic tank for the guard house is free of HE and radioactive material (Garde 1974, 05-0041). No radioactive material was found in the outfall areas, which is a finding consistent with the half-lives of the radionuclides used.

The solid waste found at SWMU Group 19-1 consists of building debris from TA-19, which was deposited in a 100- by 10-ft area in Pueblo Canyon.

Hazardous wastes, such as trimethyl borate, toluene, 2-1(1-napthyl)-5-phyenyloxozale, and terphehyl in triethylbenzene, may be present. Neither surveillance documents (Environmental Protection Group 1990, 0497) nor general Laboratory surveys for organics (Purtymun et al. 1988, 0213) show releases. Air sampling does not appear to be necessary because the activities conducted at this site do not release contaminants to the air; moreover, any readings taken at this site would be misleading because it is downwind of DP-Site and the Los Alamos Meson Physics Facility, which are known sources of radiation.

5.14.2.2 Potential Migration Pathways

Contaminants originating at TA-19 may have been released to the environment via leaks in the sewer lines and discharge from sewage and septic tank outfalls, or they may have been released from the surface disposal area via infiltration or entrainment by air and/or water. As a result, contaminants may be present in, or may migrate to soil, tuff, and/or air. Contaminants in soil may leach/disperse through the vadose zone, be entrained by surface water and transported downstream by run-off, or be entrained and transported off-site by wind. Contaminants present in the tuff may leach/disperse through the vadose zone.

5.14.2.3 Potential Public Health and Environmental Impacts

Based on the pathways listed in Subsection 5.14.2.2, contaminants may be present in or may migrate to soil or air. As a result, human exposure to site contaminants may occur through inhalation of suspended particulates or incidental ingestion of or dermal contact with soil. Additionally, terrestrial animals may be exposed to site contaminants via incidental ingestion of or dermal contact with soil or through inhalation of suspended particulates.

5.14.3 Conceptual Models

Figures 5-66 and 5-67 present the conceptual models for potential contaminant releases from the surface disposal area and septic/sewer systems and subsequent exposure by the identified receptors. In Figures 5-66 and 5-67, "off-site workers" refers to employees at the East Gate Industrial Park, and "site visitors" refers to people who may occasionally walk across the site or hike along the slopes of Pueblo Canyon adjacent to the site. Terrestrial animals in the vicinity of TA-19 may also be impacted.

5.14.4 Decisions, Domain, and Approach

This SWMU group consists of the mesatop from the eastern point of the mesa to about 400 ft west of the point (encompassing SWMUs 19-001 and 19-003 and AOC C-19-001), as well as the slopes of Pueblo Canyon, including the canyonside disposal area (SWMU 19-002) down to the main channel (Figure 5-68). A trail into Pueblo Canyon heads near the point. About 200 people work in the East Gate Industrial Park, 0.3 km to the west, which also contains one caretaker residence. The area currently belongs to DOE; however, it is unfenced, and the goal of the RCRA process is to ensure that the site is suitable for unrestricted use. Remedial action will therefore be proposed as necessary to clean the site to meet health-risk-based media cleanup standards for residential use.

Because there is no evidence of residual contamination within the domain of SWMU Group 19-1, Phase I will consist of Stage I investigations to determine whether any source of contamination is present. This decision will be based on analytical measurements from samples of the soil and shallow tuffs on the mesatop, beneath the debris in the canyonside disposal area, and from samples of sediments in the first-order channels below the outfalls and debris. Removal of subsurface structures (septic tank and drainlines) will be verified; should such structures be found at the site, they will be investigated to provide additional analytical data in accordance with the procedures outlined in Subsection 2.3.4.

Stage I data will be compared with action levels for soil and tuff to determine whether residual contamination is present at any of these sites. In the absence of contamination, no further action will be proposed at SWMU Group 19-1. If levels above action levels are observed, Phase II investigations may be required to support a baseline risk assessment and CMS.

5.14.5 Data Required

5.14.5.1 Source Characterization

Specific data requirements for source characterization in Phase I investigations include

- determining as accurately as possible the locations, boundaries, and geometries of the septic tank, drainline, and outfall (SWMU 19-001); the sanitary sewer drain and outfall (SWMU 19-003); and the disposal area (SWMU 19-002), using field surveys and Level I data, and

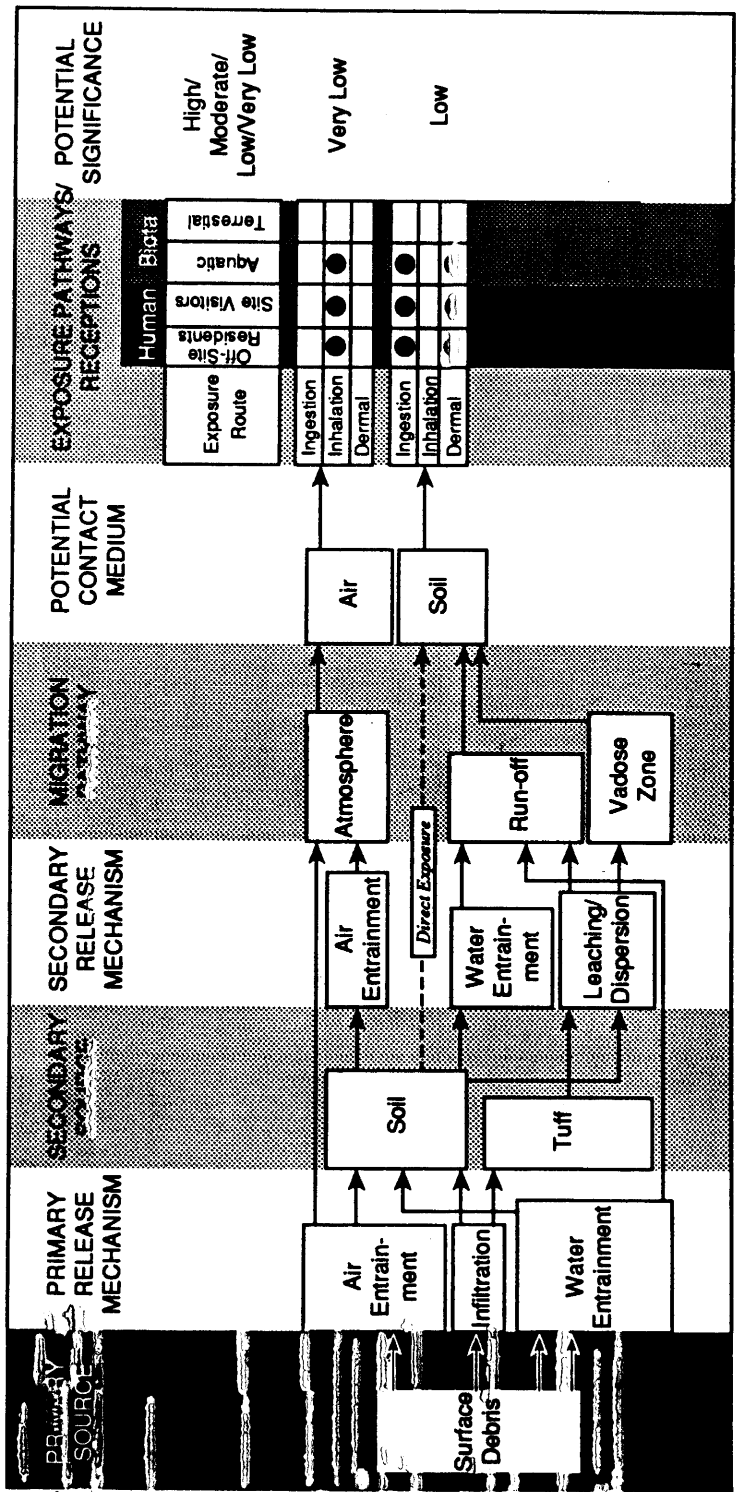


Figure 5-66. Conceptual model of SWMU 19-002.

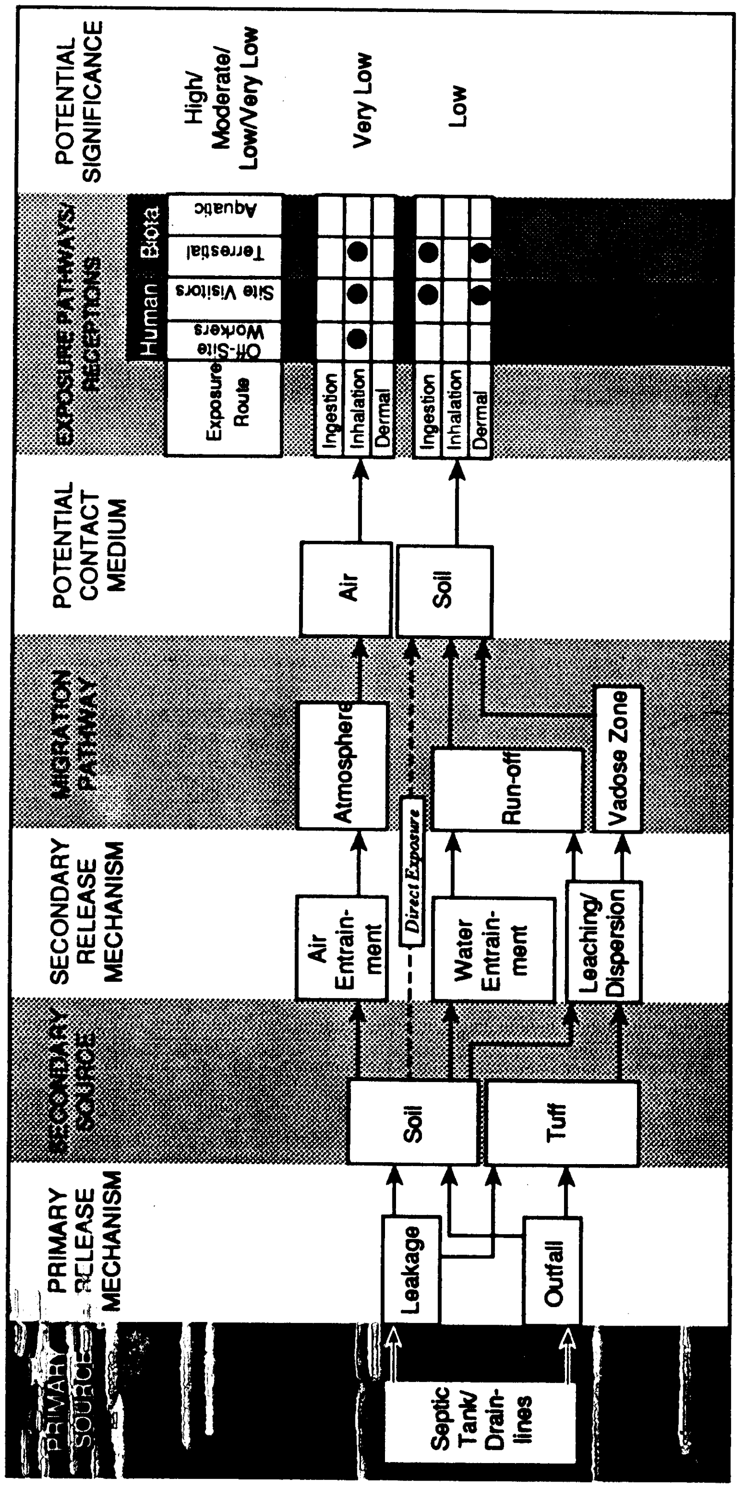
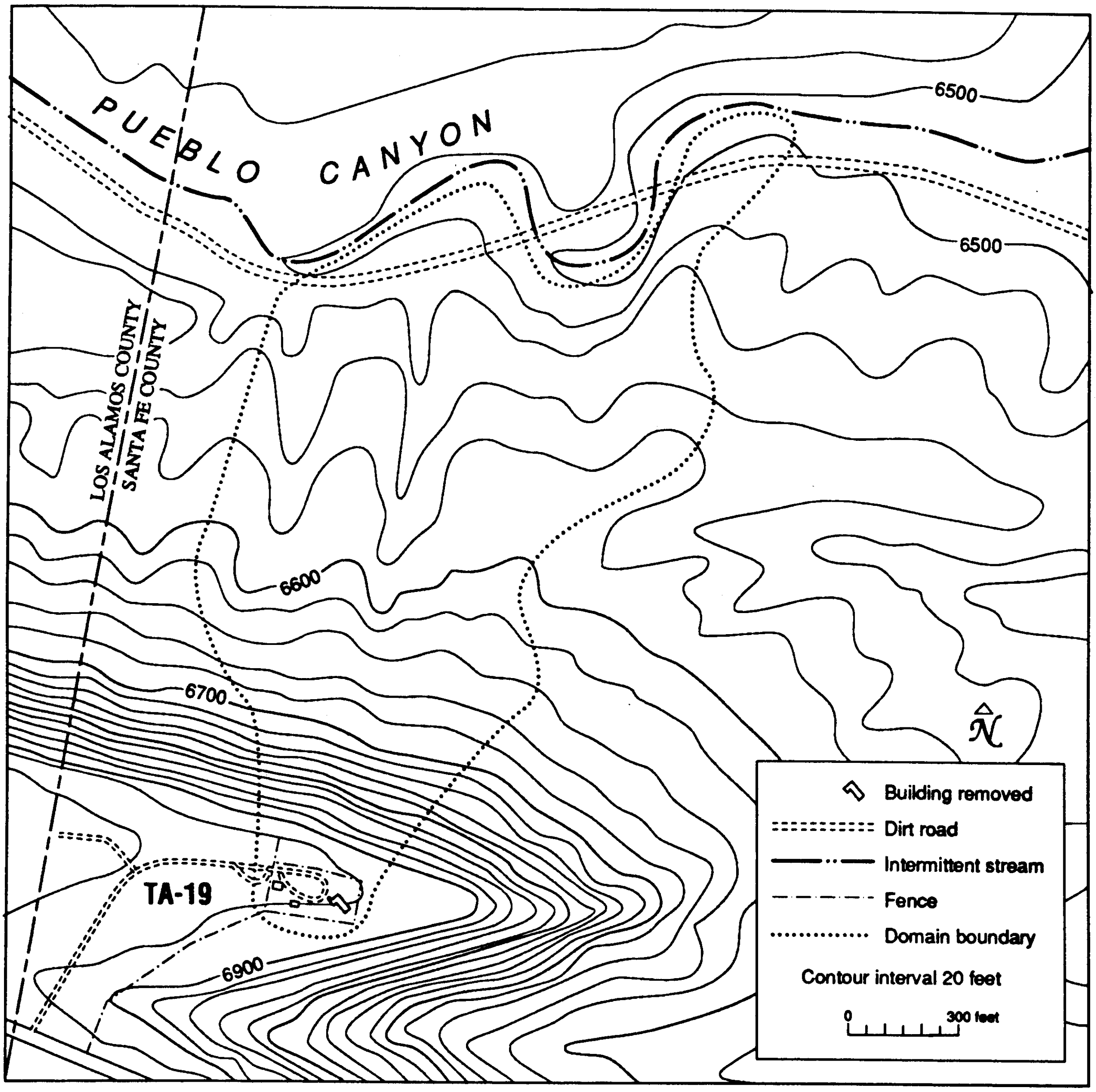


Figure 5-67. Conceptual model of SWMU Aggregate 19-A.



Source: US Geological Survey, 1977, Puye, New Mexico Quagrangle, 1:24,000

Figure 5-68. Domain of SWMU Group 19-1.

- using Level III/IV data to determine the presence or absence of, and, if present, the nature and concentrations of, any contaminants in potential release areas or site media, including surface material at the disposal area, channel sediments in surface drainages originating at or transecting the disposal area, outfall points, or the mesatop in the vicinity of the old laboratory building; sludge from the septic tank; and subsurface materials beneath the septic tank and drainlines.

Laboratory analyses will be compared with action levels. If contaminant concentrations are below action levels, no further field investigations will be conducted. All samples collected in surface and subsurface sampling activities will be screened for gross alpha, beta, and gamma to determine whether radionuclides are present. All samples with a positive screening response, all of those from the septic tank investigation, and 50% of the remaining samples will be submitted for laboratory analysis. Laboratory analyses will include at least seven observations that reflect contaminant levels at the canyon disposal area beneath the debris and downslope channels and nine from drainage channels, outfall channels, and drainlines to provide a probability of at least 0.8 of detecting above-background observations, if present, in at least 20% of those populations (Subsection 2.2.3). The numbers of screened samples will be twice these minimum laboratory sample sizes. Field duplicates will be added to the laboratory samples.

If the Level III/IV data indicate no contamination above action levels, no further action will be proposed at this site. If the Level III/IV results of Phase I sampling indicate that contaminant concentrations are above action levels, the necessity and possible scope of Phase II field sampling will be evaluated. Based on current knowledge of past activities at these SWMU sites, it is not expected that contaminants will be encountered above action levels; accordingly, no detailed Phase II sampling plans have been developed. However, should Phase II investigations be necessary, the following types of data will be collected:

- additional source characterization data to determine the lateral and vertical extent of contamination in soil, tuff, and channel sediments along potential migration pathways and in potential release areas and

- transport characteristics of specific contaminants in soil, tuff, and channel sediments.

These data, if collected, will be used to provide a complete characterization of contaminant releases, to perform a baseline risk assessment, and, if necessary, to provide a data base for designing and implementing corrective measures.

5.14.5.2 Environmental Setting

Data required to characterize the environmental setting of SWMU Group 19-1 in Phase I field investigations include a map of surface water drainages, including sediment catchment sites originating on or transecting the surface disposal area and outfall points on the north-facing valley wall from the mesa rim to the main drainage channel in Pueblo Canyon and originating on the mesatop in the vicinity of the old laboratory area. The map will be used to select sites for sampling channel sediments.

A map of surface water drainages is required because battery debris is exposed at the surface of the disposal area and is subject to weathering and transport in run-off. Also, a potential release site and possible remnant contamination in the soil and tuff may be located on the mesatop in the vicinity of the former laboratory building or at outfall points. It is expected that any contaminants that may have been released via this pathway will be detected by sampling channel sediments in drainages that originate on or transect these areas.

If Phase II investigations are necessary, the information required may include detailed hydrogeologic and geologic characterization of subsurface soil and tuff. These data, if collected, will be used to perform transport modeling and a baseline analysis of risk associated with contaminant release and migration and to design and implement corrective measures.

5.14.5.3 Potential Receptors

No specific information regarding the activities, behavior, or location of actual receptors is required for the Phase I investigation. In the event that a Phase II investigation is required, the following information regarding the potential receptors identified in Figures 5-66 and 5-67 may be required:

- frequency and duration of site visits and
- location of nearest downwind resident. In the event that the estimated risks to this receptor are considered unacceptable, a more detailed demographic survey will be required.

5.14.6 Field Sampling Plan

The field work in Phase I, Stage I, investigations of SWMU Group 19-1 will be completed in three field tasks: field surveys, surface sampling, and subsurface sampling. The RFI field work is described in the following subsections. All field work will be performed in accordance with applicable ER Program SOPs.

5.14.6.1 Task 1—Field Surveys

Three field surveys will be performed in Task 1: (1) site survey, (2) geophysical survey, and (3) geomorphologic mapping.

5.14.6.1.1 Activity 1—Site Survey

A site survey will be conducted to determine the locations of buried structures (septic tanks and drainlines), outfall points, and the extent of the surface disposal area. The locations will be determined by examining historic aerial photographs, by reviewing records, including maps and engineering plans, and by performing visual inspections.

5.14.6.1.2 Activity 2—Geophysical Surveys

If the site survey does not reveal the location of all buried structures in sufficient detail, geophysical surveys will be conducted to more precisely locate the septic tank and drainlines. A magnetic survey will be performed with appropriate spacing to ensure full resolution of large metallic objects and metallic components in the tank or lines. An EMC survey will be conducted to further define buried features. If necessary, ground-penetrating radar may be used to supplement the magnetic and EMC surveys. Once located, the sites will be marked in the field.

5.14.6.1.3 Activity 3—Geomorphologic Mapping

First-order stream channels within the domain and originating at or transecting the surface disposal area and the outfall points on the north-facing valley wall and the run-off channels originating on the mesatop in the vicinity of the old laboratory building and draining to the south will be located and mapped to determine sites for sampling channel sediments. This activity will locate all sediment catchment sites in the relevant drainages. Mapping will be completed on a scale of 1:2000.

5.14.6.2 Task 2—Surface Sampling

The following surface-sampling activities will be performed: (1) sampling surficial material at the disposal area and (2) sampling channel sediments in drainages downslope of the disposal area, beneath outfall points, and along the south rim of the mesatop.

5.14.6.2.1 Activity 1—Sampling at the Surface Disposal Area

Eight samples will be collected from the uppermost 6 in. of material in the surface disposal area (Figure 5-69). Sampling locations may be selected as nodes on a grid (approximately 30-ft spacing) or randomly, with spatial stratification to ensure coverage of the site. One field duplicate will be added to the sample. Samples will be collected following the procedures described in LANL-ER-SOP-06.09, Spade and Scoop Method for Collection of Soil Samples. Samples will be screened and analyzed as indicated in Figure 5-70.

5.14.6.2.2 Activity 2—Sampling Channel Sediments

Samples of channel sediments will be collected from drainages at or below the surface disposal area, at the outfalls associated with the septic system drains, and from the major south-draining channels along the south rim downgradient from the old laboratory building.

The three largest first-order drainage channels originating at or transecting the surface disposal area will be selected for sampling channel sediments (Figure 5-69). A total of two sediment samples will be collected from each drainage selected: the first from a sediment catchment at or immediately below the disposal area and the second from a catchment site near the terminus of the drainage channel or immediately downgradient of the first major confluence, whichever occurs farthest upstream. A total of six samples of channel sediments will be collected downslope

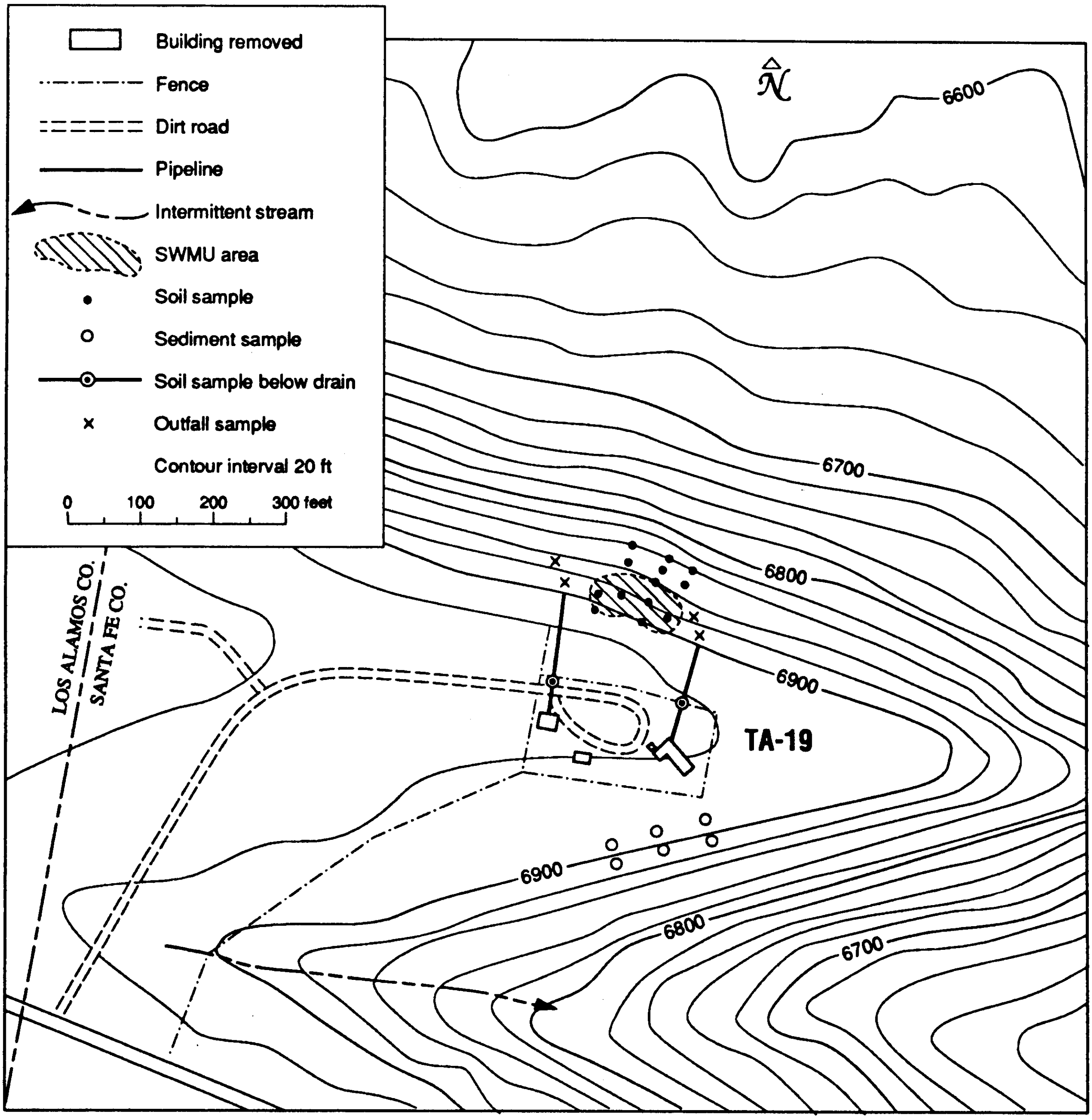


Figure 5-69. Sampling locations for SWMU Group 19-1 (East Gate Laboratory).

Sample Location	No. of Samples	Sample Description	Field Surveys: Site Survey/Mapping	Field Surveys: Geophysical Survey (Level I)	Field Surveys: Soil Gas Survey (Level II/III)	Field Surveys: Gross Alpha, Beta, Gamma (Level I)	Field Screening (Level I): Lithologic Logging	Field Screening (Level I): Combustible Gas/Oxygen	Field Screening (Level I): Organic Vapor	Field Screening (Level I): Gross Alpha, Beta, Gamma	Laboratory Analysis (Level III/IV): Gamma Spectrometry	^3H	Total U (^{234}U, ^{236}U)	^{238}Pu, $^{239/240}Pu$	^{90}Sr	^{137}Cs	^{241}Am	^{60}Co	Volatile Organics (VOA) (SW 8240)	BTEX (SW 8020)	Semivolatile Organics (BNA) (SW 8270)	TPH(418.1)	Target Analyte List Metals	TCLP Metals	PCB and Pesticides (SW 8080)
19-002	8	Surface material from disposal area	●			●				●	*										*		*		
19-002	6	Channel sediments from disposal area	●			●				●	*										*		*		
19-001, 19-003	6	Channel sediments at outfalls	●			●				●	*										*		*		
C-19-001	6	Channel sediments from mesatop channels downslope of old laboratory	●			●				●	*										*		*		
19-001	1	Septic tank sludge	●	●		●		●	●	●	●										●		●		
19-001	2	Subsurface material beneath tank	●	●		●		●	●	●	●										●		●		
19-001, 19-003	4	Subsurface material beneath drainlines	●	●		●		●	●	●	*										*		*		
19	2	Field duplicates	●	●		●		●	●	●	●										●		●		

Laboratory Analysis note: Number of samples analyzed depends on results of field screening and/or field survey. * =50%, + =30%

Figure 5-70. Screening and analysis for initial investigations at SWMU Group 19-1.

of the surface disposal area to be screened and analyzed, as indicated in Figure 5-70.

Three samples of channel sediments will also be taken as close to the outfall points as possible from sediment catchments in first- or higher-order drainage channels that have developed downslope of the outfalls associated with the septic system drains. If no distinct drainage channels are discernible, two samples will be collected from likely sediment catchment areas adjacent to the outfall points. A total of four samples of channel sediments will be collected from outfall points, which will be screened and analyzed as indicated in Figure 5-70.

In addition, two samples of channel sediments will be collected from sediment catchments in each of the three major south-draining channels downgradient of the old laboratory building area. Samples will be collected following the procedures described in LANL-ER-SOP-06.14, Sediment Material Collection. Samples will be screened and analyzed as indicated in Figure 5-70.

5.14.6.3 Task 3—Subsurface Sampling

Subsurface sampling will consist of sampling the septic tank systems and associated drainlines.

5.14.6.3.1 Activity 1—Sampling Septic Tank System Areas

Sampling the septic tank systems and drainlines will proceed as described in Subsection 2.3.4.1. Samples will be screened and analyzed as indicated in Figure 5-70.

5.15 SWMU Group 26-1 (D-Site)

This group consists of SWMU 26-001, canyonside disposal area, and SWMU Aggregate 26-A, which includes SWMUs 26-002(a and b), sump systems, and 26-003, septic system. TA-26 is located on DOE property (Figure 1-3).

5.15.1 Description and History

5.15.1.1 SWMU 26-001 (Canyon Disposal Area)

The canyon disposal area in Los Alamos Canyon (SWMU 26-001) (Figure 5-71) contains debris from a five-room concrete storage vault that was decommissioned and dismantled in 1966. Most of the vault debris currently rests on a ledge of the canyon wall; however, some debris may have fallen as far as the canyon floor (Buckland 1978, 05-0025). The debris on the ledge was covered with approximately 3 ft of soil (Blackwell 1973, 05-0015). In 1986, the CEARP field survey team observed pipe and other materials projecting from the material on the ledge (DOE 1987, 0264).

Before the vault was dismantled, the contaminated contents that were removable, which included shelving, drainlines, the sump, and duct work (Blackwell 1973, 05-0015), were disposed in MDA C. No records documenting the disposition of the radioactive materials stored in the vault have been located.

A survey of radioactive contamination at the D-Site vault area (Structures TA-26-1, -5, and -6) was conducted on April 19, 1965, before the vault was decommissioned. Alpha contamination was measured with a Ludlum Model 11 instrument equipped with a 60-cm^2 probe and/or an Eberline FM-3G equipped with a 68-in.^{2} probe. The grounds and five vault doors were found to be free of contamination. Alpha contamination was detected in the five storage rooms in quantities ranging from 0 to 10,000 cpm on floors, 0 to 400 cpm on light fixtures and ventilation ducts, and 300 to 1,200 cpm on the concrete ramp. The contaminants were suspected to be enriched ^{233}U and ^{235}U and possibly plutonium (Buckland 1965, 05-0026; LANL 1984, 05-0159).

5.15.1.2 SWMU Aggregate 26-A

SWMU Aggregate 26-A consists of SWMUs 26-002(a and b), which are a sump system (a) and the drains from the vault's equipment room (b), and SWMU 26-003, a sanitary septic system.

5.15.1.2.1 SWMUs 26-002(a and b) (Sump Systems)

SWMU 26-002(a), a sump system that served the vault, consisted of a 6-in. VCP floor drain in the south center room of the vault and a collection sump and outfall for discharge into Los Alamos Canyon. The collection sump was located outside the vault "so as to allow for access in the event of an emergency" (Jette 1946, 05-0048). The word "acid" is occasionally used in connection with the collection sump, which implies that constituents other than radionuclides were present (Blackwell 1960, 05-0013). In 1965, it was recommended that the sump and drainlines be removed

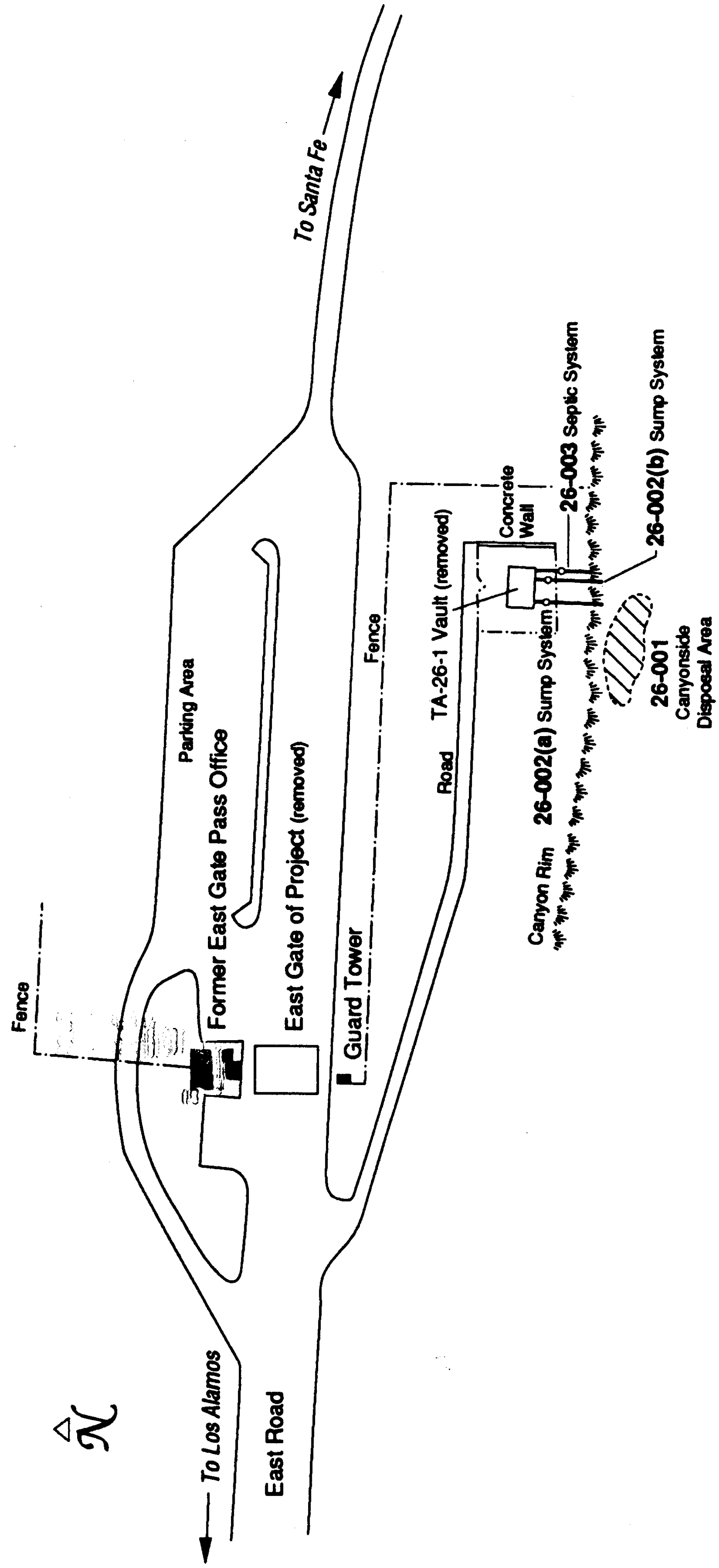


Figure 5-71. SWMU Group 26-1, D-Site location.

because of their association with the highly contaminated south center room of the storage vault (Buckland 1965, 05-0026). SWMU 26-002(b) served the equipment room of the vault through a 4-in. VCP floor drain that discharged directly into Los Alamos Canyon (LANL 1985, 05-0055) (Figure 5-72). The sump was decommissioned and its contents were apparently disposed either at MDA C or over the edge of the mesa along with the vault debris (Blackwell 1973, 05-0015); however, the sump may still be in place. Engineering records indicate that the sump and drainlines were probably in use from October 1946 until June 1965.

Because of difficulty in accessing the settling sump and associated plumbing, a radiological survey has not been conducted. H-1 personnel assumed that the sump system was contaminated with radioactivity because of the contamination found in the storage vault (Buckland 1965, 05-0026).

5.15.1.2.2 SWMU 26-003 (Sanitary Septic System)

The sanitary septic system (SWMU 26-003) consisted of a 4-in. VCP drain leading to a 250-gal. steel septic tank and outfall for discharge into Los Alamos Canyon. It served sanitary facilities located in the east room of the vault. The septic tank was thought to have handled only sanitary waste; however, because radioactive contamination was found in the building, it is possible that contaminants have been introduced into the system. The septic system was considered to be excess property, but it could not be released to the public because of possible contamination and/or the presence of sewer gas (Cotton 1965, 05-0033). The septic lines were probably removed at the same time the sump system was decommissioned; however, positive documentation of the septic tank's removal has not been located (Buckland 1966, 05-0027; Blackwell 1973, 05-0015). One document suggests that the septic tank was removed and disposed over the edge of the mesa along with the vault debris (LASL no date, 0402). Engineering records indicate that the septic system was probably in use from August 1948 to June 1965. A radiological survey of the septic tank was not conducted because the tank was not easily accessible. H-1 personnel assumed that the septic tank was free from radioactive contamination because the tank served the toilet and sink in the least contaminated room of the storage vault (Buckland 1965, 05-0026).

5.15.2 Nature and Extent of Contamination

5.15.2.1 Description and Contamination Levels

5.15.2.1.1 SWMU 26-001 (Canyon Disposal Area)

The remains of the vault located at TA-26 were bulldozed into the canyon. The walls in all five of the vault rooms apparently were contaminated with actinides. A 1965 survey conducted before decommissioning indicated the presence of ^{235}U and ^{233}U. Tritium and plutonium are also suspected. Alpha radiation was detected in all five of the vault rooms, as well as on the concrete ramp that leads to the vault entrance (Buckland 1965, 05-0026). The paint that had been applied to cover the contamination was removed, and the floor was swabbed to remove some of the alpha contamination (Blackwell 1973, 05-0015).

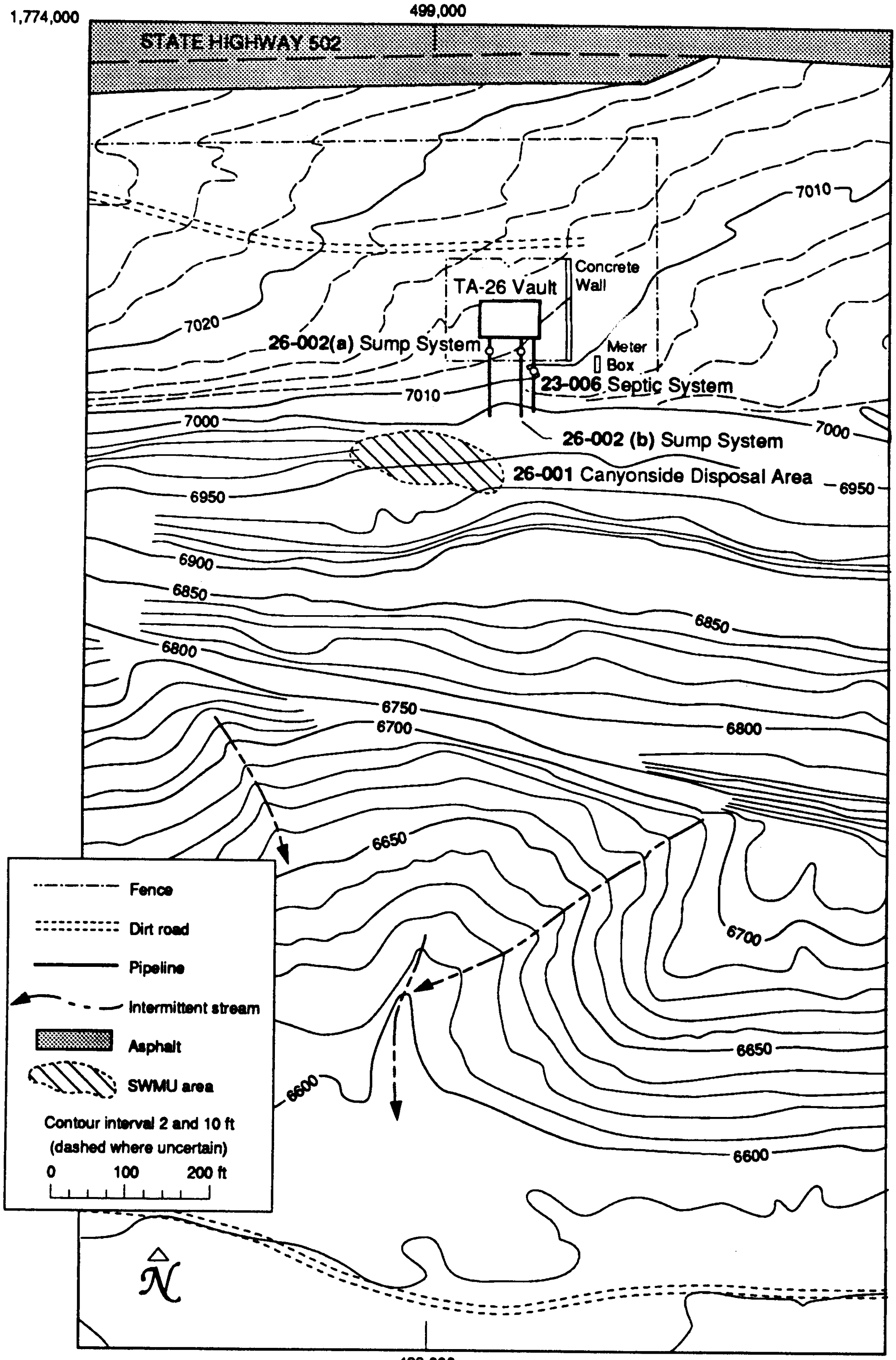


Figure 5-72. SWMU Group 26-1, D-Site.

In 1985, a Phoswich radioactivity survey was conducted on the mesa at the location of the former storage vault, which revealed levels of radiation 20% to 25% above background levels on the west side of the site (LANL 1985, 05-0055). The source of this contamination is not clear, and the extent of contamination beyond the vault site, ledge, and canyon bottom is unknown. No formal survey of the refuse on the canyon ledge has been performed; however, no alpha was detected on the mesatop after the structures had been demolished (Buckland 1978, 05-0025).

5.15.2.1.2 SWMU Aggregate 26-A

5.15.2.1.2.1 SWMUs 26-002(a and b) (Sumps)

Actinides and tritium resulting from past operations at this site may have contaminated the soil. Tritium gas, however, would no longer be present because the site was decommissioned in the mid-1960s.

5.15.2.1.2.2 SWMU 26-003 (Septic System)

The septic system at TA-26 contained sanitary waste. It is not known whether the septic tank contained radioactive waste in addition to sanitary waste.

5.15.2.2 Potential Migration Pathways

Contaminants originating at TA-26 may have been released to the environment via infiltration, mass movement, entrainment by water and/or air from the surface disposal area; or via leaks or discharges associated with the septic or sump system. As a result, contaminants may be present in the soil, channel sediments, tuff, and/or air. Contaminants in soil and channel sediments may leach/disperse through the vadose zone, be entrained by surface water and transported downstream by surface water run-off, or be entrained by air currents and transported off-site. Contaminants present in tuff may leach/disperse through the vadose zone.

5.15.2.3 Potential Public Health and Environmental Impacts

Based on the migration pathways given in Subsection 5.15.2.2, contaminants may be present in or may migrate to soil and air. As a result, human exposure to these contaminants may occur through inhalation of suspended particulates, incidental ingestion of and dermal contact with soil. Additionally, terrestrial animals may be exposed via incidental ingestion of or dermal contact with soil or via inhalation of suspended particulates.

5.15.3 Conceptual Models

Figures 5-73 and 5-74 present the conceptual models for potential contaminant releases from the surface disposal area and septic/sump systems and subsequent exposure by the receptors identified in Subsection 5.15.2.3. In Figures 5-73 and 5-74 "off site residents" refers to residents located in the vicinity of TA-26 (likely closest downwind receptors), and "site visitors" refers to people who may occasionally walk

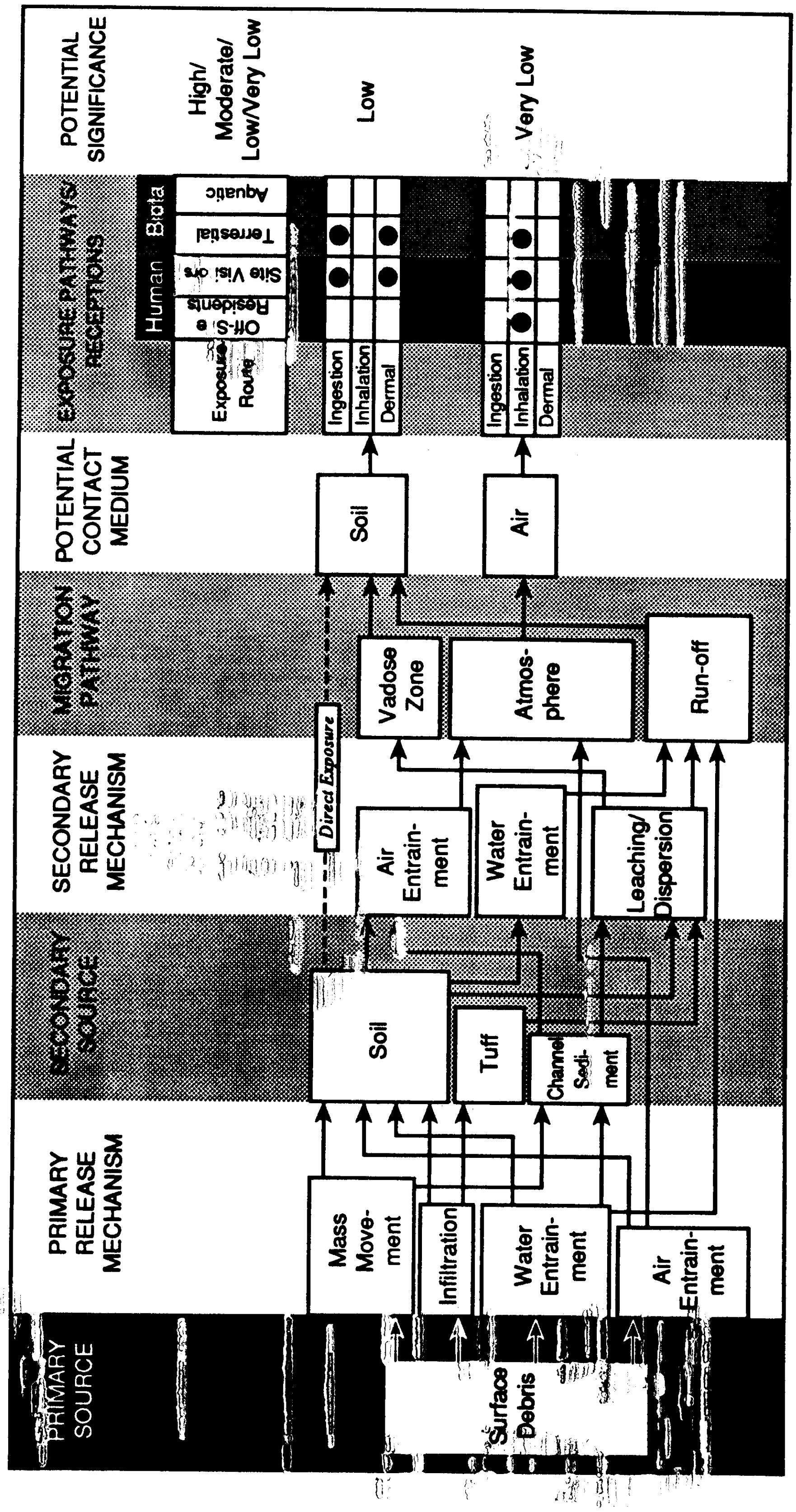


Figure 5-73. Conceptual model of SWMU 26-001 and vault area.

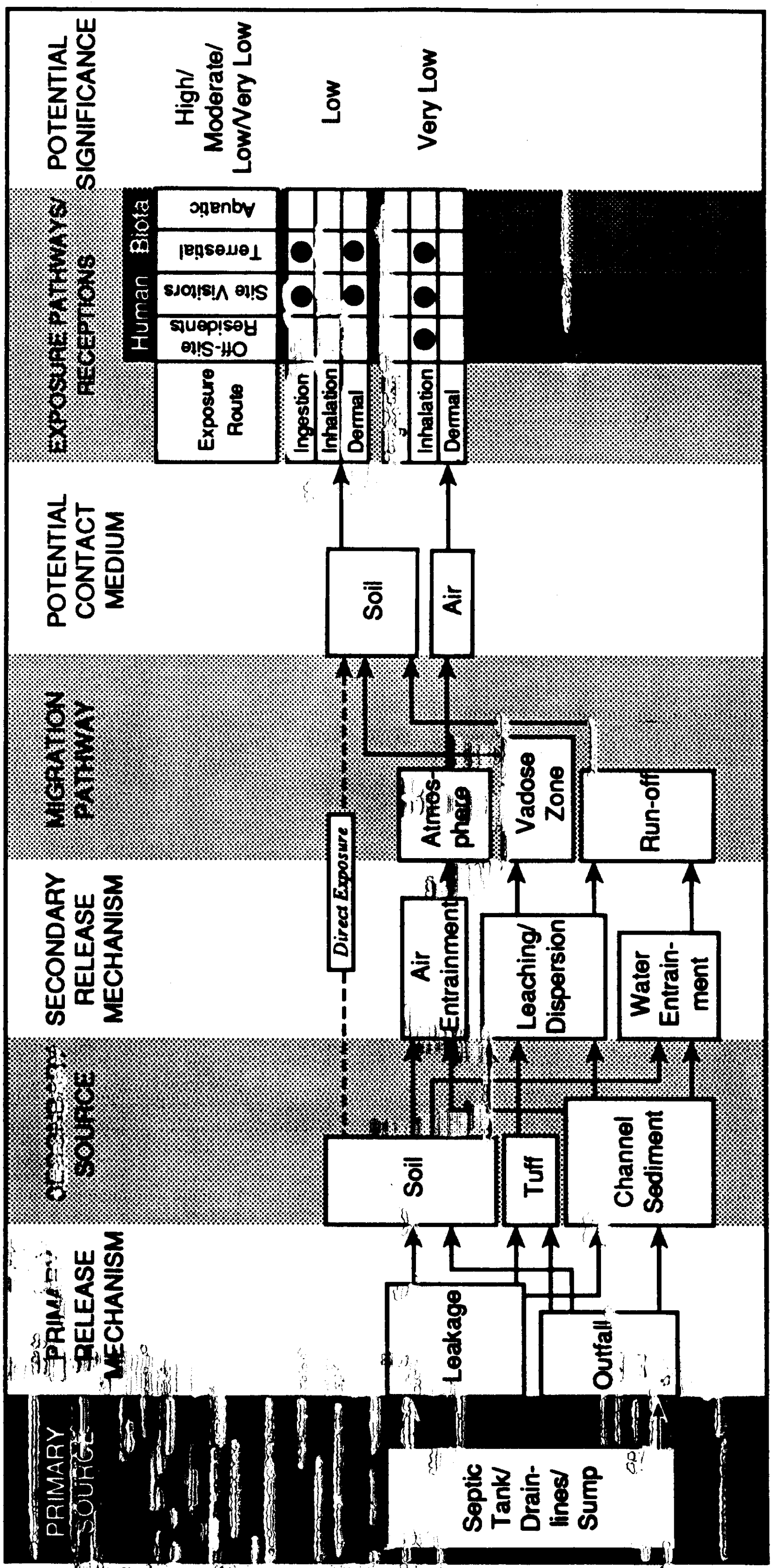


Figure 5-74. Conceptual model of SWMU Aggregate 26-A.

across the site or hike along the slopes of Los Alamos Canyon adjacent to the site. Terrestrial animals in the vicinity of TA-26 may also be impacted.

5.15.4 Decisions, Domain, and Approach

The domain of SWMU Group 26-1 consists of the portion of the mesatop that lies within the formerly fenced area (SWMU Aggregate 26-A), the portion to the southwest where debris was pushed to the canyon rim, and the south-facing slope of Los Alamos Canyon that includes the canyonside disposal area (SWMU 26-001) down to the main channel (Figure 5-72). The mesatop portion is adjacent to the main access road for the Los Alamos townsite. A building across the road is used as commercial office space, and the parking lot to its east is used by visitors, some of whom stay overnight in campers. The goal of the RCRA process for this mesatop area is to ensure that the site is suitable for unrestricted use. Remedial action will be proposed, if necessary, to clean the site to meet health-risk-based media cleanup standards for residential use. For the rubble on the bench to the south in Los Alamos Canyon, other alternatives may be evaluated, such as stabilizing the slope, restricting access, or removing the rubble. The most likely cause of public exposure to any contaminants in this part of the site is recreational use.

During Phase I, a Stage II investigation will be conducted to determine the extent of residual contamination, if any, on the mesatop. This decision will be based on analytical data obtained from samples of the soil and shallow tuffs taken across the mesatop and of sediments from the first-order channels below the outfalls. Laboratory results will be compared with background ranges (Subsection 2.2.3) to determine whether secondary contamination is present. Removal of the subsurface structures (sump, septic tank, and drainlines) will be verified; should such structures be found at the site, they will be investigated following the procedures outlined in Subsection 2.3.4 to provide additional analytical data.

The debris on the bench to the south consists of inadequately characterized and possibly contaminated debris from the demolition of the vault, and the Stage II investigation at this part of the site is designed to determine the level of contamination in the rubble and fill and the extent of releases, if any. Surface and subsurface samples from the disposal area, as well as sediment samples from the channel below it, will be collected. These Stage II data will be used to complete a baseline risk assessment for these sites and to evaluate the remedial alternatives. Additional data may be required for the detailed design of a corrective measure, if one is required.

5.15.5 Data Required

5.15.5.1 Source Characterization

Specific data requirements for source characterization in Phase I, Stage II, investigations include

- determining as accurately as possible the locations, boundaries, and geometries of the septic tank (SWMU 26-003), sump (SWMU 26-002), associated drainlines and outfalls, and the disposal area (SWMU 26-001), using field surveys and Level I data and

- using Level III/IV data to determine the nature, concentrations, and lateral and vertical extent of any contaminants present in potential release areas or site media, including near-surface material at the disposal area and on the mesatop within the old fenced area, channel sediments in surface drainages originating on or transecting the disposal area and outfall points, sludge material from the septic tank and sump, and subsurface material beneath the septic tank, sump, and drainlines.

Field surveys and field screening for radionuclides will play an integral role in the field investigation of this SWMU group. Site and geophysical surveys will be used to help locate buried structures. Screening will be used to determine areas with gross radioactive contamination, will guide selection of sampling sites, and will help determine which samples to submit for laboratory analysis. All samples with a positive field screen response will be submitted for laboratory analysis. When sample screening indicates that contamination is not present above background, a percentage of the samples will be submitted for laboratory analysis (Subsection 5.15.6). These Level III/IV data will be compared with background or action level criteria, and if contaminants are at or below these action levels in all samples, no further field investigations will be conducted.

If results of Phase I sampling indicate that contaminant concentrations are above action levels, the need for a baseline risk assessment and a CMS will be evaluated. It is expected that the results of the Phase I investigation will provide sufficient data for this purpose.

5.15.5.2 Environmental Setting

Data required to characterize the environmental setting of SWMU Group 26-1 in Phase I field investigations include a map of surface water drainages, including sediment catchment sites originating at or transecting the disposal area, the mesatop within the old fenced area, and outfall points. The map will be confined to the domain boundaries and will be used to select sampling sites for channel sediments.

A map of surface water drainages is required because the tuff on the mesatop in the vicinity of the old vault and the debris buried in the disposal area are believed to be contaminated. Potentially contaminated material in these areas is exposed to surface weathering and is subject to off-site transport in run-off. It is expected that any contaminants that may have been released via this pathway will be detected by sampling channel sediments in drainages that originate on or transect these areas. It is expected that the results of Phase I, Stage II, investigations will provide sufficient data for a baseline risk assessment, and, if necessary, a CMS.

5.15.5.3 Potential Receptors

Both background and action levels will be used in the Phase I investigation as the initial basis for determining whether there is a potential for adverse human health effects associated with the surface disposal area or septic/sump systems. These action levels were established assuming constant on-site exposure and making conservative assumptions of human behavior; thus, no specific information regarding the activities, behavior, or location of actual receptors is required for this initial assessment. In the event that measured contaminant concentrations exceed action levels, a site-specific baseline risk assessment may be conducted to support a decision for no further action at the site. Information that may be required regarding the potential receptors identified in the Subsection 5.15.3 includes

- frequency and duration of site visits and
- location of nearest downwind resident. In the event that the estimated risks to this receptor are considered unacceptable, a more detailed demographic survey may be required.

5.15.6 Field Sampling Plan

The field work in Phase I, Stage II, investigations of SWMU Group 26-1 will be completed in three field tasks: field surveys, surface sampling, and subsurface sampling. The RFI field work and associated activities are described in the following subsections. All field work will be performed in accordance with applicable ER Program SOPs.

5.15.6.1 Task 1—Field Surveys

Four field surveys will be performed in Task 1: (1) site survey, (2) geophysical survey, (3) geomorphologic mapping, and (4) radiological survey.

5.15.6.1.1 Activity 1—Site Survey

A site survey will be conducted to determine the locations of the septic tank, sump, and associated drainlines and outfall points. The locations will be determined by examining historic aerial photographs, by reviewing records, including maps and engineering plans, and by visually inspecting the site.

5.15.6.1.2 Activity 2—Geophysical Surveys

If the site survey does not reveal the location of all buried structures in sufficient detail, geophysical surveys will be conducted to more precisely locate the septic tank, sump, and lines or to determine whether the structures have been removed. A magnetic survey will be performed with appropriate spacing to ensure full resolution of large metallic objects and metallic components of the tank or sump. An EMC survey will also provide better definition of buried features. If necessary, ground-penetrating radar may be used to supplement the EMC and magnetic surveys. Once located, the sites will be marked in the field.

5.15.6.1.3 Activity 3—Geomorphologic Mapping

First-order stream channels within the domain and originating on or transecting the disposal area, the mesatop in the vicinity of the old vault, and outfall points will be located and mapped to determine sites for sampling channel sediments. This activity will locate all sediment catchment sites. Mapping will be completed on a scale of 1:2000.

5.15.6.1.4 Activity 4—Radiological Survey

A field survey for gross alpha, beta, and gamma will be conducted on the mesatop within the previously fenced area of TA-26, at the disposal area on the canyon ledge, and in the drainage channels that carry run-off from these sites to determine whether areas exist in which radiation is above background levels. This survey will help guide selection of sampling locations. In addition, all excavated material and samples will be screened to determine levels of radioactivity for the purposes of identifying health risks and selecting samples to be submitted for Level IV laboratory analysis.

5.15.6.2 Task 2—Surface Sampling

The following surface-sampling activities will be performed in Task 2: (1) sampling surface and near-surface material at the disposal area, (2) sampling surface soil/tuff on the mesatop, and (3) sampling channel sediments in drainages downslope of the disposal area and beneath outfall points.

5.15.6.2.1 Activity 1—Surface Sampling at the Disposal Area

Before beginning near-surface sampling, wipe samples will be taken at the disposal area at locations where the radiological survey indicates radiation above background levels and/or where building debris (e.g., cement and steel rubble) is exposed at the surface. A minimum of four samples will be collected from surface material and/or exposed building debris and will be analyzed in the field for gross alpha, beta, and gamma to help determine whether and where contamination is present.

Twelve spatially stratified sampling points will be selected across the surface disposal area (Figure 5-75). The selection of sampling locations may accommodate topography (e.g., topographic low points away from the canyon edge may be preferentially sampled) and areas in which the radiological survey indicates radiation above background levels, if any. A hand auger will be used to retrieve the samples in accordance with the procedures described in LANL-ER-SOP-06.10, Hand Auger and Thin Wall Tube Sampler. Each auger hole will extend to the debris/tuff interface or to the point at which the auger will go no farther, whichever occurs first. If the auger is refused at a depth of less than 3 ft, an alternate auger hole will be attempted as close to the original location as possible. The augered core will be continuously screened for gross alpha, beta, and gamma. One sample will be collected from an interval within the debris fill that either receives a positive field screen response or consists of unconsolidated fill material lying adjacent to building debris. A second sample will be taken at the debris/tuff interface. A total of 24 samples will be screened and analyzed as indicated in Figure 5-76.

5.15.6.2.2 Activity 2—Surface Sampling on the Mesatop

A 30-ft grid consisting of a minimum of 12 nodes or sampling points will be imposed over the mesatop in the vicinity of the old vault area. An additional 60-ft grid (not shown) consisting of a minimum of 13 nodes will cover the area of the mesatop from above the disposal area to the former vault (Figure 5-75). Nodes will be preferentially located where radiation is detected above background levels (if applicable). A

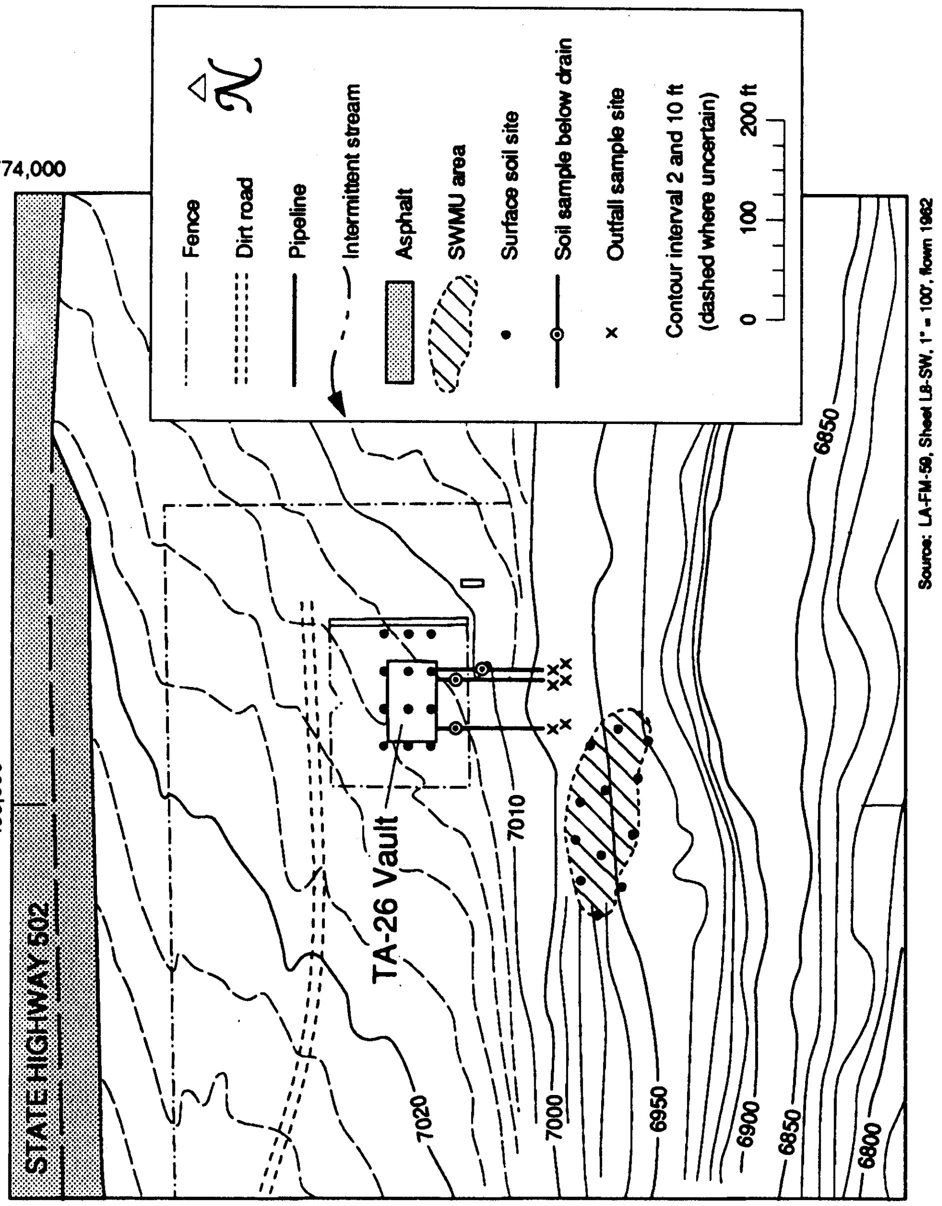


Figure 5-75. Sampling locations at SWMU Group 26-1, D-Site.

Sample Location	No. of Samples	Sample Description	Field Surveys: Site Survey/Mapping	Field Surveys: Geophysical Survey (Level I)	Field Surveys: Soil Gas Survey (Level I/II)	Field Surveys: Gross Alpha, Beta, Gamma (Level I)	Field Screening (Level I): Lithologic Logging	Field Screening (Level I): Combustible Gas/Oxygen	Field Screening (Level I): Organic Vapor	Field Screening (Level I): Gross Alpha, Beta, Gamma	Laboratory Analysis (Level III/IV): Gamma Spectrometry	^{3}H	Total U (^{234}U, ^{236}U)	^{238}Pu, $^{239/240}Pu$	^{90}Sr	^{137}Cs	^{241}Am	^{60}Co	Volatile Organics (VOA) (SW 8240)	BTEX (SW 8020)	Semivolatile Organics (BNA) (SW 8270)	TPH(418.1)	Target Analyte List Metals	TCLP Metals	PCB and Pesticides (SW 8080)
26-001	4-8	Wipe samples from building debris/disposal area	•			•				•															
26-001	24	Near-surface samples from disposal area	•			•	•			•	*	*	*	*			*						*		
26-001 (Old Vault Area)	25	Surface samples from mesa top	•			•				•	+	+	+	+			+						+		
26-001	~6	Channel sediments from surface disposal area	•			•				•	•	•	•	•			•						•		
26-002, 26-003	6	Channel sediments from outfalls	•			•				•	•	•	•	•			•						•		
26-001 (Old Vault Area)	4	Subsurface core samples from mesa top	•			•	•			•	•	•	•	•			•						•		
26-002	1	Sump sludge	•	•		•				•	•	•	•	•			•						•		
26-002	2	Subsurface material beneath sump	•	•		•				•	•	•	•	•			•						•		
26-003	1	Septic tank sludge	•	•		•				•	•	•	•	•			•						•		
26-003	2	Subsurface material beneath septic tank	•	•		•				•	•	•	•	•			•						•		
26-002, 26-003	6	Subsurface material beneath drainlines	•	•		•				•	•	•	•	•			•						•		

Laboratory Analysis note: Number of samples analyzed depends on results of field screening and/or field survey. * =50%, + =30%

Figure 5-76. Screening and analysis for initial investigations at SWMU Group 26-1.

sample of the soil or tuff from the uppermost 6 in. will be collected at each sampling point and will be field-screened for gross alpha, beta, and gamma. If field screening indicates the presence of radionuclides above background levels, coring and subsurface sampling will occur at four sites as described in Task 3, Activity 2. Samples will be collected following the procedures described in LANL-ER-SOP-06.09, Spade and Scoop Method for Collection of Soil Samples. All samples that indicate a positive screen response and 30% of the remaining samples will be analyzed as indicated in Figure 5-75.

5.15.6.2.3 Activity 3—Sampling Channel Sediments

Channel sediments will be collected from all first-order drainages that originate at or transect the surface disposal area and the three outfalls associated with the septic system and sump drains. A total of two samples will be collected from each drainage below the disposal area: the first from a sediment catchment at or immediately below the disposal area and the second from a catchment site immediately downgradient of the first major confluence. Two samples will be collected from each of the drainages downslope of the outfalls as close to the outfall points as possible. Samples will be collected using the procedures described in LANL-ER-SOP-06.14, Sediment Material Collection. A minimum of 10 channel sediment samples will be collected, screened, and analyzed as indicated in Figure 5-76.

5.15.6.3 Task 3—Subsurface Sampling

Subsurface sampling will consist of (1) coring and sampling subsurface material on the mesatop and (2) sampling the septic tank system, the sump, and associated drainlines.

5.15.6.3.1 Activity 1—Subsurface Sampling on the Mesatop

Cores will be drilled at locations on the mesatop where surface sampling and radiological screening indicate that radiation is present in surface material above background levels, if any. Cores will be drilled following the procedures described in LANL-ER-SPO-04.01, Drilling Methods and Drill Site Management. They will be continuously screened for gross alpha, beta, and gamma radiation, and a confirmatory clean sample will be collected at a point 2 ft below the last positive screen response. Samples will be analyzed as indicated in Figure 5-76.

5.15.6.3.2 Activity 2—Sampling the Septic Tank System, Sump, and Drainlines

Sampling of the septic tank system, sump, and drainlines will proceed as described in Subsection 2.3.4.1. Samples will be screened and analyzed as indicated in Figure 5-76.

5.16 SWMU Group 73-1 (Los Alamos Airport)

SWMU Group 73-1 consists of SWMUs 73-001(b), waste oil pit, and 73-001(d), debris disposal area, and SWMU Aggregate 73-A, which consists of SWMUs 73-001(a), landfill, and 73-004(d), landfill office septic system. TA-73 is located on DOE property (Figure 1-3).

5.16.1 Description and History

5.16.1.1 SWMU 73-001(b) (Waste Oil Pit)

A pit used for disposal of waste oil [SWMU 73-001(b)] (Figure 5-77), estimated to be approximately 100 by 25 ft with an unknown depth, was located just west of the bunker area (Francis 1991, 05-0038; Limbaugh 1963, 05-0068). The Zia Company reportedly issued work orders to place clean sand in the waste oil pit to solidify its contents (LANL 1990, 0145). Based on available maps, the period of operation of this pit is estimated to be from 1947 to 1974 (Black & Veatch 1947, 05-0010).

5.16.1.2 SWMU 73-001(d) (Debris Disposal Area)

A landfill debris disposal area, SWMU 73-001(d), is located at the northeast end of the runway, although its exact location is unknown (Figure 5-77). In 1984, the site was used to bury debris excavated from the western portion of the landfill [SWMU 73-001(a)] (LANL 1990, 0145). The disposal area consisted of two pits excavated to a depth of 60 ft (Burgess 1990, 05-0029). In 1986, the landfill debris disposal areas were covered with soil and hydroseeded (LANL 1990, 0145). The period of operation of this disposal area is estimated to be from 1984 to 1986.

5.16.1.3 SWMU Aggregate 73-A (Landfill Facilities)

5.16.1.3.1 SWMU 73-001(a) (Landfill)

DOE, and, more recently, Los Alamos County, operated a burning area/landfill [SWMU 73-001(a)] (also known as the city dump) situated north of the airport runway (Figure 5-77). The draft CEARP report (DOE 1987, 0264) refers to a Laboratory document that mentions "a yet to be identified radioactive disposal area in the vicinity of the airport that was active in 1943-1944...." On high oblique aerial photographs taken in 1946, large trenches north of the current runway (Figure 5-78) are two possible sites for this disposal area. Laboratory use of the disposal area probably began in1943, and Los Alamos County probably assumed operations for municipal waste disposal in 1965 (Miller and Shaykin 1966, 05-0091). The county continued to operate the disposal area until June 30, 1973 (IT Corporation 1991, 05-0045). Garbage was collected twice weekly from the Laboratory and the townsite and was burned "on the edge of a deep canyon located adjacent to the municipal airport" (Miller 1963, 05-0090). Intentional burning at the landfill ceased in 1965, when the county assumed operations (Miller and Shaykin 1966, 05-0091). Heavy equipment was used to remove burned residues and ash from the burn area on a monthly basis. Flammable materials were disposed in a specially designated area separate from

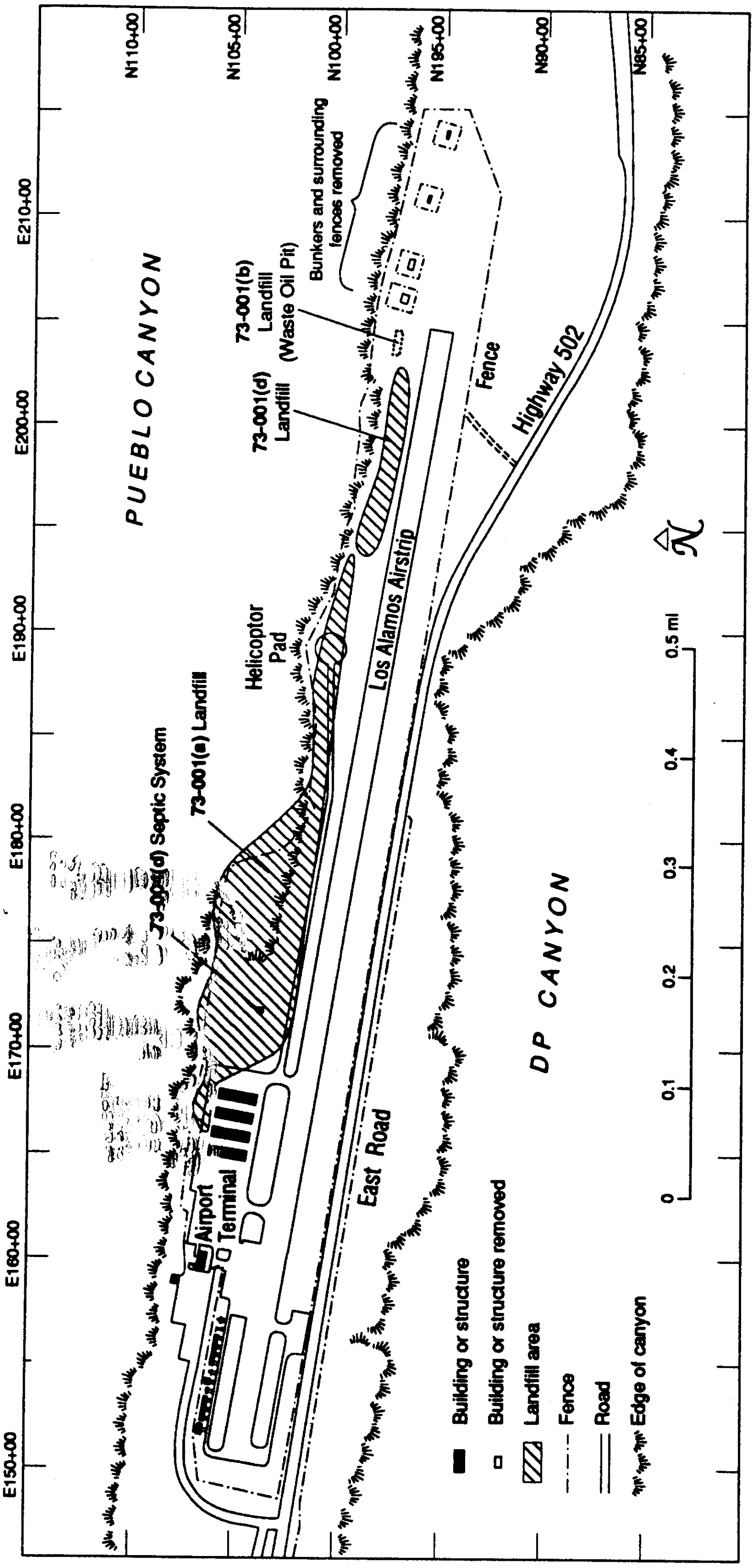


Figure 5-77. SWMU Group 73-1 (Los Alamos Airport).

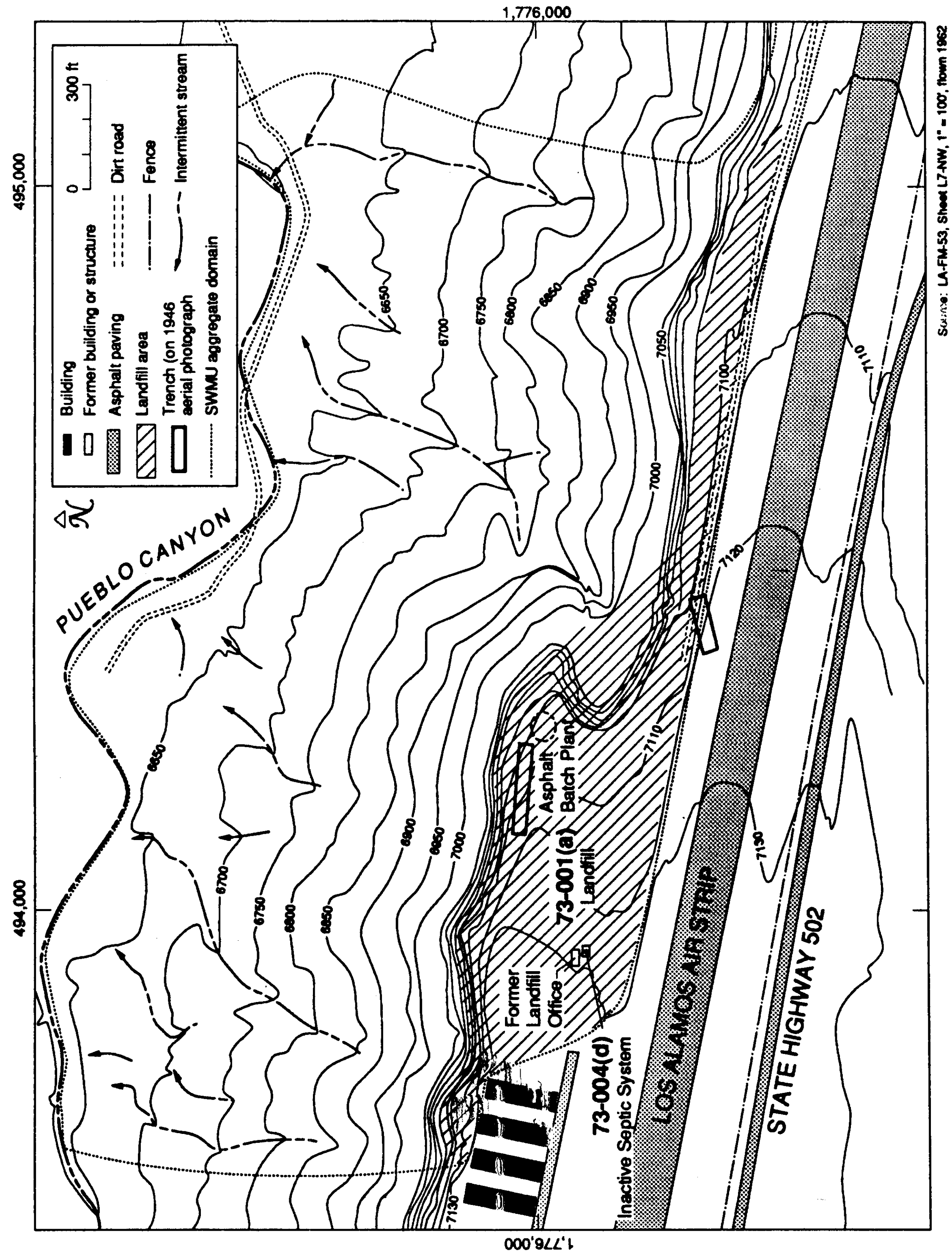


Figure 5-78. SWMU Aggregate 73-A [Los Alamos Airport (East)].

the burning area. In addition, animal carcasses from an unspecified source were disposed in the landfill (Miller 1963, 05-0090).

Two separate incidents involving accidental disposal of radioactive materials were documented in 1953. On April 3, 1953, 125 lb of ^{238}U (also called tuballoy) in the form of scrap and oxide were taken from the dock of the TU Building. The individual from CMR-6 who reported the material missing thought that it was taken to the city landfill. Through extensive monitoring and recovery efforts, approximately 25 lb of the material were retrieved; however, the remaining 100 lb were never located. Approximately three truckloads of soil were placed over the area from which the material was recovered, and monitoring continued on a weekly basis for the next several weeks (Blackwell 1953, 05-0012; H-Division 1953, 0465) No significant counts were measured in urine samples collected from 23 men who worked at the landfill. The truck that hauled the material was monitored for radioactivity; the highest reading measured 0.2 mr/hr. The truck was subsequently taken to the decontamination pit and washed until monitoring produced a value of zero (Blackwell 1953, 05-0012). The location of the decontamination pit is unknown.

Also in 1953, a 20-lb block of depleted uranium (^{238}U), which was apparently being used as a doorstop, was reported missing by an employee of CMR-6 in Sigma Building. A janitor had placed the doorstop in a dumpster, which was subsequently emptied at the city landfill. Although attempts were made to find and recover the uranium, recovery efforts were hampered by continuous burning activities at the landfill and the depth of the ashes in which searchers had to wade. Although a few pounds of uranium were recovered during this effort, the balance remains in the landfill (Buckland 1978, 05-0025).

In the spring of 1958, a fire was reported when a can of sodium ignited in the vehicle that was carrying it to the landfill. The cause of the fire was thought to have been contact with moist air. The fire was extinguished without property loss (H-Division 1958, 0479).

A 1959 memo noted that an explosion could occur at the landfill as a result of disposal of trash from Kappa Site (DOE 1987, 0264). Kappa Site was a firing site, located within the current boundaries of TA-36, at which mixed wastes, hazardous materials, explosive materials (such as HE), uranium, lead, zinc, barium, and beryllium were historically used, and may, therefore, have been disposed in this landfill.

Also associated with this SWMU is a hot-mix asphalt batch plant operated from about the mid-1940s until 1954 (LANL 1990, 0145). The asphalt plant was owned by The Zia Company and appears on a 1946 photograph to have been located east of the airport (Sandia Laboratories 1946, 05-0163) but may have been located west of the incinerator (IT Corporation 1991, 05-0149). The asphalt batch plant was located within the landfill [SWMU 73-001(a)] (Figure 5-78) and, therefore, is addressed as part of SWMU Aggregate 73-A (Subsection 5.16.2.1.3). Additional information on the operation and decommissioning of this plant is unavailable.

5.16.1.3.2 SWMU 73-004(d) (Landfill Office Septic System)

A septic tank [SWMU 73-004(d)], located near the airport landfill office (Figure 5-78), most likely handled only sanitary waste. The septic system served the airport landfill office, which was located east of the airport terminal building (Limbaugh Engineering & Aerial Services, Inc., 1963, 05-0067). The septic system included a 4-in. VCP that extended from the landfill office to a septic tank north of the office. A leach field was located east of the tank (The Zia Company 1960, 05-0142). It appears from available drawings and information on landfill operations that the landfill office septic system was used between about 1960 and 1973.

5.16.2 Nature and Extent of Contamination

5.16.2.1 Description and Contamination Levels

5.16.2.1.1 SWMU 73-001(b) (Waste Oil Pit)

Used oils from the motor pool, craft shops, and vehicle shop are known contaminants at this SWMU (Miller 1962, 05-0089; Francis 1991, 05-0038). Some sand was added to the oil to increase its viscosity before disposal in the pit. No soil samples appear to have been analyzed for organics. No releases have been reported.

5.16.2.1.2 SWMU 73-001(d) (Debris Disposal Area)

The debris in this SWMU was apparently taken from the landfill [SWMU 73-001(a)] and, therefore, may contain the same hazardous materials as those found at that SWMU. There are no known releases.

5.16.2.1.3 SWMU Aggregate 73-A (Landfill Facilities)

5.16.2.1.3.1 SWMU 73-001(a) (Landfill)

The airport landfill contains radioactive and solid waste and may also contain hazardous waste, including HE. Although municipal waste was the main constituent, known deposition of more than 100 lb of uranium is documented.

5.16.2.1.3.2 SWMU 73-004(d) (Landfill Office Septic System)

The septic tank at SWMU 73-004(d) was probably used only for sanitary wastes, and there is no evidence to indicate that it contained any hazardous materials.

5.16.2.2 Potential Migration Pathways

Contaminants originating at the airport landfill, landfill disposal pits, or waste oil pit may have been released to the environment via leaching/dispersion, mass movement, volatilization, and entrainment by air and/or water. As a result, contaminants may be present in the soil, tuff, and/or air. Contaminants in soil may leach/disperse through the vadose zone or migrate upward via vapor phase diffusion and enter the atmosphere. In addition, surface soils may be entrained by surface water and transported downstream by run-off, or they may be entrained and transported off-site by wind. Contaminants in tuff may leach/disperse through the vadose zone.

5.16.2.3 Potential Public Health and Environmental Impacts

Based on the migration pathways listed in Subsection 5.16.2.2, contaminants may be present or may migrate to soil or air. As a result, human exposure to site contaminants may occur through inhalation of vapors or suspended particulates or incidental ingestion or dermal contact with soil. Additionally, terrestrial animals may be exposed to site contaminants via incidental ingestion, dermal contact with vegetation or soil, or inhalation of vapors or suspended particulates. Vegetation is considered to be a potentially significant contact medium because the landfill debris lies at the surface and is therefore in contact with the short roots of the native grasses.

5.16.3 Conceptual Models

Figures 5-79, -80, and -81 present the conceptual models for potential contaminant releases from the airport landfill, landfill disposal pits, and waste oil pit and subsequent exposure by the receptors identified in Subsection 5.16.2.3. In these figures, "off-site residents" refers to residents located in the vicinity of the airport (likely closest downwind receptor), "site visitors" refers to passengers at the airport and people who hike along the slopes of Pueblo Canyon adjacent to the airport, and "on-site workers" refers to employees at the airport facilities. Terrestrial animals in the vicinity of the airport, primarily in Pueblo Canyon, may also be impacted.

5.16.4 Decisions, Domain, and Approach

The domain of this SWMU aggregate includes the mesa north and east of the runway and the north-facing slope of Pueblo Canyon below the major landfill areas down to the main channel, as shown in Figures 5-82 and 5-83. SWMU 73-004(d), the septic system for the former landfill office, is within the landfill, as is the site of the former asphalt batch plant, which are addressed together. The goal of the RCRA process for this SWMU aggregate is to ensure that incorporating these sites in the DOE-owned airport facility (to which private operators also have access) is compatible with the health and safety of both site visitors and workers and off-site receptors. Should DOE release this site to municipal or other public authorities, the deed would carry restrictions appropriate for a former landfill area.

Corrective measures may be required for parts of the site. Remedial alternatives for the major landfill areas could include capping (to reduce the potential for exposure to contaminated soil, erosion, vapor release, and infiltration) and stabilizing the north-facing slope (to reduce the potential for mass wasting and erosion). Similar measures may be appropriate for the waste oil pit, although material from this small site could also be moved to a waste management facility.

Historical evidence implies that small amounts of radioactive and hazardous materials were discarded in the airport landfill [SWMU 73-001(a)] and that the pit at SWMU 73-001(b) received waste oils. Therefore, Phase I field work at this SWMU group will consist of Stage II activities designed to determine whether materials in the landfill, including contaminants, are contained by the landfill as constructed and by an investigation to determine the most likely release mechanisms and proximate migration pathways (Figure 5-79). If contaminants are not being contained, the nature of the released contaminants and the mechanism by which they are released will be ascertained so that a conceptual model can be developed for use in preparing a realistic baseline risk assessment. Potential surface releases from these sites will

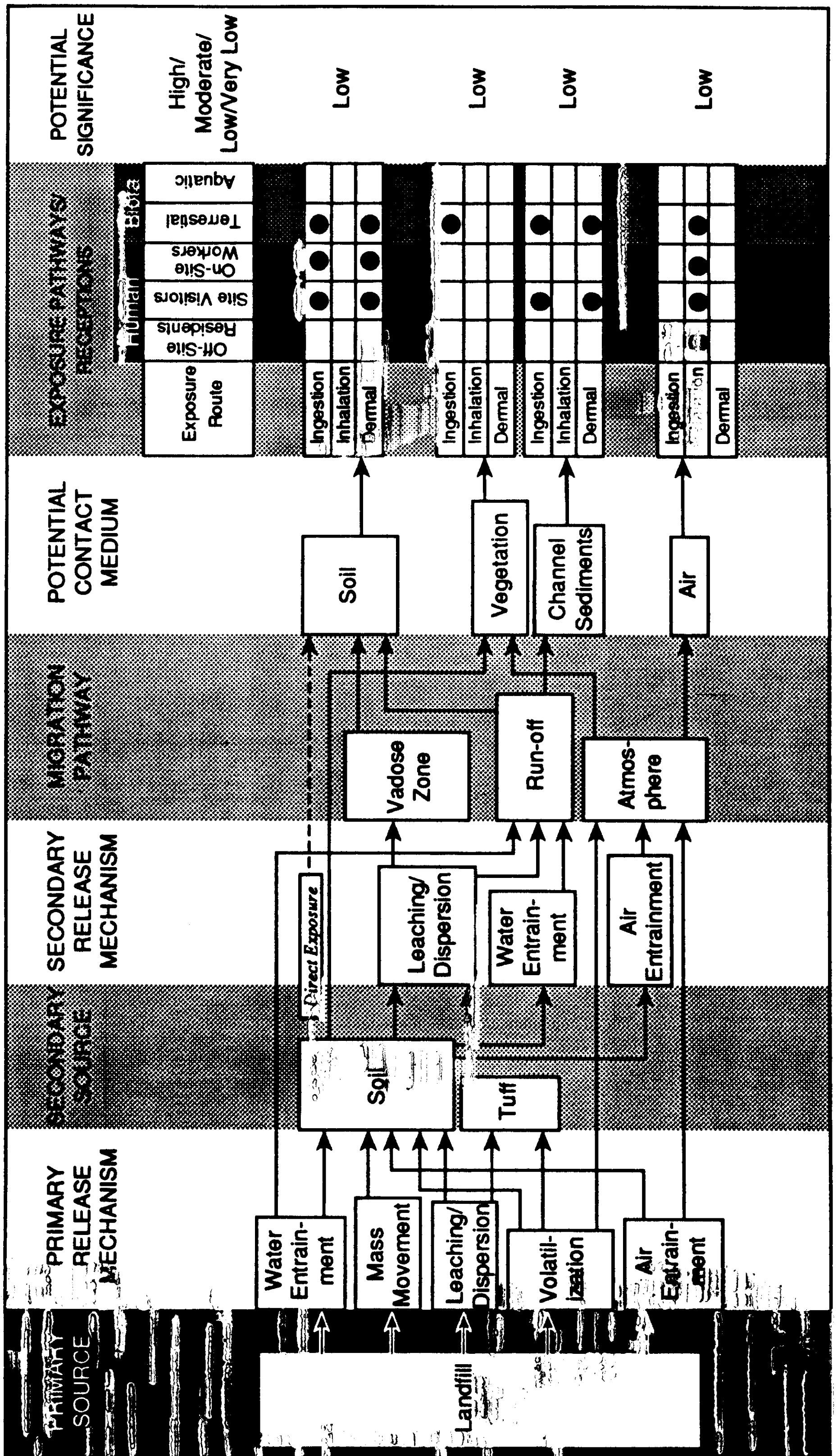


Figure 5-79. Conceptual model of SWMU Aggregate 73-A.

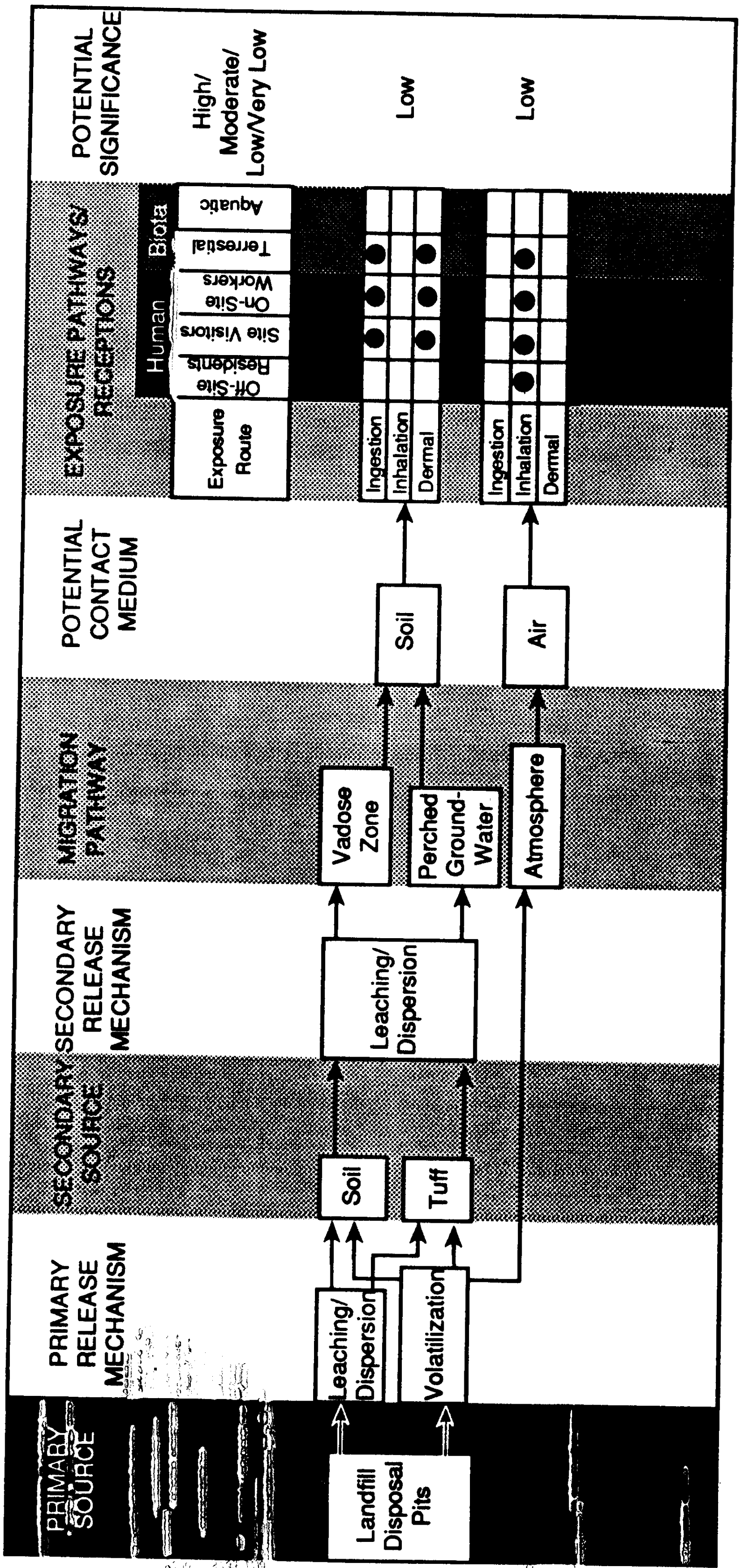


Figure 5-80. Conceptual model of SWMU 73-001(d).

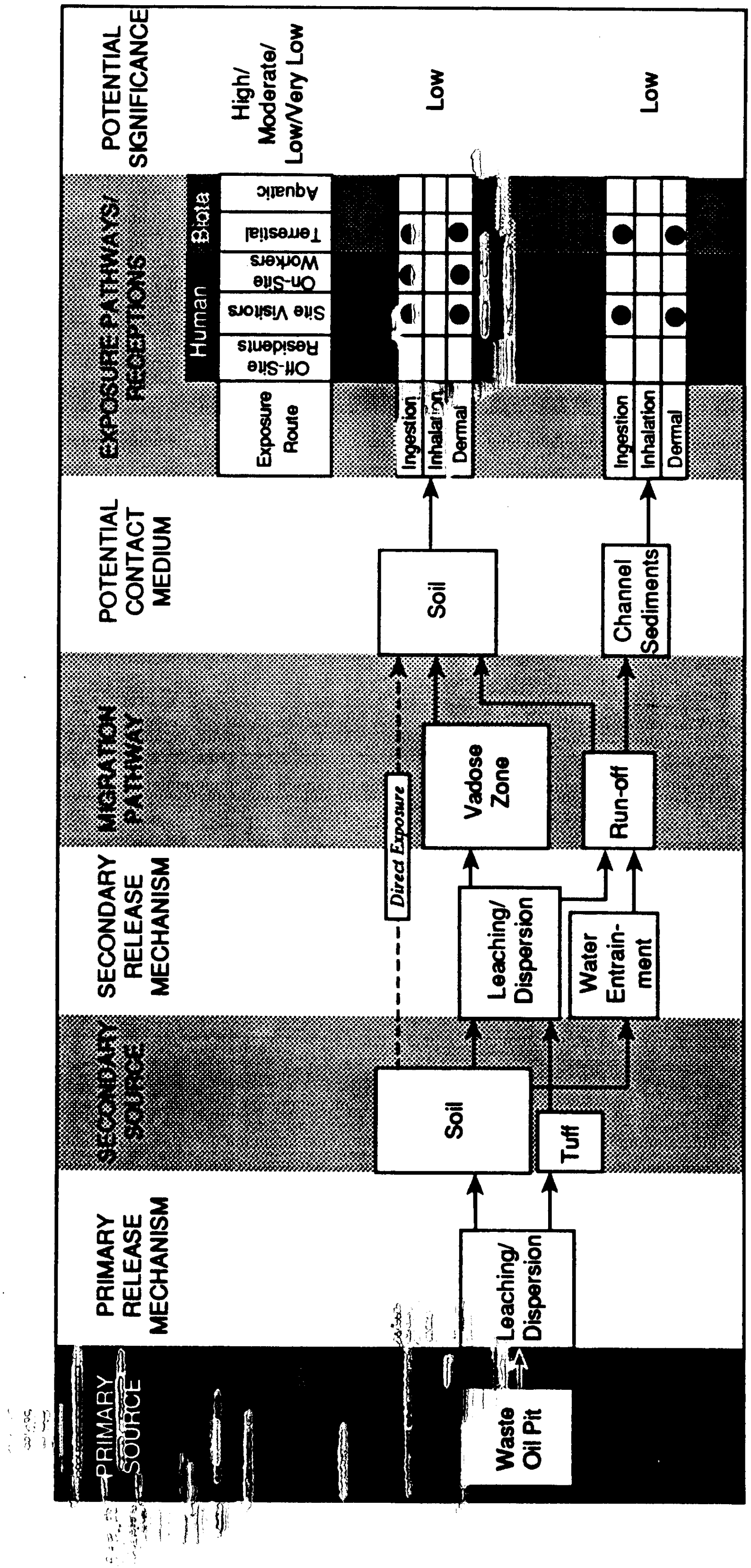
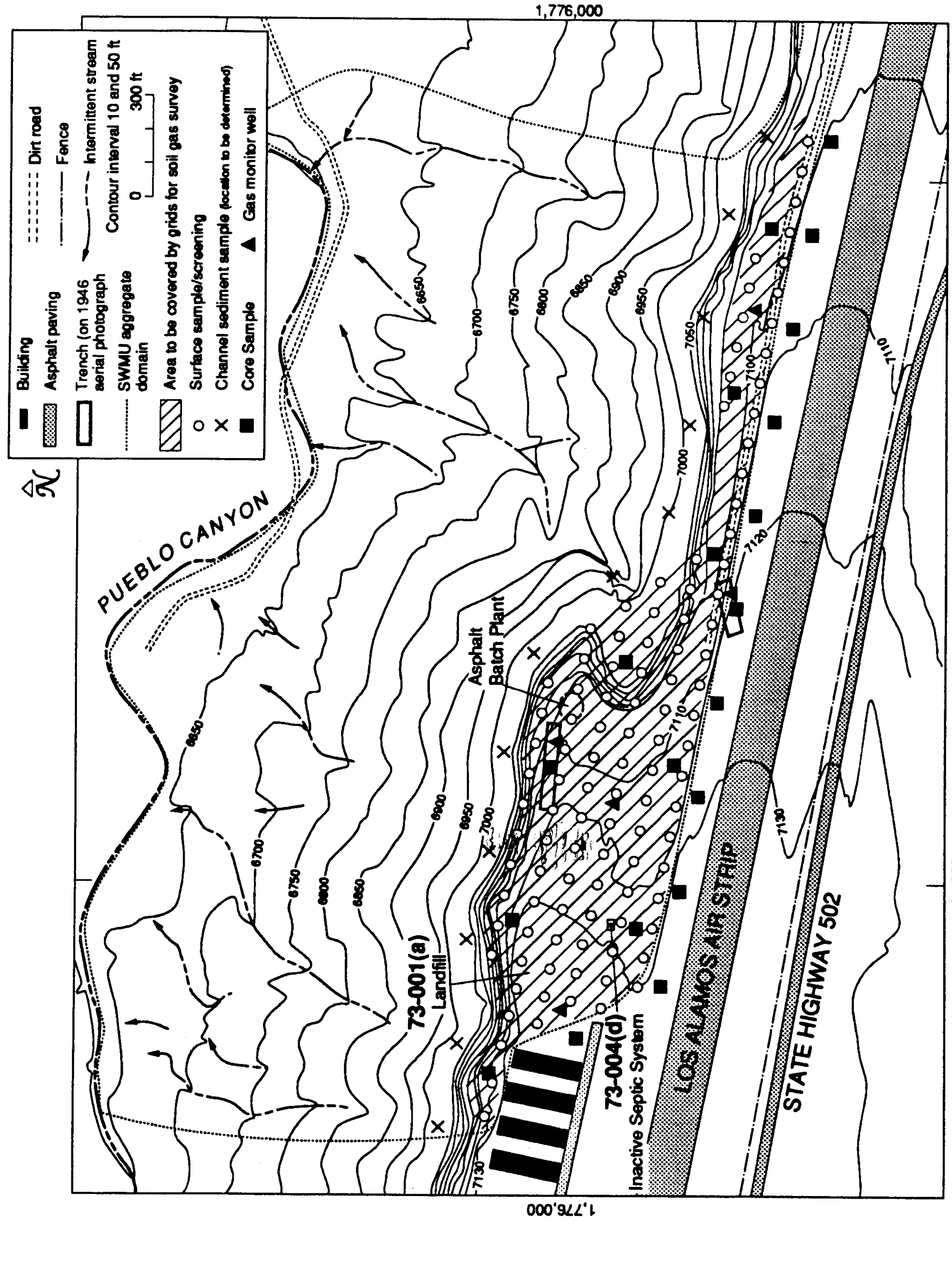


Figure 5-81. Conceptual model of SWMU 73-001(b).



Source: LA-FM-53, Sheet L7-NW, 1" = 100', flown 1962

Figure 5-82. Sampling locations at SWMU Aggregate 73-A [Los Alamos Airport (East)].

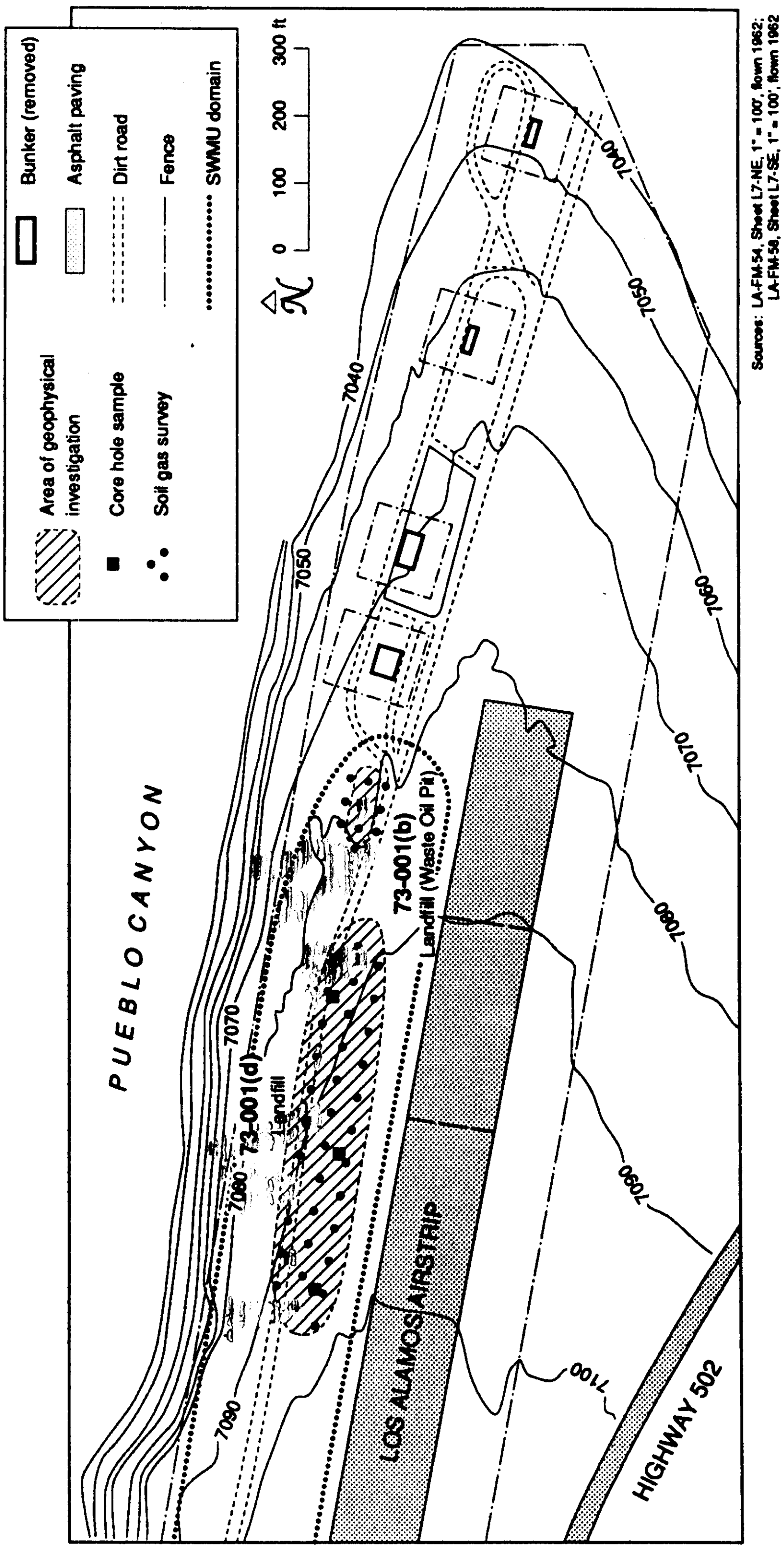


Figure 5-83. Sampling locations at SWMUs 73-001 (b and d).

be investigated by sampling surface soils on the mesatop and by sampling the catchments along the channels on the north-facing slopes. A preliminary soil gas survey and gas-monitoring wells will measure gas releases from the landfill. Subsurface migration will be studied in leachate and tuff samples from beneath the landfill and the waste oil pit. In conjunction with installation-wide framework studies, investigators will evaluate the possibility that geologic processes, such as cliff retreat, will disrupt the site over the long term.

During these studies, data collected around the perimeter of SWMU Group 73-1 will be used to complete a baseline risk assessment for these sites and to evaluate the need for corrective action. If releases from this site are observed, additional data may be required to determine their extent, to characterize the migration pathways, and to evaluate remedial alternatives. The design of such further investigations will be contingent on the specific results of the studies described in the following subsections.

5.16.5 Data Required

5.16.5.1 Source Characterization

Specific data requirements for source characterization in Phase I, Stage II, investigations include

- determining as accurately as possible the locations, boundaries, and geometries of the units to be investigated in SWMU Group 73-1, using field surveys and Level I data and
- using Level III/IV data to determine the nature, concentrations, and lateral and vertical extent of any contaminants present in potential release areas and site media, including contaminants in surface material and exposed refuse at the landfill [SWMU 73-001(a)], vadose zone gases at the landfill, leachate in subsurface materials beneath and/or surrounding the landfill, subsurface material beneath the waste oil pit and the debris disposal areas [SWMUs 73-001(b and d)], and channel sediments in surface drainages originating at or transecting the landfill.

Field surveys and field screening for organic vapors and radionuclides will play an integral role in the field investigation of this SWMU group. Geophysical and soil gas surveys will be used to help locate landfill boundaries. A soil gas survey will also be used to determine whether elevated concentrations of organic vapors and/or methane are present in subsurface gases, to help define any areas in which volatile fluids may be accumulating, to provide Level II/III data to guide selection of sampling sites, and to assist in defining the lateral extent of contaminant migration. Field screening for organic vapors and gross alpha, beta, and gamma will be used to determine where to collect samples and/or which samples to submit for laboratory analysis. All samples with a positive field screen response will be submitted for laboratory analysis. When sample screening indicates that contamination is not present above background levels, a percentage of the samples will be submitted for laboratory analysis, as indicated in Subsection 5.16.6. The number of samples submitted for laboratory analysis will guarantee a probability of 80% or better of observing contaminant levels above action levels, in the event that excessive levels exist in at least 10% of the surface soils or the channel sediments. A smaller number of core samples will be obtained from the bottom and perimeter of the landfill to be analyzed for leachate and vapor phase contaminants (?) that might be migrating from the landfill.

Level III/IV data will be compared with action level criteria, and, if contaminants are at or below action levels in all samples, no further field investigations will be conducted. If Level III/IV results of Phase I, Stage II, sampling indicate that contaminant concentrations are above action levels, the need for a baseline risk assessment and a CMS will be evaluated. It is expected that the results of Phase I, Stage II, investigations will provide sufficient data for this purpose.

5.16.5.2 Environmental Setting

Data required to characterize the environmental setting of SWMU Group 73-1 in Phase I, Stage II, field investigations include

- a map of the domain that shows surface water drainages, including sediment catchment sites, originating at or transecting the surface of the landfill and draining north toward Pueblo Canyon. The map will be used to select sampling sites for channel sediments.
- a map of surficial deposits located along the north-facing valley wall of Pueblo Canyon within the domain boundaries, including geomorphic features indicative of slope instability. The map will be used to evaluate the potential effects of future erosion and mass wasting on the integrity of the landfill.

A map of surface water drainages is required because landfill debris is exposed on the land surface and is subject to weathering and transport in surface water run-off. It is expected that sampling channel sediments in drainages that originate on or transect the landfill surface will detect any contaminants that may have been released via this pathway. A slope stability study of the north boundary of the landfill will be required if the risk assessment demonstrates that humans will be placed at an unacceptable level of risk should the landfill material be exposed through slope failure. It is expected that results of Phase I, Stage II, investigations will provide sufficient data for a baseline risk assessment and, if necessary, a CMS.

5.16.5.3 Potential Receptors

Action levels [i.e., health-risk-based levels of contaminant concentrations for specific media (Subsection [illegible].3.2)] will be used in the Phase I investigation as the initial basis for determining whether there is a potential for adverse human health effects associated with the landfill, debris pits, or waste oil pit. These action levels were established assuming constant on-site exposure and making conservative assumptions of human behavior; thus, no specific information regarding the activities, behavior, or location of actual receptors is required for this initial assessment. In the event that measured contaminant concentrations exceed action levels, a site-specific baseline risk assessment will be conducted to evaluate the need for further action or a CMS. Information that may be required regarding the potential receptors identified in Subsection 5.16.3 includes

- frequency and duration of site visits,
- location of on-site workers relative to source area(s), and
- location of nearest downwind resident. In the event that the estimated risks to this receptor are considered unacceptable, a more detailed demographic survey may be required.

5.16.6 Field Sampling Plan

The field work in Phase I, Stage II, investigations of SWMU Group 73-1 will be completed in three tasks: field surveys, surface sampling, and subsurface sampling. The RFI field work and associated activities are summarized in the following subsections. All field work will be performed in accordance with applicable ER Program SOPs.

5.16.6.1 Task 1—Field Surveys

Five surveys will be performed in Task 1: (1) site survey, (2) geophysical survey, (3) geomorphologic mapping, (4) soil gas survey, and (5) radiological surveys.

5.16.6.1.1 Activity 1—Site Survey

A site survey will be conducted to locate the boundaries of the landfill, waste oil pit, and debris disposal areas. The locations will be determined by examining historic aerial photographs, reviewing records, including maps and engineering plans, and by visually inspecting the site.

5.16.6.1.2 Activity 2—Geophysical Surveys

If the site survey does not reveal the boundaries and geometries of the disposal areas and the waste oil pit in sufficient detail, geophysical surveys will be conducted to more precisely locate the boundaries of the disposal areas and to locate anomalies to be avoided during drilling activities. A magnetic survey will be performed with appropriate spacing to ensure full resolution of large metallic objects. An EMC survey will be conducted to further define landfill and magnetic anomalies. If necessary, ground-penetrating radar may also be used to supplement the magnetic and EMC surveys. Once located, the sites will be marked in the field.

5.16.6.1.3 Activity 3—Geomorphologic Mapping

Two geomorphologic features will be mapped. First, the first-order stream channels within the domain that originate on or transect the landfill surface will be located and mapped to determine sites for sampling channel sediments. This activity will locate all sediment catchments and leachate discharge points. Mapping will be completed on a scale of 1:2000.

Second, surficial deposits on the north-facing canyon wall and mesa rim will be mapped as part of the framework studies. Mapping will be completed on a scale of 1:2000, with the objective of identifying those areas in which mass wasting or landsliding has occurred in the recent past or in which there is high potential that such events will occur in the future. The mapping will focus on identifying erosional features, including rills, gullies, major drainage channels, sites of seepage, erosion, rockfall, and landslide debris and will also attempt to map fracture patterns along the north canyon wall. Mapping criteria will include features indicative of landsliding, such as (1) partially detached blocks (torreva blocks) on or adjacent to canyon walls, (2) partially opened fractures near the mesa edge, (3) areas of high frequency of fractures in bedrock, (4) pronounced concavities or embayments along the canyon walls, which would suggest a history of rapid cliff retreat, (5) deposits of bouldery colluvial debris on canyon slopes or in canyon bottoms that would indicate large-scale slope failure in the past, and (6) areas of very steep slopes or other erosionally unstable areas.

5.16.6.1.4 Activity 4—Soil Gas Surveys

Soil gas surveys will be conducted at the main landfill, the debris disposal areas, and the waste oil pit (Figures 5-82 and 5-83). At the main landfill, the survey will be conducted on a grid spacing of 100 by 100 ft. To determine whether gaseous contaminants have migrated laterally, soil gas samples will also be taken around the perimeter of the landfill. When positive readings are obtained from these samples, additional samples will be taken at successive 20-ft intervals from the perimeter until clean samples are obtained. At the debris disposal areas and the waste oil pit, the samples will be collected on a grid of a size suggested by the actual geometry of the sites as defined by the geophysical surveys. Soil gas samples will be taken at a depth of 6 ft, using a stainless steel sampling tube driven into the surface of the landfill. Target analytes will include methane, benzene, toluene, xylene, trichloroethylene, 1,1-dichloroethylene, vinyl chloride, freon-113, and dichlorobenzene. If the gas probes detect significant quantities of methane, appropriate precautionary measures will be taken during subsequent drilling activities in affected areas.

5.16.6.1.5 Activity 5—Radiological Survey

A field survey for gross alpha, beta, and gamma will be conducted on the surface of the main landfill to determine whether areas exist in which radiation is above action levels. This survey will help guide selection of locations for surface sampling. In addition, all excavated material and samples will be screened to determine levels of radioactivity for the purposes of identifying health risks and selecting samples to be submitted for Level IV laboratory analysis.

5.16.6.2 Task 2—Surface Sampling

The following activities will occur under the surface sampling program: (1) sampling surficial material at the main landfill, (2) sampling channel sediments in drainages originating on or transecting the landfill, and (3) sampling surficial materials to determine their ages for use in the slope stability study.

5.16.6.2.1 Activity 1—Surface Sampling at Main Landfill

Approximately 60 samples will be collected from the uppermost 6 in. of material over the main landfill, which may be selected at nodes of a regular grid (spacing of 100-120 ft) or as a spatially stratified random sample. All samples will be field-screened for organic vapors and gross alpha, beta, and gamma. All samples with a positive field screen response and 30% of samples with a negative field screen response will be analyzed as indicated in Figure 5-84. Six field duplicates and six neighbors (20 ft from two other samples) will be added, and at least two of each will be submitted for laboratory analysis. Samples will be collected following the procedures described in LANL-ER-SOP-06.09, Spade and Scoop Method for Collection of Soil Samples.

5.16.6.2.2 Activity 2—Sampling Channel Sediments

Samples of channel sediments will be collected from drainages that originate on or transect the surface of the landfill. The largest first-order drainage channel in every 300-ft interval of landfill boundary will be selected for sampling, and those drainages that transect areas of open refuse will be sampled first. A total of three sediment samples will be collected from each drainage selected: two from sediment catchments located immediately downchannel of the northern boundary of the landfill and the third from a site either near the terminus of the drainage channel or immediately downgradient of the first major confluence, whichever occurs farthest upstream. Approximately 36 samples and two field duplicates will be collected from the landfill drainages, which will be screened and analyzed as indicated in Figure 5-84. Samples will be collected using the procedures described in LANL-ER-SOP-06.14, Sediment Material Collection. The 30% of samples with negative field screening response will be selected so that at least one sample from each channel is submitted for analysis.

5.16.6.2.3 Activity 3—Leachate Sampling

The north slope of the exposed landfill will be examined for leachate discharge. Samples of any discharges will be collected and will be analyzed as shown in Figure 5-84. Samples will be collected using the procedures described in LANL-ER-SOP-06.15, Coliwasa Samples for Liquids and Slurries, or other approved sampling procedures.

5.16.6.3 Task 3—Subsurface Sampling

Subsurface sampling will consist of three separate activities: (1) installing gas-monitoring wells at the main landfill, (2) coring and sampling subsurface material from beneath the main landfill, and (3) coring and sampling subsurface material from the waste oil pit and the debris disposal areas.

5.16.6.3.1 Activity 1—Gas-Monitoring Wells

Gas-monitoring wells will be installed at the main landfill to detect and monitor contaminants that may be present in the vapor phase. Five wells will be installed at locations uniformly distributed over the interior of the landfill. Well locations will be prioritized at points, if any, at which the soil gas survey detected anomalous concentrations of gaseous contaminants (Figure 5-82). Each well will penetrate the full thickness of the landfill debris. Wells will be installed following procedures prepared and approved by the ER Program.

Sample Location	No. of Samples	Sample Description	Field Surveys: Site Survey/Mapping	Field Surveys: Geophysical Survey (Level I)	Field Surveys: Soil Gas Survey (LevelI/III)	Field Surveys: Gross Alpha, Beta, Gamma (Level I)	Field Screening (Level I): Lithologic Logging	Field Screening (Level I): Combustible Gas/Oxygen	Field Screening (Level I): Organic Vapor	Field Screening (Level I): Gross Alpha, Beta, Gamma	Laboratory Analysis (Level III/IV): Gamma Spectrometry	^{3}H	Total U (^{234}U, ^{238}U)	^{238}Pu, $^{239/240}Pu$	^{90}Sr	^{137}Cs	^{241}Am	^{60}Co	Volatile Organics (VOA) (SW 8240)	BTEX (SW 8020)	Semivolatile Organics (BNA) (SW 8270)	TPH(418.1)	Target Analyte List Metals	TCLP Metals	PCB and Pesticides (SW 8080)
73-001(a)	72	Surface material from main landfill		●	●	●			●	●	+		+	+	+	+	+		+		+		+		+
73-001(a)	36	Channel sediments from main landfill	●			●				●	+		+	+	+	+	+				+		+		+
73-001(a)	5	Gas monitor well samples from main landfill			●		●	●	●										●						
73-001(a)	≤ 60	Core samples from landfill		●			●	●	●	●	*		*	*	*	*	*		*		*		*		*
73-001(a)	24	Core samples from landfill perimeter		●	●		●	●	●	●	*		*	*	*	*	*		*		*		*		*
73-001(b)	2	Core samples from waste oil pit		●	●		●	●	●	●	●		●	●	●	●	●		●		●		●		●
73-001(d)	12	Core samples from debris disposal areas		●	●		●	●	●	●	*		*	*	*	*	*		*		*		*		*
73-001(a)	0-4	Leachate samples	●			●				●	●		●	●	●	●	●		●		●		●		●

Laboratory Analysis note: Number of samples analyzed depends on results of field screening and/or field survey. * =50%, + =30%

Figure 5-84. Screening and analysis for initial investigations at SWMU Group 73-1.

5.16.6.3.2 Activity 2—Coring at the Main Landfill

Cores will be drilled in the interior and around the perimeter of the main landfill to confirm containment of contaminants and/or to determine the lateral and vertical extent of contaminant migration. Ten cores will be drilled at uniformly distributed locations throughout the interior of the landfill and will penetrate the fill material to the fill/tuff interface. Samples collected at 5-ft intervals in the landfill material and in the uppermost tuff interval will be screened for organic vapor and gross alpha, beta, and gamma radiation. If field screening indicates the presence of organic vapors or radionuclides, coring will continue with field screening of samples at 5-ft intervals. At a point 5 ft below the last positive field screen response, a second, confirmatory sample will be collected. If field screening the first sample does not indicate contamination, coring will be terminated. Cores will be drilled following the procedures described in LANL-ER-SOP-04.01, Drilling Methods and Drill Site Management. All samples that indicate a positive screen response and 50% of the remaining samples will be analyzed as indicated in Figure 5-84.

Approximately 12 cores will be drilled at intervals of 300 ft around the southern boundary of the landfill (Figure 5-82). Investigators will not attempt to obtain cores along the north side, where the landfill boundary coincides with the canyon rim. Core locations may vary to include areas in which the soil gas survey indicates the presence of vapor phase contaminants. The cores will extend to depths corresponding to the base of the landfill as determined from nearby boreholes (currently estimated to be approximately 30 ft). The cores will be continuously retrieved and screened for organic vapors and gross alpha, beta, and gamma. One sample will be collected (and screened) at the depth corresponding to that at the base of the landfill. If field screening indicates the presence of organic vapors or radionuclides, coring will continue to a point 5 ft below the last positive field screen response, at which point a second, confirmatory sample will be collected. If field screening the first sample does not indicate the presence of contamination, coring will be terminated. Cores will be drilled following the procedures described in LANL ER-SOP-04.01, Drilling Methods and Drill Site Management. All samples that indicate a positive screen response and 50% of the remaining samples will be analyzed as indicated in Figure 5-84.

5.16.6.3.3 Activity 3—Coring at the Waste Oil Pit and Debris Disposal Areas

Cores will be drilled at the waste oil pit and at each of the debris disposal areas to determine whether contaminants have been contained and/or to determine the vertical extent of migration, following the procedures described in LANL-ER-SOP-04.01, Drilling Methods and Drill Site Management. One core will be drilled in the waste oil pit and will be field-screened for organic vapor. A sample will be collected from the core interval with the highest organic screen reading or with visible staining or contamination. The core will continue past the zone of contamination as determined by oil staining and/or field screening response. One core sample will be taken from clean material (unstained, no screen response) to confirm that the vertical extent of contaminant migration has been defined. Both samples will be analyzed as indicated in Figure 5-84.

Three cores will be centrally located along the length of each debris disposal area (Figure 5-83). The cores will extend to the fill/tuff interface and will be continuously screened for organic vapors and gross alpha, beta, and gamma. A sample will be collected in the uppermost tuff interval and will be field-screened. If field screening indicates the presence of organic vapors or radionuclides, coring will continue to a point 5 ft below the last positive field screen response, at which point a second, confirmatory sample will be collected. If field screening the first sample does not indicate the presence of contamination, coring will be terminated. All samples that indicate a positive screen response and 50% of the remaining samples (minimum of two samples per debris area) will be analyzed as indicated in Figure 5-84.

5.17 SWMU Group 73-2 (Los Alamos Airport)

SWMU Group 73-2 consists of SWMUs 73-001(c), airport bunkers; 73-002, incinerator/surface disposal; 73-003, steam cleaning plant; and 73-005, surface disposal. Group 73-2 also includes SWMU Aggregate 73-B, composed of SWMUs 73-004(a-c), septic systems, and 73-006, airport building outfalls. TA-73 is located on DOE property (Figure 3-1).

5.17.1 Description and History

5.17.1.1 SWMU 73-001(c) (Airport Bunkers)

In 1947, four bunkers used for storing HE were constructed along the north canyon rim east of the airstrip at 2200, 2220, 2280, and 2320 Fox Street (Figure 5-85). The bunkers are shown on several early topographic maps (USGS 1948, 05-0124; The Zia Company 1948, 05-0134; Limbaugh Engineering & Aerial Services, Inc., 1963, 05-0067). The concrete bunkers, measuring approximately 46 ft 8 in. square, were built on four pads and were covered with earth (The Zia Company, 1974, 05-0180). The Zia Company acquired the bunkers in June 1948 (Larson 1973, 05-0060); however, the protective force of the Laboratory's security branch apparently continued to use the bunker at 2200 Fox Street for some time between 1948 and 1964. In July 1964, the protective force permanently vacated the bunker and returned control of the structure to The Zia Company (O'Connor 1964, 05-0101; Nottrott 1964, 05-0099). By July 1973, The Zia Company no longer needed the bunkers and listed them as excess facilities (Larson 1973, 05-0059). The bunkers were slated for removal according to a June 1974 document (Larson 1974, 05-0061). In September and October 1973, Groups H-1, H-5, and H-8 conducted contamination surveys of the structures (Montoya 1973, 05-0093). Aerial photographs taken in 1974 indicate that, after demolition of the bunkers, concrete rubble from the bunkers may have been placed in two large pits adjacent to the bunker site and in a trench at and currently beneath the northeast corner of the runway [SWMU 73-001(c)]. The debris was covered with fill. Existing lightning arrestor poles and some fencing were removed or relocated at that time. Steel doors, vent pipes, and other salvageable items were sent to the Zia salvage yard (The Zia Company, 1974, 05-0180).

5.17.1.2 SWMU 73-002 (Incinerator/Surface Disposal)

An incinerator (SWMU 73-002) operated for a short time at TA-73 beginning in 1947. The incinerator building, currently used for storage, is located west of the Los Alamos Airport terminal. The first floor of the two-story building was referred to as the stoking floor, and the second floor as the charging floor. A 6-ft-diameter stack was located behind the building (W. C. Kruger Co. 1947, 05-0052). The incinerator, whose primary use was to destroy classified documents from the Laboratory, was used for only a short period because it did not function properly (IT Corporation 1991, 05-0149).

In June 1948, The Zia Company acquired the incinerator building, which it held until September 1973. Before 1973, but sometime after incineration had ceased, the old incinerator building was used by the Los Alamos Dog Obedience Club (Larson 1973, 05-0060). The incinerator equipment and stack have been removed, but no information on the removal operation is available.

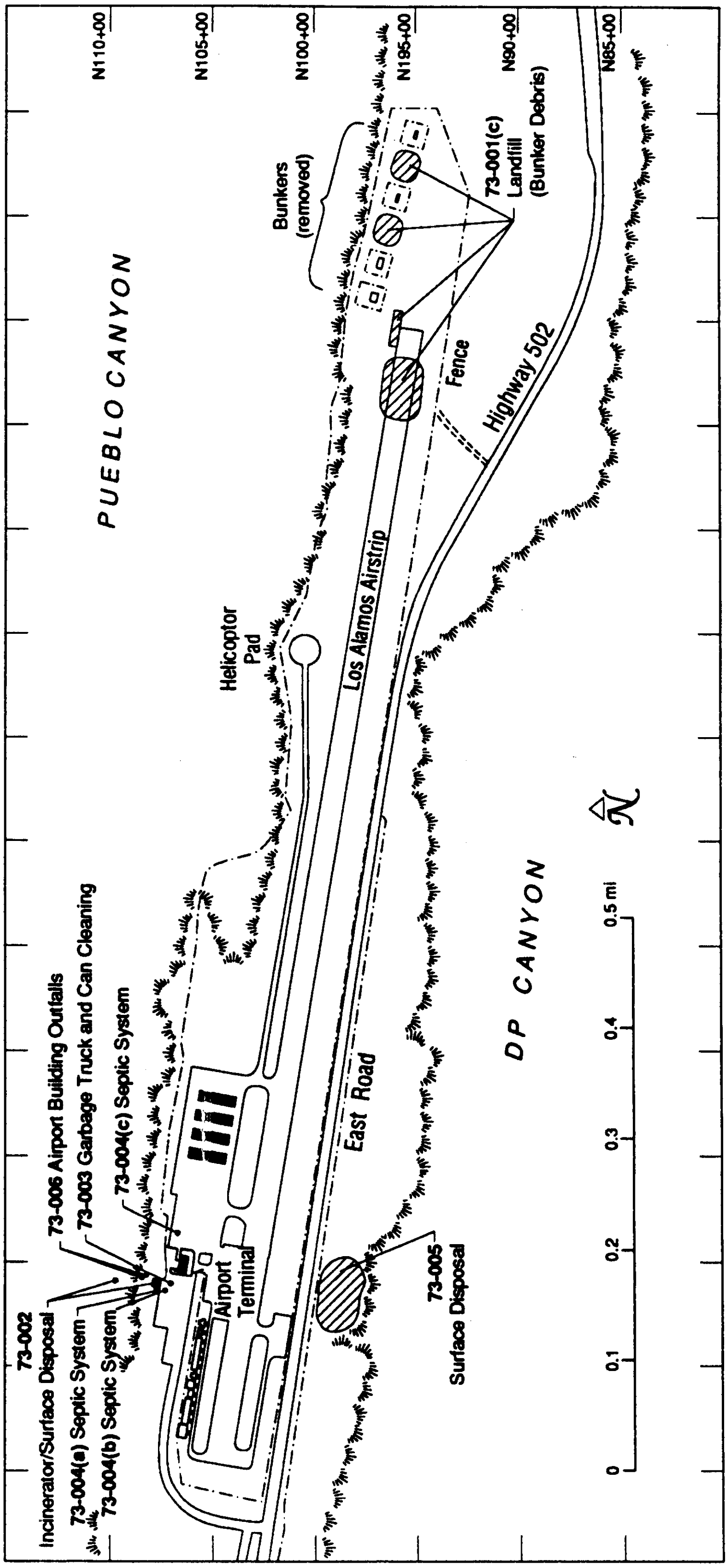


Figure 5-85. SWMU Group 73-2 (Los Alamos Airport).

Associated with SWMU 73-002 is a surface disposal area located on the slope below the canyon rim north of the incinerator building (Figure 5-86). The debris from the concrete staging area north of the building may have been disposed in Pueblo Canyon.

5.17.1.3 SWMU 73-003 (Steam Cleaning Plant)

The former steam cleaning plant for garbage trucks, cans, and dumpsters (SWMU 73-003) that contained municipal waste (IT Corporation 1991, 05-0149) was located immediately west of the existing airport terminal building, approximately 30 ft south of the incinerator. The trucks were cleaned in the east side of the plant and garbage cans in a concrete-block-enclosed area to the west. An open storage yard, approximately 50 by 18 ft with a 6-in. curb, was also located on the west side of the plant. The washwater from the plant discharged to a septic tank [SWMU 73-004(b)] (The Zia Company 1949, 05-0138).

The plant operated from 1949 until sometime before October 31, 1970, at which time the building was used by the Railway Express Company (Nottrott 1970, 05-0100; Sander 1970, 05-0105). Zia demolished the building and its concrete slab in June 1971 (Junge 1971, 05-0049; Junge 1971, 05-0050; Sander 1971, 05-0106; Sander 1971, 05-0107; Sander 1971, 05-0108; Parker 1971, 05-0102). The site of the former plant is currently paved and is used as a parking lot.

5.17.1.4 SWMU 73-005 (Surface Disposal)

A surface disposal area (SWMU 73-005) has been identified on the mesa north of TA-21 and south of East Road and the airport (DOE 1987, 0264). During the 1986 CEARP field survey, mounds, concrete, and other debris were observed at this location (DOE 1987, 0264). The debris is apparently the remains of small office and storage buildings erected and used by construction contractors in the mid- to late 1940s. The area was referred to as "contractors' row" [which should not be confused with two other areas (in TA-31 and TA-61) also known as "contractors' row"]. No Laboratory operations were conducted at this site (IT Corporation 1991, 05-0149). The land is currently owned by the DOE and is fenced to restrict access.

5.17.1.5 SWMU Aggregate 73-B

5.17.1.5.1 SWMUs 73-004(a-c) (Septic Systems)

The incinerator was served by a concrete septic tank [SWMU 73-004(a)] located northwest of the building (Figure 5-86). Overflow was diverted through a 6-in. VCP to an outfall to Pueblo Canyon (W. C. Kruger Co. 1947, 05-0052). The period of operation of this septic system was concurrent with that of the incinerator (1947 to 1973).

A concrete septic tank [SWMU 73-004(b)] was located approximately 80 ft to the northwest of the cleaning plant. The overflow was diverted through a 6-in. VCP to an outfall to Pueblo Canyon (The Zia Company 1949, 05-0138).

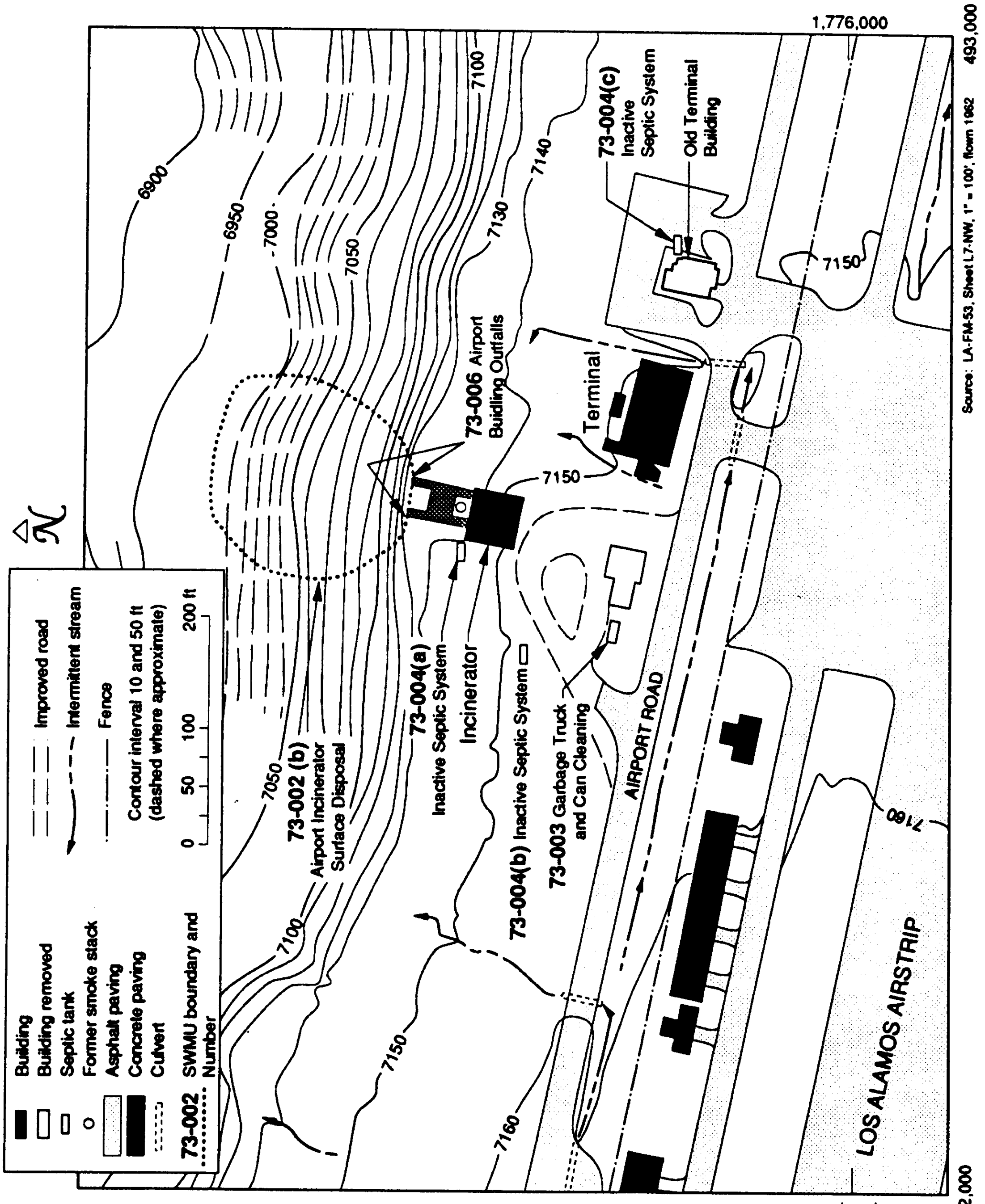


Figure 5-86. SWMU Aggregate 73-B, Los Alamos Airport (West).

A 4-in. VCP connected the airport terminal to a septic tank north of the terminal [SWMU 73-004(c)], which subsequently discharged to the canyon through an outfall (Figure 5-86). The period of operation for the system at the terminal is unknown.

5.17.1.5.2 SWMU 73-006 (Airport Building Outfalls)

The incinerator building contained two drainlines that discharged through separate outfalls to Pueblo Canyon (SWMU 73-006) (Kruger 1947, 05-0053). One drainline, which originated at a 5-in. floor drain on the east side of the stoking room, was constructed of 6-in. VCP and extended approximately 18 ft from the north side of the building to the canyon rim. A second 6-in. VCP drainline originated from a 5-in. floor drain on the west side of the stoking room. This drainline exited the northeast side of the building, angled 90°, and extended approximately 21 ft from the building to the canyon rim (W. C. Kruger Co. 1947, 05-0053; LANL 1990, 0145). The incinerator drains are presumed to have handled wash water. The period of operation of these drainlines was probably concurrent with that of the incinerator (1947 to 1973).

5.17.2 Nature and Extent of Contamination

5.17.2.1 Description and Contamination Levels

5.17.2.1.1 SWMU 73-001(c) (Airport Bunkers)

In 1973, H-1 conducted a contamination survey that showed all four structures to be free of radioactive contamination (Buckland 1973, 05-0024). Group H-5 determined that there was no significant chemical or toxic contamination in any of the structures but found two cases labeled "High Explosive" in the bunker at 2280 Fox Street (Mitchell 1973, 05-0092; Montoya 1973, 05-0093). The structures were found to be free of radioactive contamination.

5.17.2.1.2 SWMU 73-002 (Incinerator/Surface Disposal)

The types of materials incinerated at this SWMU are not known, and there are no known contaminants associated with the incinerator. A 1973 survey conducted by H-8 noted that the surface disposal area contains ashes and rusty cans, presumably end products of the incineration operation (Montoya 1973, 05-0093; Schiager 1973, 05-0109). There are no known releases.

5.17.2.1.3 SWMU 73-003 (Steam Cleaning Plant)

There are no known contaminants associated with the cleaning plant.

5.17.2.1.4 SWMU 73-005 (Surface Disposal)

There are no known contaminants associated with this surface disposal area.

5.17.2.1.5 SWMU Aggregate 73-B

5.17.2.1.5.1 SWMUs 73-004(a-c) (Septic Systems)

SWMU 73-004(a) handled sanitary waste from the toilet and shower facilities located on the charging floor of the incinerator building (W. C. Kruger Co. 1947, 05-0053). SWMUs 73-004(b and c) apparently received only sanitary waste and had outfalls to Pueblo Canyon. There are no known releases.

5.17.2.1.5.2 SWMU 73-006 (Airport Building Outfalls)

The incinerator drains were thought to contain only wash water. There are no known releases.

5.17.2.2 Potential Migration Pathways

Contaminants originating at the Los Alamos Airport may have been released to the environment via leaks in sewer lines and discharge from septic tank and drainline outfalls or may have been released from the surface disposal area located near the former incinerator building via mass movement, infiltration, and air and/or water entrainment. Additionally, contaminants, if present, may have been released via leaching/dispersion from the trenches containing the debris from the concrete storage bunkers. As a result, contaminants may be present in soil, channel sediment, tuff, and/or air. Contaminants in soil and channel sediments may leach/ disperse through the vadose zone, be entrained by surface water and transported downstream by surface water run-off, or be entrained and transported off the site by wind. Contaminants present in tuff may leach/disperse through the vadose zone.

5.17.2.3 Potential Public Health and Environmental Impacts

Based on the migration pathways listed in Subsection 5.17.2.2, contaminants may be present in or may migrate to soil or air. As a result, human exposure to site contaminants may occur through inhalation of suspended particulates or incidental ingestion of or dermal contact with soil. Additionally, terrestrial animals may be exposed to site contaminants via incidental ingestion of or dermal contact with soil or inhalation of suspended particulates.

5.17.3 Conceptual Models

Figures 5-87, -88, and -89 present the conceptual models for potential contaminant releases from the surface disposal area, former septic systems, the floor drains in the incinerator building, and bunker disposal pits and subsequent exposure of the receptors identified in Subsection 5.17.2.3. In these figures, "off-site residents" refers to residents located in the vicinity of the airport (likely closest downwind receptor), "site visitors" refers to passengers at the airport and people who hike along the slopes of Pueblo Canyon adjacent to the airport, and "on-site workers" refers to employees at the airport facilities. Terrestrial animals in the vicinity of the airport, primarily in Pueblo Canyon, may also be impacted.

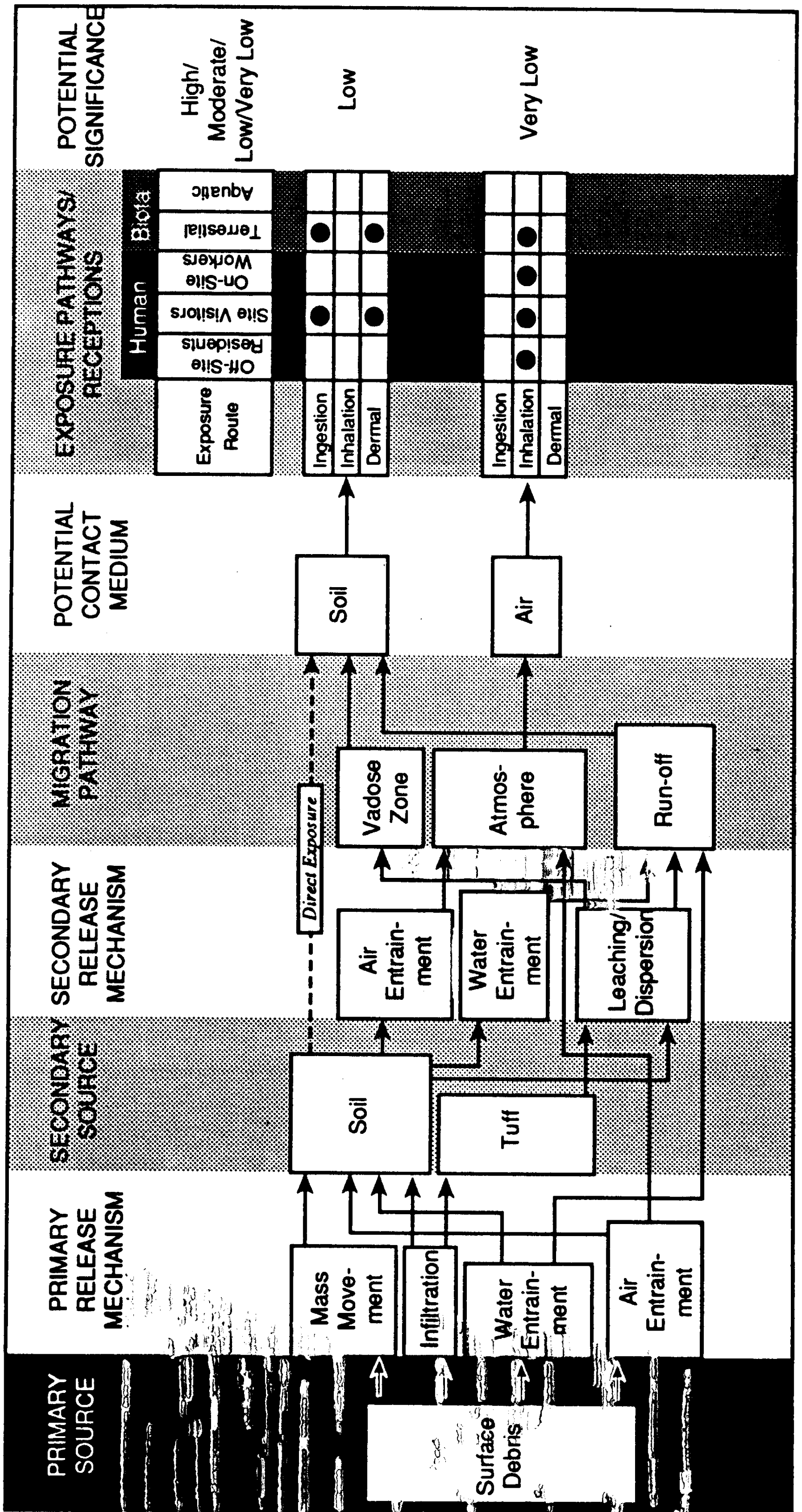


Figure 5-87. Conceptual model of SWMU 73-002.

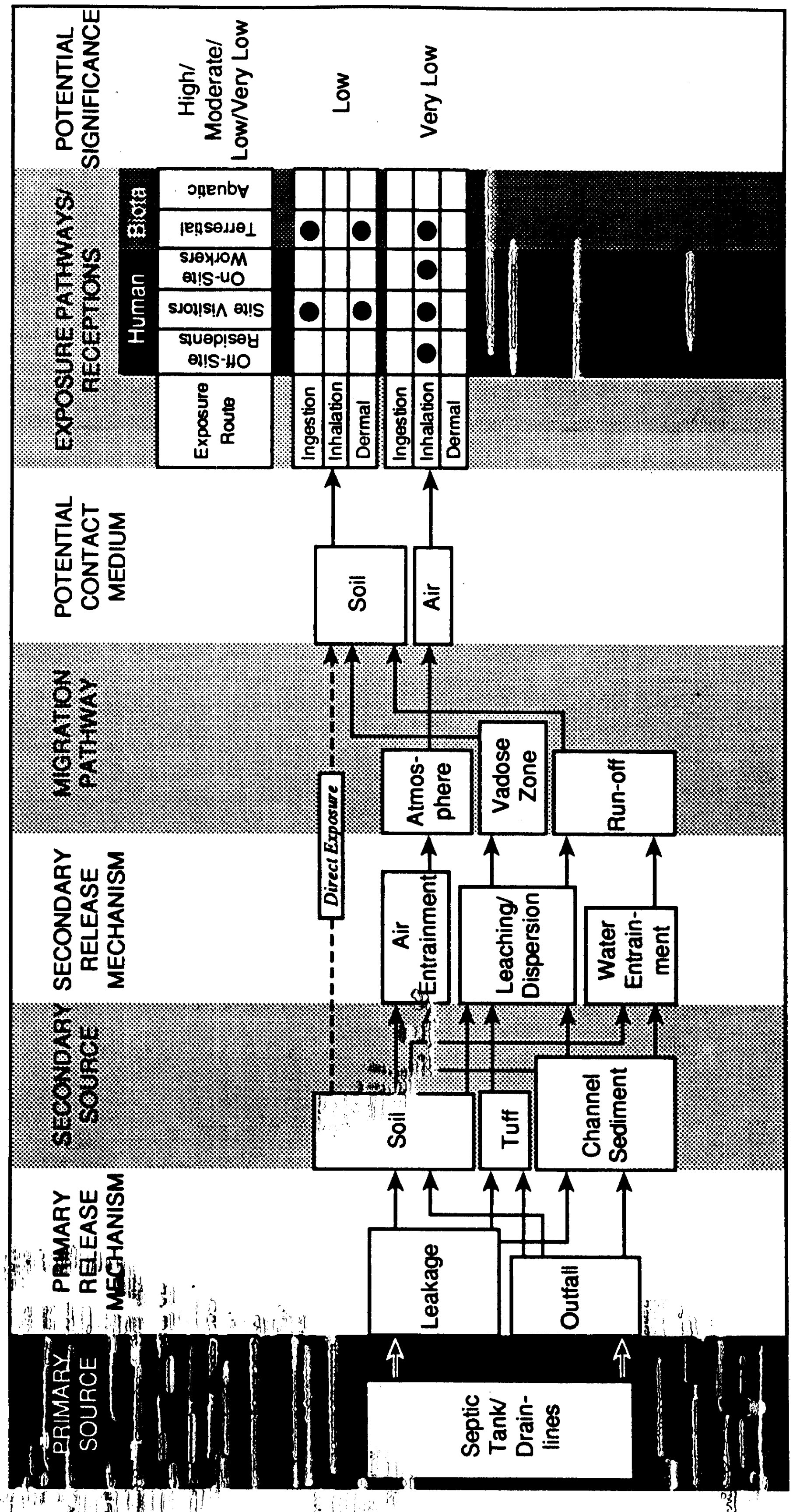


Figure 5-88. Conceptual model of SWMU Aggregate 73-B.

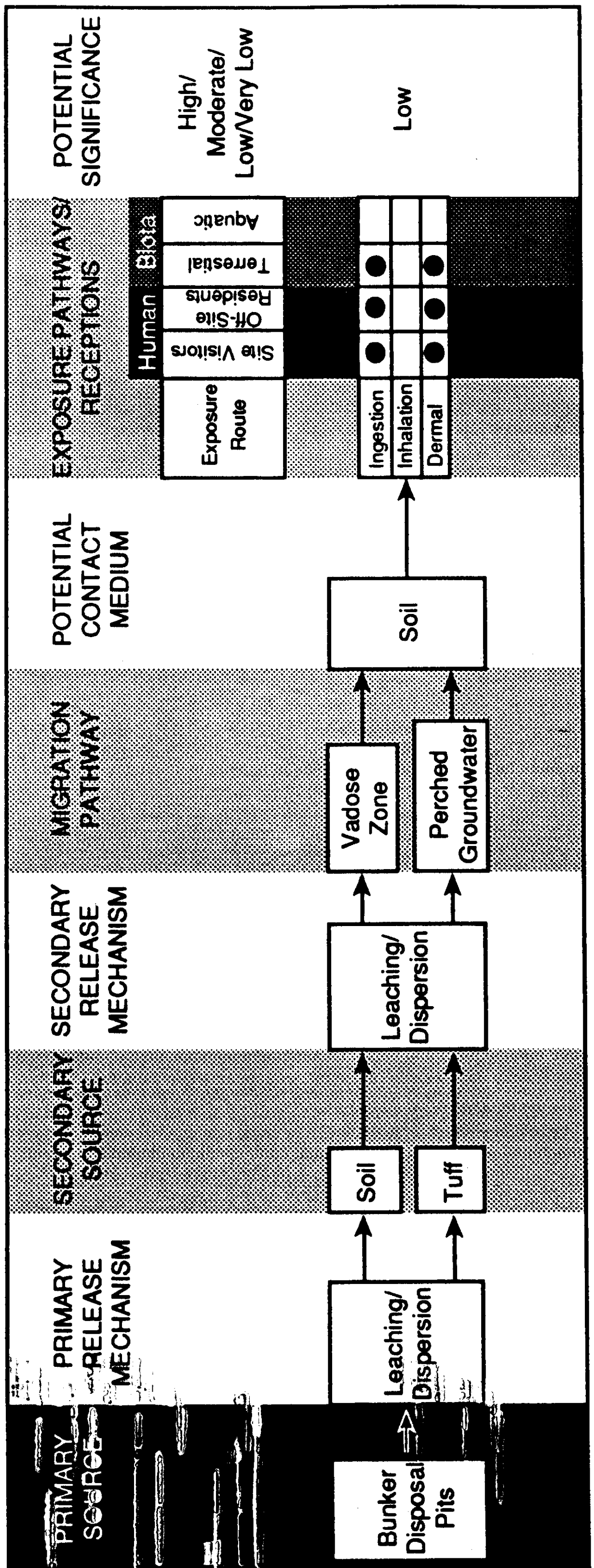


Figure 5-89. Conceptual model of SWMU Aggregate 73-001.

5.17.4 Decisions, Domain, and Approach

The domain of SWMU Group 73-2 includes areas north and west of the airport terminal building (Figure 5-90) and at the east end of the runway (Figure 5-91). The western part of the domain is adjacent to the airport terminal building, which serves many plane passengers and provides office space for several workers. The goal of the RCRA process for this site is to ensure that these areas are suitable for public use. Remedial action will therefore be proposed, if necessary, to clean the sites to meet health-risk-based media cleanup standards for site workers and visitors.

Because there is no evidence of hazardous materials associated with any of these sites, Phase I will consist of Stage I investigations to determine whether any source of contamination is present. This decision will be based on analytical measurements of soil samples taken from the debris apron behind the incinerator building and on measurements of sediments from the first-order channels carrying run-off from the outfalls and debris apron. Investigation of subsurface structures associated with the septic systems will follow the procedures outlined in Subsection 2.3.4. The bunker debris at the east end of the runway will be analyzed to confirm reports from the decontamination surveys (Montoya 1973, 05-0093).

Phase I data will be compared with action levels. In the absence of contamination, no further action will be proposed for the SWMUs in SWMU Group 73-2. If levels above background are observed, Phase II investigations may be required to support a baseline risk assessment and CMS.

5.17.5 Data Required

5.17.5.1 Source Characterization

Specific data requirements for source characterization in Phase I investigations include

- determining as accurately as possible the locations, boundaries, and geometries of the units to be investigated in SWMU Group 73-2, using field surveys and Level I data, and
- using Level III/IV data to determine the presence or absence of, and, if present, the nature and concentrations of, any contaminants in potential release areas or site media, including surface material associated with the surface disposal area (SWMU 73-002), subsurface material beneath the septic tanks and drainlines (SWMUs 73-004 and 73-006), subsurface material from the airport bunker debris pits [SWMU 73-001(c)] and the surface disposal area south of the airport (SWMU 73-005), and channel sediments in surface drainages originating at or transecting the surface disposal area (SWMU 73-002) or at outfall points (SWMU 73-006).

All surface and subsurface samples will be screened for combustible gas, oxygen, and organic vapor to determine whether contamination is present. If sample screening indicates that contamination is not present above background levels, 50% of the samples will be submitted for laboratory analysis.

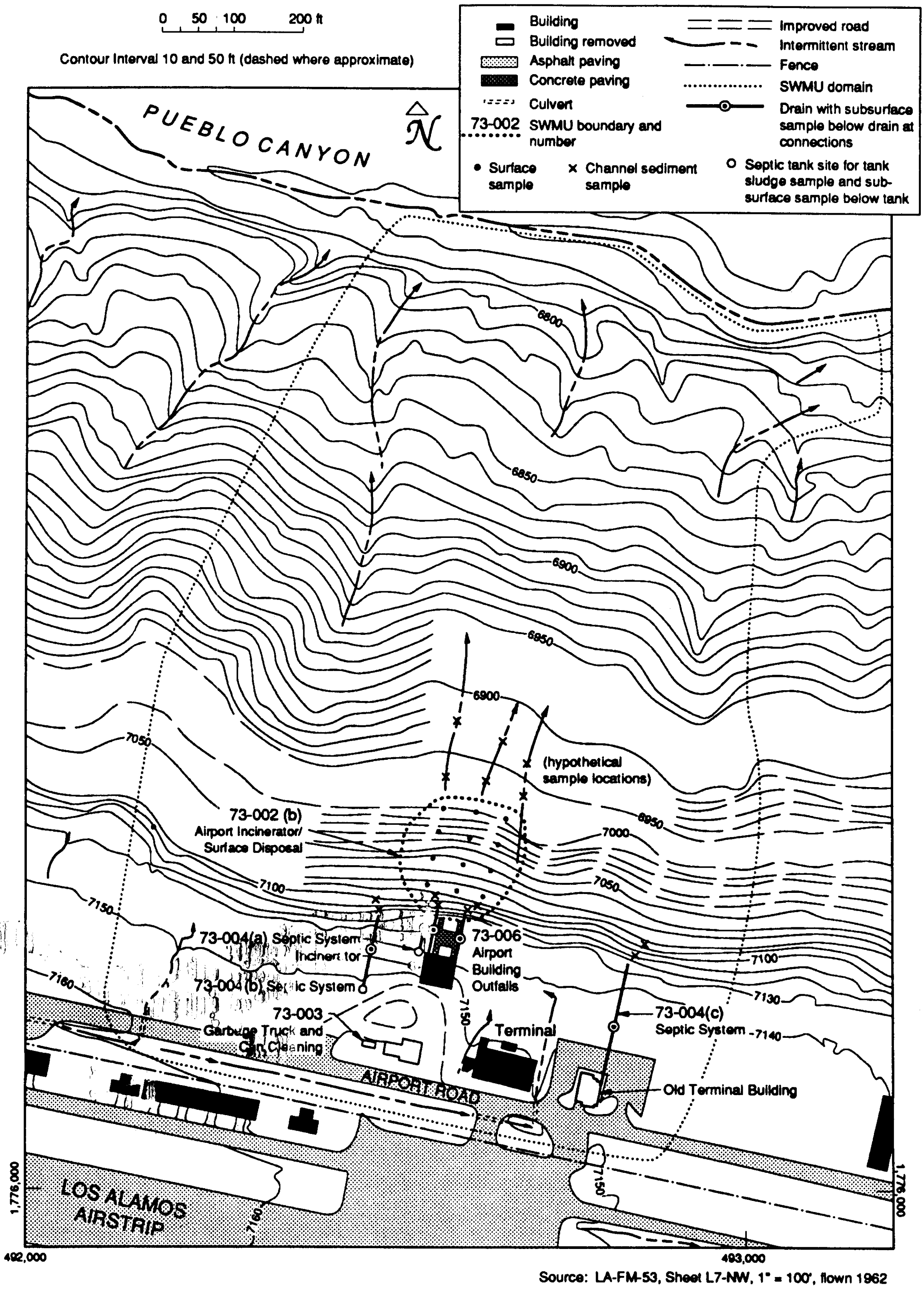


Figure 5-90. Sampling locations at SWMU Aggregate 73-B [Los Alamos Airport (West)].

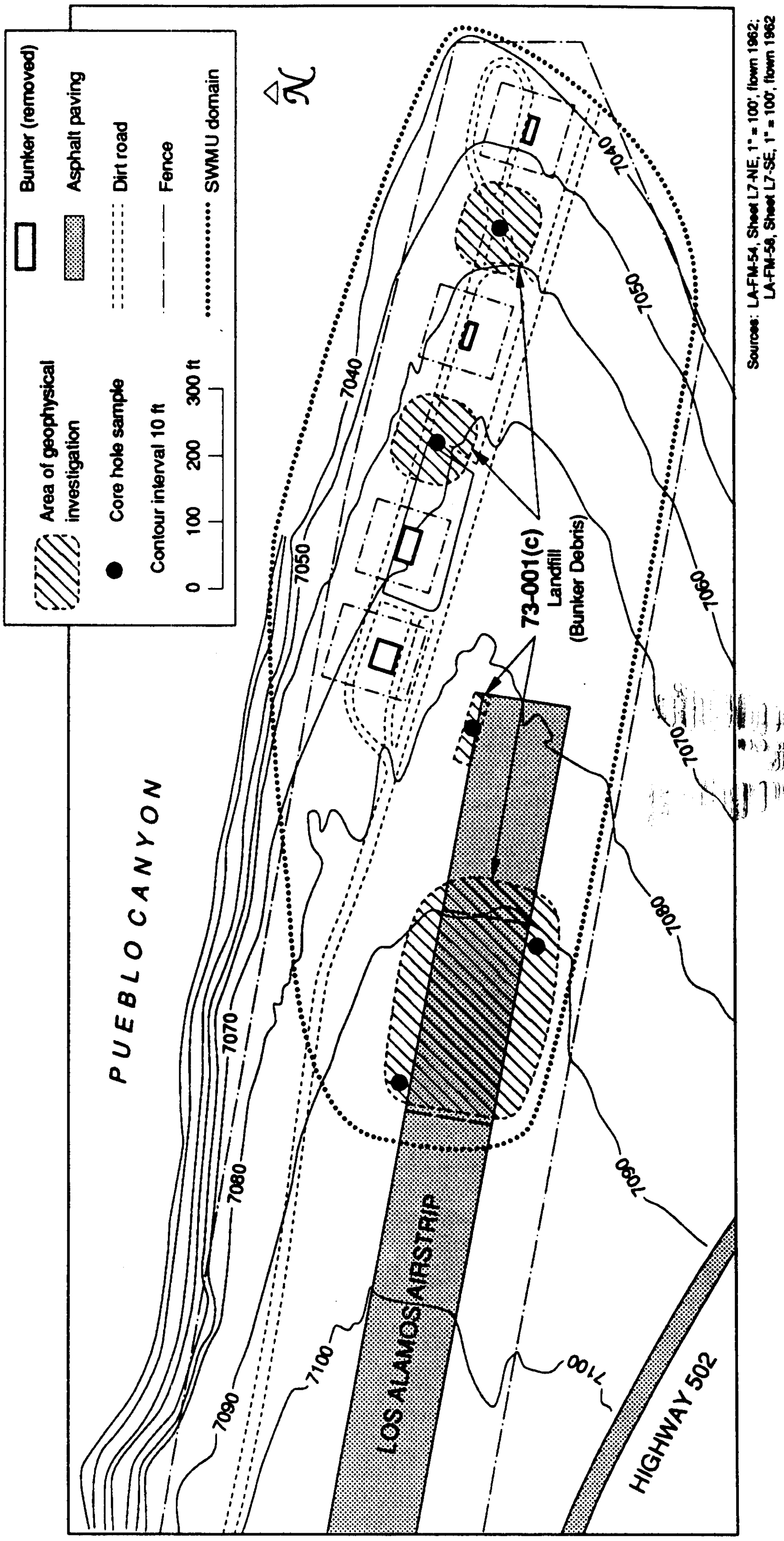


Figure 5-91. Sampling locations at SWMU 73-001(c) (Bunker Debris).

The number of samples submitted for laboratory analysis will provide a probability of 80% of observing contaminant concentrations above action levels, if excessive levels exist in more than 20% of the surface debris area (represented by samples from downslope channel sediments and soil from the debris apron) or in 20% of the building outfalls and septic systems. Smaller laboratory samples (but sizes adequate for field screening samples) will be obtained at areas containing bunker debris and at the other surface disposal areas south of the runway. If contaminant concentrations are at or below action concentrations, no further field investigations will be conducted.

If the results of Phase I sampling indicate that contaminant concentrations are above action levels, the necessity and possible scope of Phase II field sampling will be evaluated. Based on current knowledge of past activities at these SWMU sites, it is not expected that contaminants will be encountered above action level concentrations; accordingly, no detailed Phase II sampling plans have been developed. However, should Phase II investigations be necessary, the following types of information may be collected:

- additional source characterization data to determine the lateral and vertical extent of contamination in soil, tuff, and channel sediments along potential migration pathways and in potential release areas and

- transport characteristics of specific contaminants in soil, tuff, and channel sediments.

This information would be used to provide a complete characterization of contaminant releases, to perform a baseline risk assessment, and, if necessary, to provide a data base for designing and implementing corrective measures.

5.17.5.2 Environmental Setting

Data required to characterize the environmental setting of SWMU Group 73-2 in Phase I field investigations include a map of surface water drainages, including sediment catchments that originate at or transect the surface disposal area and outfall points on the north-facing valley wall within the domain boundaries. The map will be used to select sampling sites for channel sediments.

If Phase II investigations are necessary, the information required may include detailed hydrogeologic and geologic characterization of subsurface soil and tuff. This information, if collected, will be used to perform transport modeling and analysis of risk associated with contaminant release and migration and to design and implement corrective measures.

5.17.5.3 Potential Receptors

No specific information regarding the activities, behavior, or location of actual receptors is required for the Phase I investigation. In the event that a Phase II investigation is required, the following information regarding the potential receptors identified in Figures 5-86, -87, and -88 may be required:

- frequency and duration of site visits,
- location of on-site workers relative to source area(s), and
- location of nearest downwind resident. In the event that the estimated risks to this receptor are considered unacceptable, a more detailed demographic survey will be required.

5.17.6 Field Sampling Plan

The field work in Phase I, Stage I, investigations of SWMU Group 73-2 will be completed in three field tasks: field surveys, surface sampling, and subsurface sampling. The RFI field work and associated activities are summarized in the following subsections. All field work will be performed in accordance with applicable ER Program SOPs.

5.17.6.1 Task 1—Field Surveys

The following field surveys will be performed: site survey, geophysical survey, and geomorphologic mapping.

5.17.6.1.1 Activity 1—Site Survey

A site survey will be conducted to determine the locations of the buried structures (three septic tanks and five drainlines), the outfall points, and the airport bunker debris pits. The locations will be determined by examining historic aerial photographs, reviewing records (including maps and engineering plans), and by visually inspecting the site.

5.17.6.1.2 Activity 2—Geophysical Survey

If the site survey does not reveal the location of all buried structures in sufficient detail, geophysical surveys will be conducted to more precisely locate the septic tanks, drainlines, and bunker debris pits. A magnetic survey will be performed with spacing appropriate to ensure full resolution of large metallic objects and metallic components in the tanks' construction. An EMC survey will be conducted to further define buried features. If necessary, ground-penetrating radar may also be used to supplement the magnetic and EMC surveys. Once located, the sites will be marked in the field.

5.17.6.1.3 Activity 3—Geomorphologic Mapping

First-order stream channels within the domain that originate at or transect the surface disposal area and the outfall points will be located and mapped to determine sites for sampling channel sediments. This activity will locate all sediment catchment sites in the relevant drainages. Mapping will be completed on a scale of 1:2000.

5.17.6.2 Task 2—Surface Sampling

The following surface sampling activities will be performed: (1) sampling surficial material at the surface disposal area and (2) sampling channel sediments in drainages that originate at or transect the surface disposal area and outfall points.

5.17.6.2.1 Activity 1—Sampling at the Surface Disposal Area

Approximately 10 samples will be collected from the uppermost 6 in. of surface material at the surface disposal area, including one field duplicate. Samples will be screened and analyzed as indicated in Figure 5-92. Samples will be collected following the procedures described in LANL-ER-SOP-06.09, Spade and Scoop Method for Collection of Soil Samples.

5.17.6.2.2 Activity 2—Sampling Channel Sediments

Samples of channel sediments will be collected from drainages at or below the surface disposal areas and the outfalls associated with the drains in the septic system and incinerator building. The three largest first-order drainage channels that originate at or transect the surface disposal area will be selected for sampling channel sediments (Figure 5-90). A total of two sediment samples will be collected from each drainage selected: the first from a sediment catchment at or immediately below the disposal area and the second either from a catchment site near the terminus of the drainage channel or immediately downgradient of the first major confluence, whichever occurs farthest upstream. A total of six samples of channel sediments will be collected from the surface disposal area and will be screened and analyzed as indicated in Figure 5-92.

Three samples of channel sediments will also be taken from sediment catchments in first- or higher-order drainage channels that have developed downslope of the outfalls associated with the drains for the septic systems and the incinerator building, as close to the outfall points as possible. If no distinct drainage channels are discernible, two samples will be collected from likely sediment catchment areas adjacent to the outfall points. Samples will be collected following the procedures described in LANL-ER-SOP-06.14, Sediment Material Collection. A total of 16 channel sediment samples, including one field duplicate, will be screened and analyzed as indicated in Figure 5-92. Cores will be drilled following the procedures described in LANL-ER-SOP-04.01, Drilling Methods and Drill Site Management.

5.17.6.3 Task 3—Subsurface Sampling

Subsurface sampling will consist of sampling septic tank systems, including associated drainlines, the incinerator building drainlines, and the material buried in the airport bunker debris pits and in the surface disposal area south of the airport.

5.17.6.3.1 Activity 1—Sampling Septic Tank System Areas

Sampling the three septic tank systems will proceed as described in Subsection 2.3.4.1. A total of 12 samples will be screened and analyzed as indicated in Figure 5-92. Several decisions are possible at the end of Phase I. If the results of Phase

Sample Location	No. of Samples	Sample Description	Field Surveys: Site Survey/Mapping	Field Surveys: Geophysical Survey (Level I)	Field Surveys: Soil Gas Survey (Level II/III)	Field Surveys: Gross Alpha, Beta, Gamma (Level I)	Field Screening (Level I): Lithologic Logging	Field Screening (Level I): Combustible Gas/Oxygen	Field Screening (Level I): Organic Vapor	Field Screening (Level I): Gross Alpha, Beta, Gamma	Laboratory Analysis (Level III/IV): Gamma Spectrometry	^{3}H	Total U (^{234}U, ^{236}U)	^{238}Pu, $^{239/240}Pu$	^{90}Sr	^{137}Cs	^{241}Am	^{60}Co	Volatile Organics (VOA) (SW 8240)	BTEX (SW 8020)	Semivolatile Organics (BNA) (SW 8270)	TPH(418.1)	Target Analyte List Metals	TCLP Metals	PCB and Pesticides (SW 8080)
73-002	10	Surface material from disposal area							●										*		*		*		*
73-002	6	Channel sediments from disposal area	●																*		*		*		*
73-004(a-c), 73-006	16	Channel sediments below outfalls	●																*		*		*		*
73-004(a-c)	12	Samples from septic tank systems	●	●				●	●										●		●		●		●
73-000(c)	10	Subsurface core material from airport bunker debris pits	●	●			●	●	●										*		*		*		*
73-005	8	Subsurface core material from surface disposal area south of airport	●	●			●	●	●										*		*		*		*

Laboratory Analysis note: Number of samples analyzed depends on results of field screening and/or field survey. * =50%, + =30%

Figure 5-92. Screening and analysis for initial investigations at SWMU Group 73-2.

sampling indicate that contaminants are present above background levels, additional site characterization will be conducted as necessary (Subsection 2.3.4).

5.17.6.3.2 Activity 2—Coring at Airport Bunker Debris Pits and the Surface Disposal Area South of the Airport

Cores will be drilled at five locations in the airport bunker debris pits (Figure 5-91) and at four locations in the surface disposal area south of the airport (Figure 5-93). Coring will penetrate through the debris to the fill/tuff interface. Cores will be field-screened for organic vapor and radionuclides, and two samples will be collected from each core at intervals, if any, shown to be contaminated during field screening . If a positive screening response is not obtained, two samples will be collected from each core, one from an appropriate interval (based on professional judgment) within the debris/fill and one sample from the debris/tuff interface. Cores will be drilled following the procedures in LANL-ER-SOP-04.01, Drilling Methods and Drill Site Management. The samples will be analyzed as indicated in Figure 5-92.

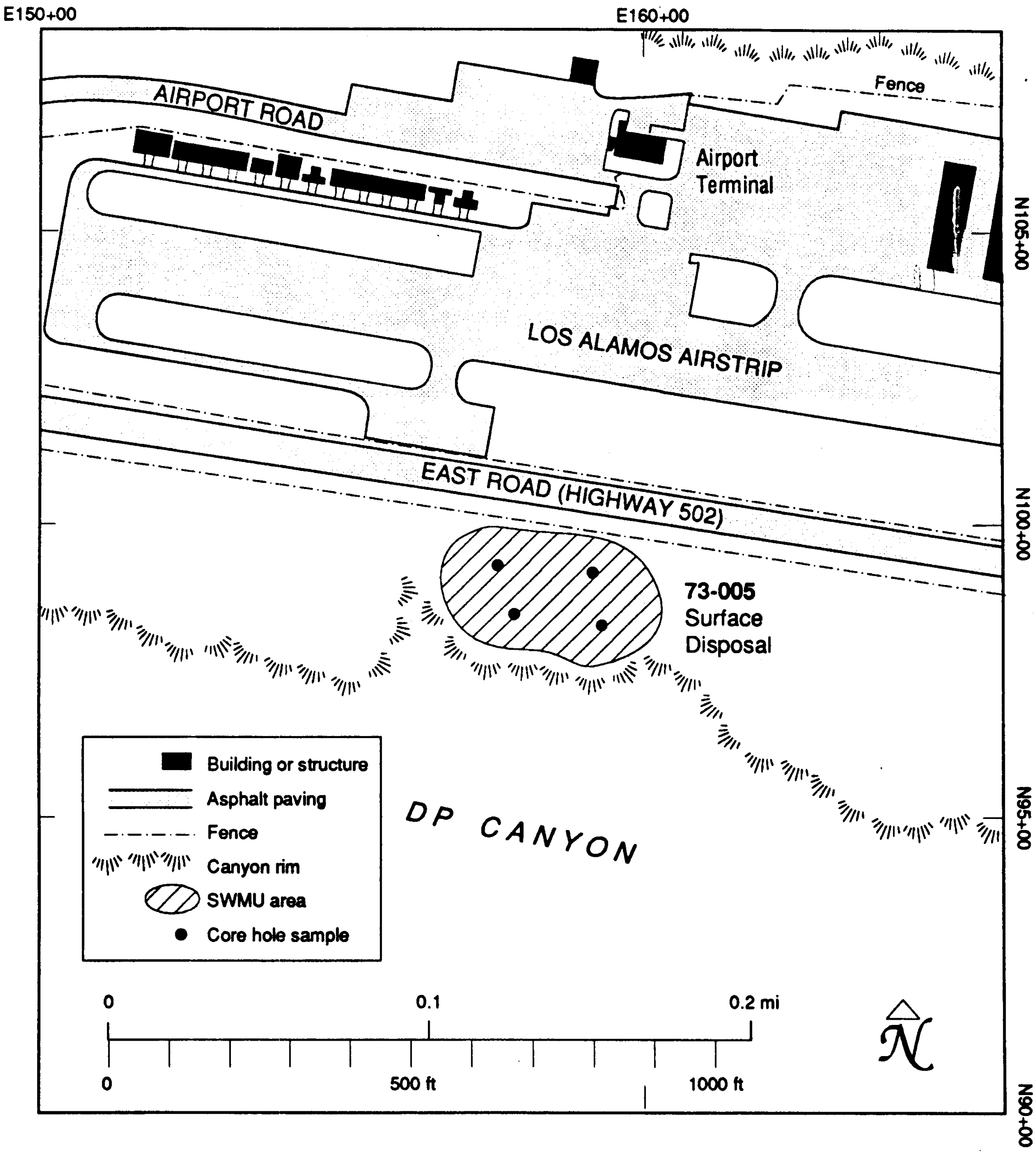


Figure 5-93. Sampling locations at SWMU 73-005 (Surface Disposal).

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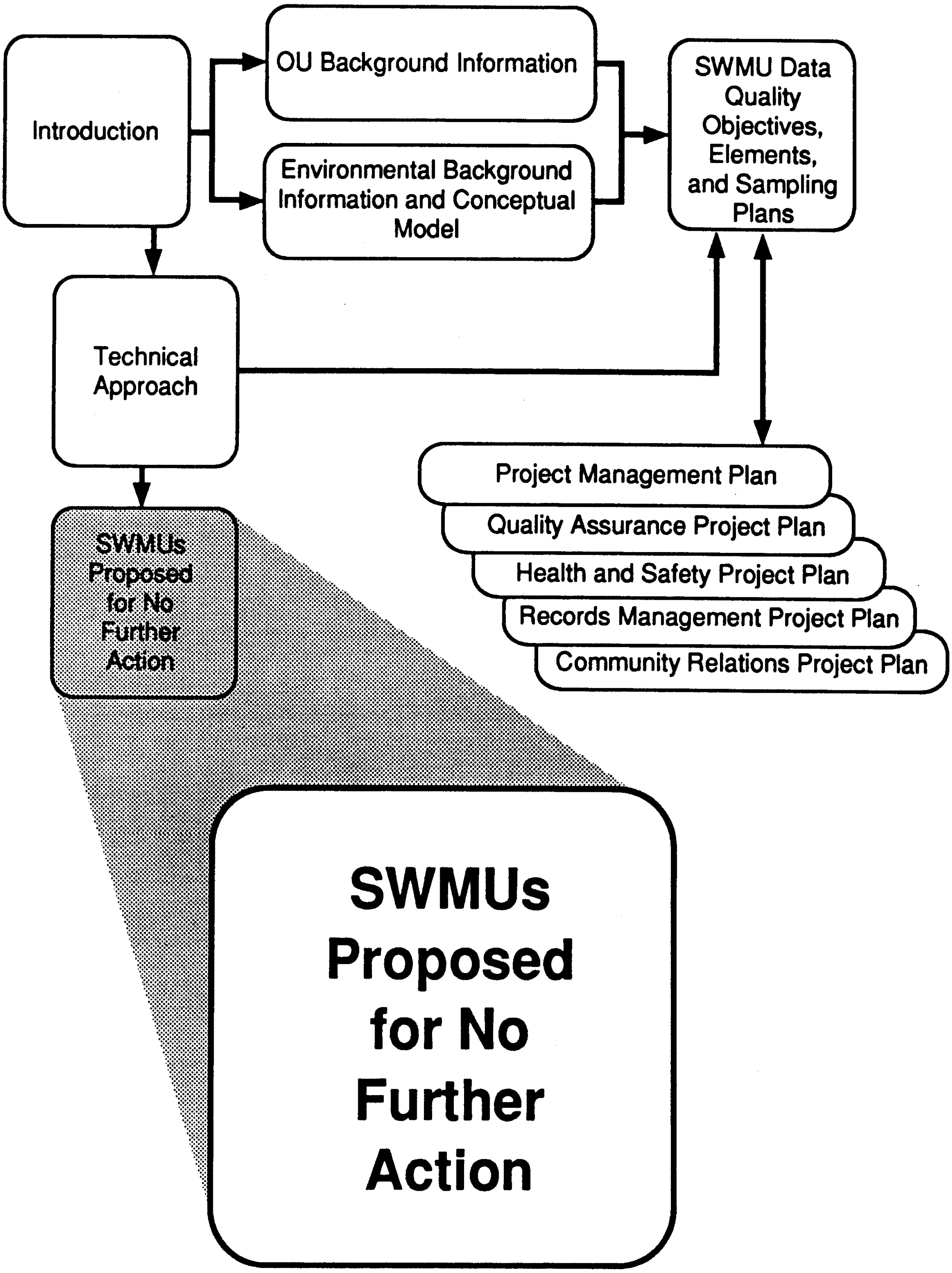
CHAPTER 6



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6.0 SOLID WASTE MANAGEMENT UNITS PROPOSED FOR NO FURTHER ACTION

This chapter presents solid waste management units (SWMUs) recommended for no further action.

6.1 SWMU 0-005 (Mortandad Canyon "Landfill")

SWMU 0-005 (Mortandad Canyon "Landfill") is located on land owned by the Department of Energy (DOE). It is listed in Table A of the Hazardous and Solid Waste Amendments (HSWA) Module of Los Alamos National Laboratory's (the Laboratory's) permit to operate under the Resource Conservation and Recovery Act.

6.1.1 Description and History

A small fenced area designated as SWMU 0-005 (Mortandad Canyon "Landfill") is located approximately 1.6 km west of the Los Alamos/Santa Fe County line (Figure 3-6). The fenced area is posted with signs that indicate the presence of radioactivity.

The 117-m^2 enclosure, which is located on alluvial sediments, was used to examine the transport of radioactive particulates from the ground surface to plants as a result of rain splash (LANL 1990, 0145). Because tomato plants were used as the recipients of the particulates, the waste site was referred to as a garden. These studies occurred between 1976 and the early 1980s. Soil from within the fenced area was put in 55-gal. drums and transported to TA-50, where four radionuclides, all with half-lives less than 115 days [^{182}Ta (half-life 115 days), ^{141}Ce (33 days), ^{124}Sb (60 days), and ^{46}Sc (84 days)] were mixed into the soil by rotating the drums. The drums of contaminated soil were then taken back to the study plot, and the soil was returned to the enclosure.

Several of the empty drums were stacked inside and one outside the fence (Aldrich 1991, 05-0154). These drums were still located at the fence line in 1986 at the time of the CEARP field survey but were removed before the CEARP team visited the site in November 1988 (DOE 1987, 05-0035; LANL 1990, 0145; Aldrich 1991, 05-0154).

6.1.2 Basis for Recommendation of No Further Action

Because the radionuclide transport experiments were discontinued in the early 1980s, the species involved have long since decayed to negligible levels. The fenced area, therefore, does not contain any hazardous materials that would pose a threat to human health or the environment. Additionally, the drums reported at the study plot in the 1980s were empty drums that had been used to transport soil containing the same four radionuclides and therefore did not release anything that could pose a hazard today. It is recommended that no further action be taken at this site.

6.2 SWMU 0-008 (North Mesa Surface Disposal Area)

SWMU 0-008 (North Mesa Surface Disposal area) is located on Los Alamos County land.

6.2.1 Description and History

The North Mesa Surface Disposal Area (SWMU 0-008) is a small, open disposal area containing building debris that appears to have come from a demolished weather hutment called "Point Weather." The hutment, which was located on Kwage Mesa (an eastern arm of North Mesa) either near the eastern end of the mesa or approximately 1.25 mi east of the rodeo grounds (Figure 3-4) (Aldrich 1991, 05-0153), housed a generator and served as a weather station used in connection with shots fired at Bayo Canyon (IT Corporation 1991, 05-0149; DOE 1987, 0264). No Laboratory testing activities were conducted on North Mesa or Kwage Mesa.

6.2.2 Basis for Recommendation of No Further Action

Available site information indicates that SWMU 0-008 does not pose a threat to human health or the environment for the following reasons:

- no known laboratory activities occurred at the site,
- the generator was probably removed before the building was demolished in accordance with standard operating procedures for demolition,
- the debris observed by the CEARP field survey team in 1986 is consistent with the type of debris that would be expected from demolition of the weather station hutment, and
- no hazardous materials were used at the weather hutment (Aldrich 1991, 05-0153).

It is therefore recommended that no further action be taken.

6.3 SWMU 0-010 (Surface Disposal Area)

SWMU 0-010 is a surface disposal area located on DOE property.

6.3.1 Description and History

A surface disposal area (SWMU 0-010) was observed on a small mesa west of Materials Disposal Area B (MDA B), TA-21 (Figure 3-2) (LANL 1990, 0145). According to the SWMU report (LANL 1990, 0145), the area prompted suspicion because "an area in which soil was piled above the natural contour" was observed and a 1948 aerial photograph "appeared" to have trenches on it. Later examinations of the aerial photograph taken in 1946 (Los Alamos County circa 1946, 05-0147) and of another photograph taken in 1946 (Sandia Laboratories 1946, 05-0167) show that the features described in the SWMU report are not trenches but an open storage area in which supplies were stockpiled in rows. Photogrammetric analysis of the stockpiles shows that the supplies consist of 10-ft-long objects that are not drums. In the early 1950s, the small mesa became a playground for a trailer court (Limbaugh Engineering & Aerial Surveys, Inc., 1963, 05-0177).

6.3.2 Basis for Recommendation of No Further Action

Because it is concluded that the objects in the photographs are rows of supplies stored in containers that are considerably larger than 55-gal. drums and because these containers have no characteristics that indicate that they are associated with potentially hazardous materials, it is recommended that no further action be taken at this site.

6.4 SWMU 0-015 (Active Sportsmen's Club Firing Range)

SWMU 0-015 is an active firing range located on General Services Administration (GSA) land.

6.4.1 Description and History

The Sportsmen's Club Firing Range (SWMU 0-015) is located on GSA land in Rendija Canyon (Figure 3-5). It consists of several small-arms ranges and has been in operation since 1966 (LANL 1990, 0145). Lead is present in earthen berms and on the surface of the ranges. Shattered clay projectiles are present on the skeet and trap ranges. The extent of contamination in the soil and surface water is unknown. There are no documented occurrences of releases from the site.

6.4.2 Basis for Recommendation of No Further Action

Contamination at the site is directly related to use of the firing range, and there are no plans to change the use of this land in the future. Because the site is going to continue to be used as a firing range and additional contamination will occur as a result, the site should not be cleaned up until the range is decommissioned. This SWMU is similar to thousands of other firing ranges in the United States and has no higher risk associated with it. It is recommended that no further action be taken at this site until it ceases to be used as a range and the land is dedicated to some other use.

6.5 SWMU 0-024 (Cistern on Barranca Mesa)

SWMU 0-024 is a cistern located on private property on Barranca Mesa.

6.5.1 Description and History

A cistern on Barranca Mesa (SWMU 0-024) was an unlined hole with a wood cover in the Bandelier tuff (Aldrich 1991, 05-0153) and was used as a disposal site for military ordnance (DOE 1987, 0264). The cistern is located on the plot at the east end of Barranca Road just west of the Deer Trap trailhead (Figure 3-5). The cistern was located in May 1965, and its entire contents of expended munitions and gun components were removed (Aldrich 1991, 05-0153).

6.5.2 Basis for Recommendation of No Further Action

Based on available site information, the abandoned cistern does not pose a threat to human health or the environment because all expended munitions and gun components have been removed from the cistern. Additionally, the exact location of the cistern is no longer known; locating it would be difficult and require significant disruption of private property. It is therefore recommended that no further action be taken.

6.6 SWMU 0-025 (Tank Mesa "Landfill")

SWMU 0-025 is the Tank Mesa "Landfill."

6.6.1 Description and History

Tank Mesa "Landfill" (SWMU 0-025) is listed as a possible waste disposal area (LANL 1990, 0145). Tank Mesa, currently known as Otowi Mesa on topographic maps (LASL circa 1950, 05-0062; USGS 1984, 05-0126), is located between Barrancas and Bayo canyons at the east end of Barranca Mesa (Figure 3-4). It is a residential area.

Examination of Engineering File 1757 (Russo, no date, 05-0178), which was evaluated by the CEARP, did not reveal documentation that Tank Mesa was the site of a landfill. The only reference to Tank Mesa occurred in what appeared to be reminder notes from a meeting. Although the notes include a few references to disposal areas, the words "Tank Mesa" are distinctly separate from those references. There is no reason to assume that Tank Mesa is associated with the disposal areas. The archive search uncovered no additional information on this SWMU.

6.6.2 Basis for Recommendation of No Further Action

Re-examination of available site information shows that the reference cited for a landfill on Tank/Otowi Mesa in the SWMU report (LANL 1990, 0145) contains no documentation that such a site ever existed. Based on this information and on the fact that Otowi Mesa is an extremely narrow arm of Barranca Mesa, whose surface consists of undisturbed bedrock, there is no reason to suspect that a landfill exists on the mesa. Therefore, it is recommended that no further action be taken at the site.

6.7 SWMU 0-026 (Gun Mount "Landfill")

SWMU 0-026 is the Gun Mount "Landfill" on North Mesa. The location of this SWMU is unknown.

6.7.1 Description and History

According to the SWMU report (LANL 1990, 0145) The Gun Mount "Landfill" (SWMU 0-026) consists of a buried gun mount, radio poles, hutments, and similar miscellaneous structures. A CEARP interviewee reported that a uranium-contaminated gun mount, approximately 5 by 5 by 6 ft, was disposed on North Mesa in 1946 (DOE 1987, 0264). The bolt-down, Navy-style gun mount was reportedly used at the Laboratory (DOE 1987, 0264). It is difficult to determine whether the gun mount was actually disposed on North Mesa. Interviews with another former Laboratory employee and a Zia employee who had knowledge of such operations indicate that the gun mount is probably not on North Mesa but may be somewhere on Laboratory property or was perhaps shipped to Idaho or some other location (IT Corporation 05-0148; Francis 1991, 05-0038).

The radio poles and hutments are shown on a 1948 topographic map (DOE 1987, 0264) at a location that is now in the vicinity of the Los Alamos Middle School (USGS 1948, 05-0124). The radio poles were used for radio communications to Fort Sam Houston in Texas (IT Corporation 05-0149). The exact function of the hutments is unknown; however, they may have housed generators (IT Corporation 05-0149). The disposition of the decommissioned structures is unknown. The SWMU report (LANL 1990, 0145) speculates that the gun mount and remains of two structures are in a "landfill" but provides no basis for the speculation.

6.7.2 Basis for Recommendation of No Further Action

If the gun mount is buried on North Mesa, its exact location is unknown. The best information available indicates that it is not on North Mesa; however, even if it were buried there, the associated uranium would not be in a form that could migrate in the environment, nor would it be biologically available in the event the structure were uncovered.

The disposition of the decommissioned structures associated with radio communications is unknown. However, because no known Laboratory activities occurred at the site, any debris associated with the hutments should not pose a hazard to human health or the environment. Any contamination resulting from the single generator would be minimal. It is therefore recommended that no further action be taken.

6.8 SWMU 0-035(a) (Surface Disposal)

6.8.1 Description and History

On July 12, 1991, during the upgrading of the bridge spanning Los Alamos Canyon, a 55-gal. drum was discovered in the canyon beneath the bridge (Environmental Protection Group 1991, 05-0164). The drum was exposed during grading to level the ground for a large crane. The drum was punctured but did not leak. Analysis of the material in the drum showed it to be a tar made up of several polynuclear aromatic hydrocarbons (Bell 1991, 05-0165).

An electromagnetic survey was conducted over the area, which revealed a section of pipe and roll of cable (Aldrich 1992, 05-0176); however, no additional drums were found (Tiedman 1991, 05-0166).

6.8.2 Basis for Recommendation of No Further Action

Because tar did not leak from the drum and because no other drums were found in the electromagnetic survey, it is recommended that no further action be taken at this site.

6.9 Areas of Concern C-73-001 through C-73-004

Areas of Concern C-73-001 through C-73-004 consist of four black iron fuel tanks.

6.9.1 Description and History

Four fuel tanks, identified in Appendix C of the SWMU report, were located near the southwest corner of the Los Alamos Airport (Figure 3-9). The capacities of the tanks are C-73-001—2,000 gal., C-73-002—6,000 gal., C-73-003—4,000 gal., and C-73-004—6,000 gal. Two of the tanks were installed in 1965, and the other two were installed in 1973. The tanks, owned by a private aviation club, were removed in April-May 1992 and replaced by new double-walled tanks. The land is owned by DOE.

6.9.2 Basis for Recommendation of No Further Action

Because no significant contamination was found when the tanks were removed, it is recommended that no further action be taken at this site.

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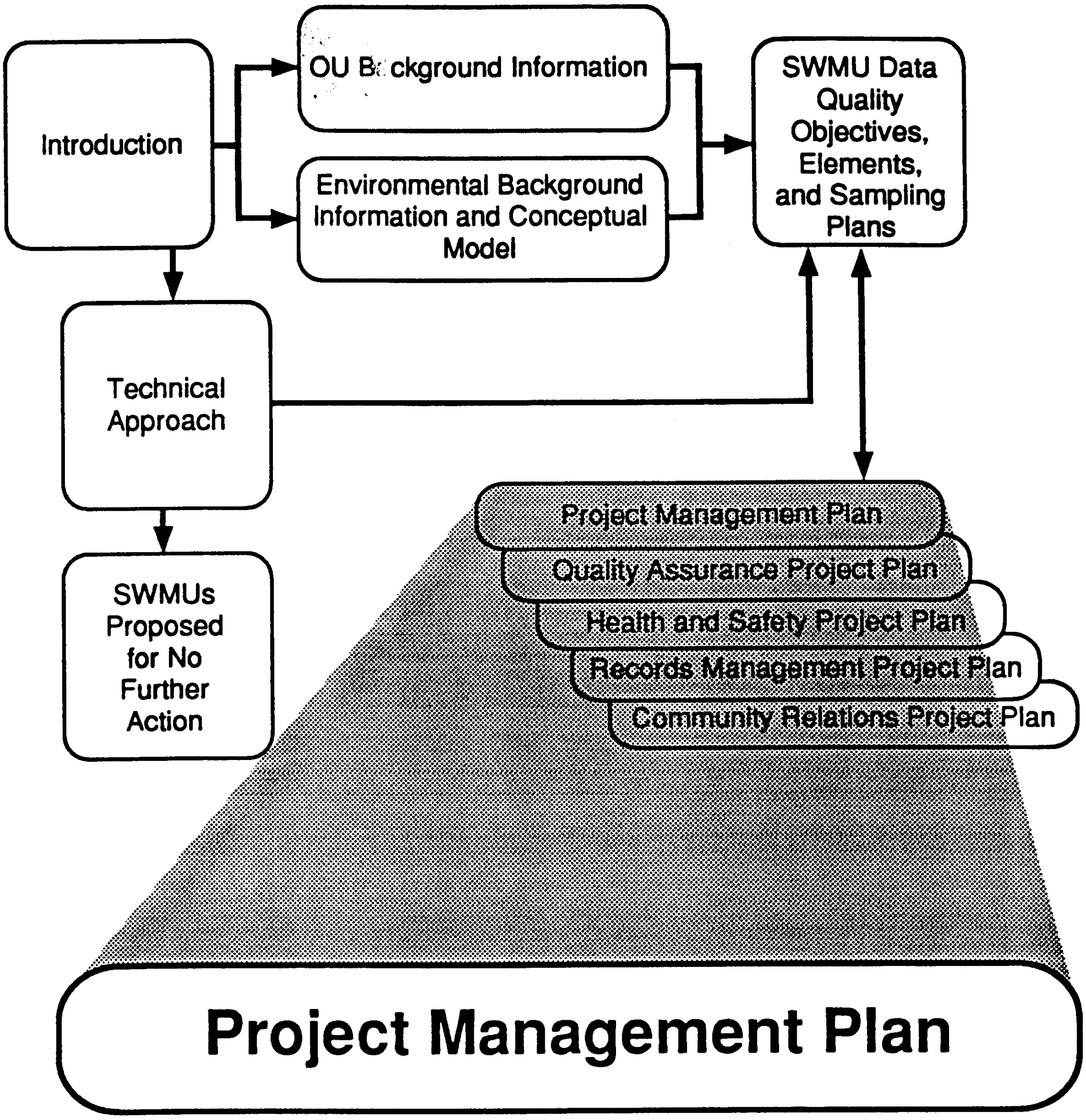
ANNEX I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Project Management Plan

This annex presents the technical approach, schedule, reporting milestones, budget, corrective measures projections, and management structure for the implementation of the Resource Conservation and Recovery Act (RCRA) facility investigation (RFI) for Operable Unit (OU) 1071. This project management plan is an extension of Los Alamos National Laboratory's (the Laboratory's) Program Management Plan described in Annex I of the Installation Work Plan (IWP) (LANL 1991, 0553). This annex discusses the requirements for project management plans set forth in the Hazardous and Solid Waste Amendments (HSWA) Module (Task II, E., p. 39) of the Laboratory's permit to operate under the Resource Conservation and Recovery Act (EPA 1990, 0306) as they apply to OU 1071.

1.0 TECHNICAL APPROACH

The technical approach to the RFI for OU 1071 is described in Chapter 2 of the work plan. This technical approach is based on the Environmental Restoration (ER) Program's overall technical approach to the RFI/ corrective measures study (CMS) process as described in Chapter 3 of the IWP (LANL 1991, 0553). The ER Program's technical approach includes

- identification of the action levels that trigger a CMS,
- sampling approach to site characterization,
- decision analysis and cost-effectiveness studies to support selection of remedial alternatives, and
- application of the observational approach to the RFI/CMS process.

This technical approach provides an efficient, scientifically defensible means of collecting data and generating the analyses that will be used to support the CMS or a recommendation for no further action.

The technical objectives for the OU 1071 work plan include

- determining whether contaminants are present at each SWMU in OU 1071;
- if contaminants are found, defining the lateral and vertical extent of contamination;
- acquiring sufficient data to perform a risk assessment, when necessary; and
- providing sufficient data to plan and perform a CMS or to recommend no further action.

The priorities for OU 1071 field work are based on the land ownership of the SWMUs in OU 1071 and the potential health risks posed by these SWMUs. The highest priority has been assigned to the mortar (ordnance) impact areas (SWMU Aggregate 0-D) because they potentially pose the greatest health risk. The sampling plans have been prioritized as follows:

(1) SWMU Aggregate 0-D, Mortar (Ordnance) Impact Areas,

(2) SWMUs located on privately owned and Native American property,

(3) SWMUs located on Los Alamos or Santa Fe County property,

(4) SWMUs located on National Forest land, and

(5) SWMUs located on Department of Energy (DOE) land.

This sequence allows for SWMUs on land not controlled by DOE to be assessed early in the RFI process.

2.0 SCHEDULE

The schedule for the entire RFI/CMS process at the Laboratory, including that for OU 1071, has been prescribed in the Program Management Plan (Annex I, Table I-3) and the Projected Schedule and Cost for the Corrective Action Process at Los Alamos National Laboratory (Appendix S) in the IWP (LANL 1991, 0553).

A schedule for OU 1071, developed from parametric data, is presented in Figure I-1. Figure I-2 is an improved RFI schedule of the sampling plans that was built entirely from the bottom up and will replace the schedule of Figure I-1 with a change control board action. Almost no field work has been scheduled between November 15 and March 1 because of winter conditions. Turnaround time for analyses is assumed to be 60 days. The activities described in this improved schedule are contingent on DOE and Environmental Protection Agency (EPA) approval of this and subsequent documents required by the HSWA Module. The schedule is also contingent on the availability of necessary funding, other resources, and contractual mechanisms at the appropriate times to complete field work and comply with reporting requirements. Current FY92 funding will cause the principal part of the RFI start to be delayed about 8 months. Interim actions and increased emphasis on SWMUs in and near the townsite have necessitated initiation of field activities in FY92 rather than in FY93 (Figure I-3)

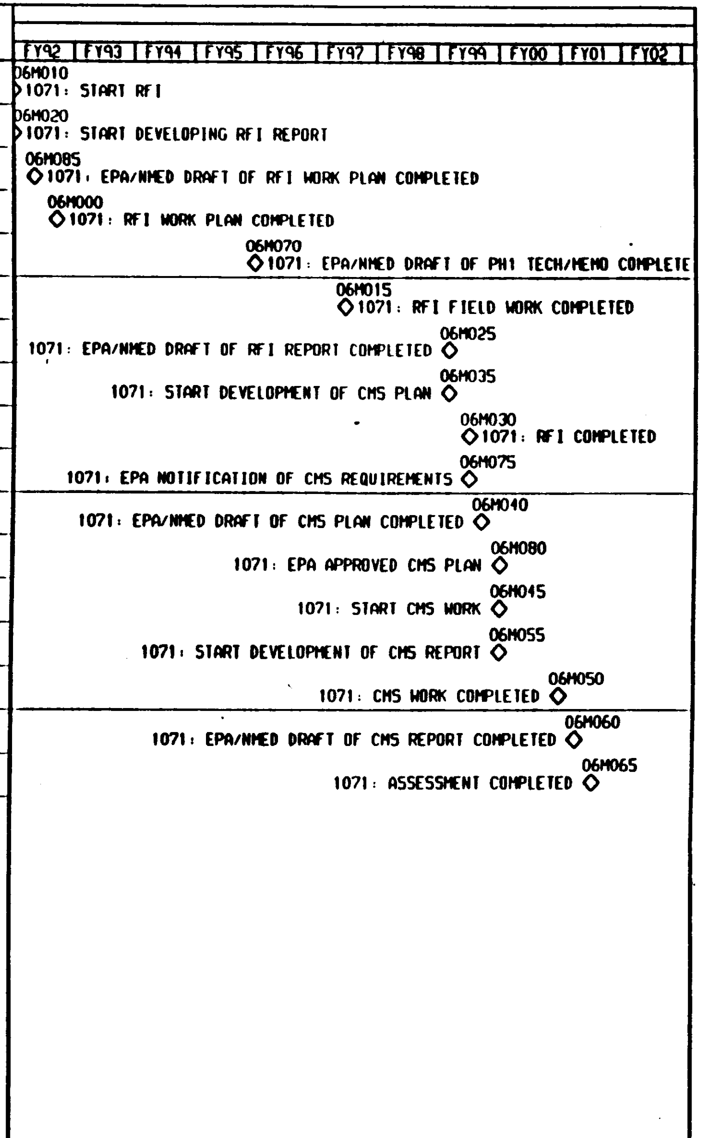
3.0 REPORTS

The results of the OU 1071 RFI field work will be presented in five principal types of documents: monthly progress reports, quarterly technical progress reports, annual reports, RFI phase reports, and the RFI report (Table I-1). Work plan modifications will be included in the appropriate reports, as required.

The progress of the OU 1071 field work will be summarized in quarterly technical progress reports, as required by the HSWA Module (Task V, C, p. 46). The quarterly technical progress reports will provide timely information adequate to allow regulatory agencies to gauge the progress of the RFI, and they will be summarized in an annual report.

An RFI phase report will be submitted for each sampling plan described in Chapter 5. Table I-2 shows the expected submittal dates of these reports based on the detailed schedule (Figure I-2). These documents will serve as the equivalent of RFI

ACTIVITY ID	ACTIVITY DESCRIPTION	EARLY START	EARLY FINISH
06M010	1071: START RFI	1OCT91	
06M020	1071: START DEVELOPING RFI REPORT	1OCT91	
06M085	1071: EPA/NMED DRAFT OF RFI WORK PLAN COMPLETED	4FEB92	
06M000	1071: RFI WORK PLAN COMPLETED	17JUN92	16JUN92
06M070	1071: EPA/NMED DRAFT OF PH1 TECH/MEMO COMPLETED		26SEP95
06M015	1071: RFI FIELD WORK COMPLETED		21MAR97
06M025	1071: EPA/NMED DRAFT OF RFI REPORT COMPLETED		2DEC98
06M035	1071: START DEVELOPMENT OF CMS PLAN	3DEC98	
06M030	1071: RFI COMPLETED		6APR99
06M075	1071: EPA NOTIFICATION OF CMS REQUIREMENTS		6APR99
06M040	1071: EPA/NMED DRAFT OF CMS PLAN COMPLETED		21JUN99
06M080	1071: EPA APPROVED CMS PLAN		13OCT99
06M045	1071: START CMS WORK	14OCT99	
06M055	1071: START DEVELOPMENT OF CMS REPORT	14OCT99	
06M050	1071: CMS WORK COMPLETED		5OCT00
06M060	1071: EPA/NMED DRAFT OF CMS REPORT COMPLETED		12JAN01
06M065	1071: ASSESSMENT COMPLETED		30APR01



LOS ALAMOS NATIONAL LABORATORY
OU-1071
MILESTONE CHART

(c) Primavera Systems, Inc.

Figure I-1. RFI schedule for OU 1071.

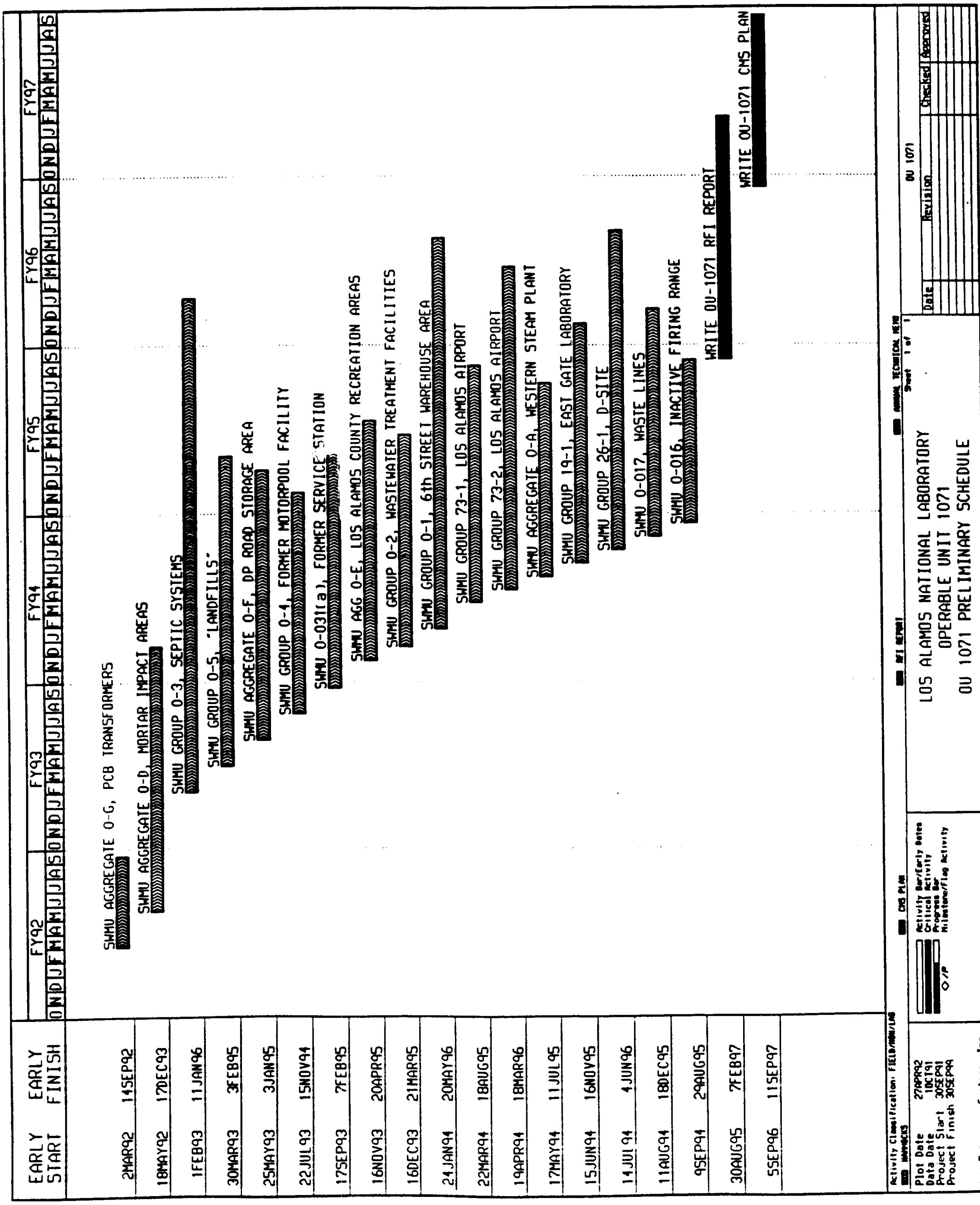


Figure I-2. Improved RFI schedule of sampling plans for OU 1071.

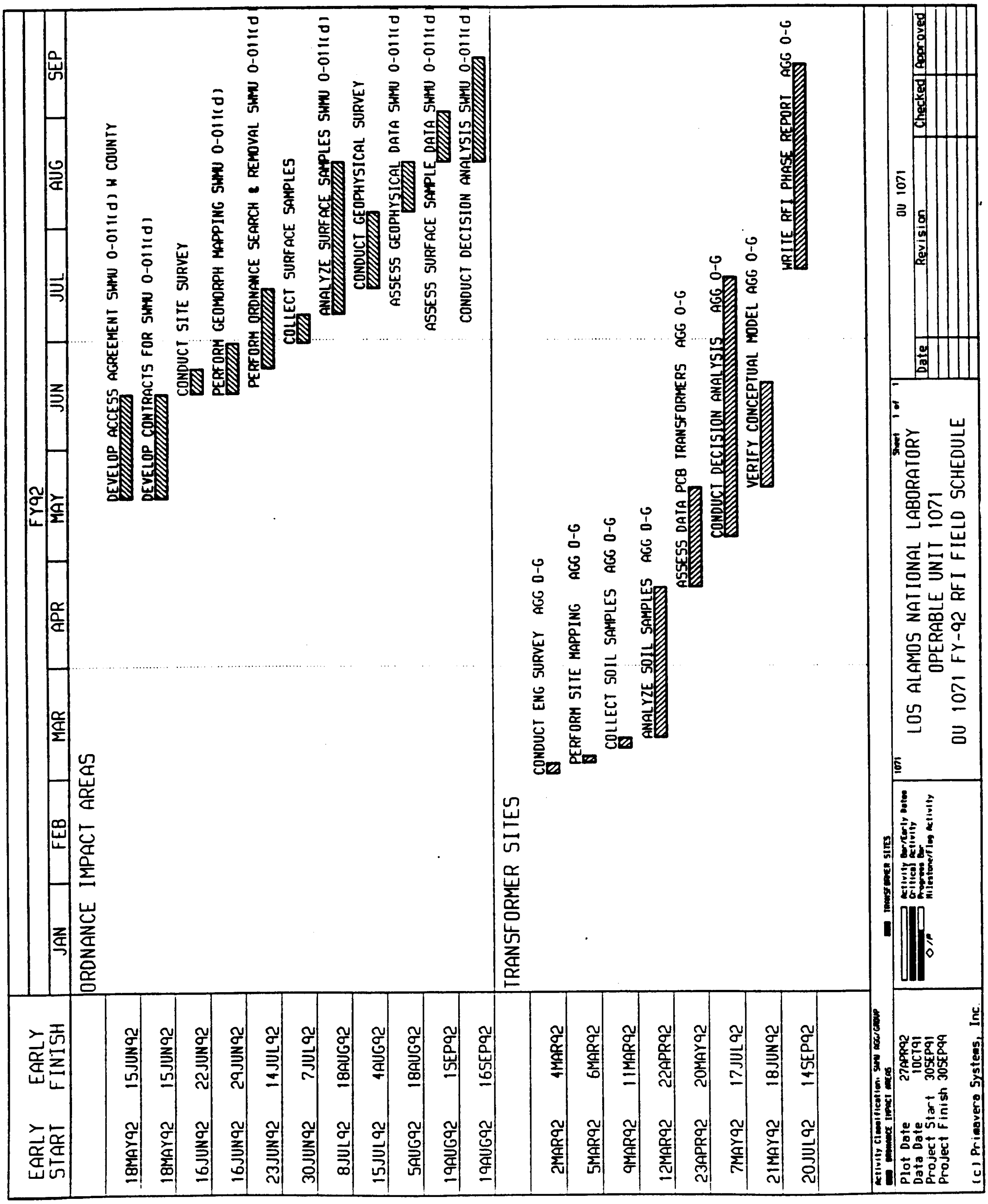


Figure I-3. FY92 RFI field schedule for OU 1071.

TABLE I-1

REPORTING REQUIREMENTS FOR OU 1071

Document	EPA	DOE	Due Date
Monthly	X	X	25th of the following month
Quarterly	X		February 15, May 15, August 15
Annual	X	X	November 15
Phase Reports	X	X	As in baseline; DOE milestones

reports for a sampling plan. In addition, work plans for any additional characterization of SWMUs in OU 1071 may be included in the RFI phase report. These reports will also serve as the means for recommending no further action.

The RFI report will summarize the field work conducted during the RFI investigations described in the work plan for OU 1071. The RFI report will describe the procedures, methods, and results of field investigations and will include information on the type and extent of contamination, sources and migration pathways, and actual and potential receptors. The report will also contain sufficient information to support delisting sites that require no further action or to recommend a CMS.

4.0 BUDGET

Attachment I-1 shows the estimated costs for RFI activities in the baselined parametric estimated cost/schedule. The costs will undoubtedly change when a detailed (bottom up) cost/schedule for the RFI field work replaces the applicable baselined activities and costs.

5.0 CORRECTIVE MEASURES

The parametric estimated schedule for OU 1071 given in Figure I-1 estimates the delivery date of the CMS plan to the EPA as June 1999. The more probable delivery date is in late 1998 based on the detailed schedule (Figure I-2). This date is before the deadline of May 2000 given in the HSWA Module.

Discussion of the CMS at this time is limited because of the current lack of data for most of the SWMUs in OU 1071. Following initial investigation and data analysis, SWMUs in which there is no evidence of significant contaminant release will be proposed for no further action in the appropriate RFI phase report/work plan modification. Corrective measures will be proposed for SWMUs if the RFI characterizations described in this work plan indicate that a significant contaminant release may have occurred.

5.1 Estimated Number of SWMUs in Corrective Measures Study

It is difficult to predict the number of SWMUs that will be considered in the CMS before the RFI data have been collected. Based on current data, the CMS may

TABLE I-2

RFI PHASE REPORTS

Subject of RFI Phase Reports	Draft Due	Chapter in RFI Work Plan	SWMU/AOC	Comments
1. SWMU Aggregate 0-G PCB Transformers (3 SWMUs)	9/92	5.9	0-029(a) 0-029(b) 0-029(c)	Los Alamos Canyon Well #5 Los Alamos Canyon Well #4 Guaje Canyon Well #1
2. SWMU Aggregate 0-D Mortar Impact Areas (4SWMUs, 1 AOC)	12/93	5.3	0-011(a-d) C-0-020	Mortar Impact Area Mortar Impact Area (AOC)
3. SWMU Group 0-4 Former Motorpool Facility (2 SWMUs)	11/94	5.12	0-031(b) 0-032	Former Service Station Former Zia Motorpool Facility
4. SWMU Aggregate 0-F DP Road Storage Area	1/95	5.7	0-027 0-030(a)	DP Road Storage Area Septic System
5. SWMU 0-031(a) Soil Contamination Beneath Former Service Station (1SWMU)	2/95	5.11	0-031(a)	Former Service Station, Trinity and 4th Streets
6. SWMU Group 0-5 "Landfills" (2 SWMUs)	2/95	5.13	0-034(a) 0-034(b)	"Landfill" "Landfill"
7. SWMU Group 0-2 Wastewater Treatment Plants (3 SWMUs)	3/95	5.6	0-018(a) 0-018(b) 0-019	Pueblo Canyon Wastewater Treatment Plant Bayo Canyon Wastewater Treatment Plant Central Wastewater Treatment Plant

TABLE I-2. (continued)

Subject of Phase Reports	Draft Due	Chapter in RFI Work Plan	SWMU/AOC	Comments
8. SWMU Aggregate 0-E Los Alamos Recreation Areas (2 SWMUs)	4/95	5.8	0-028(a) 0-028(b)	Los Alamos County Golf Course North Mesa Athletic Fields
9. SWMU Aggregate 0-A Western Steam Plant (2 SWMUs)	7/95	5.1	0-003 0-012	Decommissioned Container Storage Area Western Steam Plant
10. SWMU 0-016 Inactive Firing Range (1 SWMU)	8/95	5.4	0-016	Inactive Firing Range
11. SWMU Group 73-1 Los Alamos Airport (4 SWMUs)	8/95	5.16	73-001(a) 73-001(b) 73-001(d) 73-004(d)	Landfill Landfill: Waste Oil Pit Landfill Inactive Septic System
12. SWMU Group 19-1 East Gate Laboratory (3 SWMUs, 1 AOC)	11/95	5.14	19-001 19-002 19-003 C-19-001	Septic System Surface Disposal Drainline and Outfall Potential Soil Contamination Beneath Former Buildings
13. SWMU 0-017 Waste Lines (1 SWMU)	12/95	5.5	0-017	Waste Lines

TABLE I-2. (concluded)

Subject of Phase Reports	Draft Due	Chapter in RFI Work Plan	SWMU/AOC	Comments
14. SWMU Group 0-3 Septic Systems (13 SWMUs)	1/96	5.10	0-030(c-k, n-q)	Septic System
15. SWMU Group 73-2 Los Alamos Airport (5 SWMUs)	3/96	5.17	73-001(c) 73-002 73-003 73-004(a-c) 73-005 73-006	Landfill: Airport Bunker Debris Airport Incinerator/Surface Disposal Garbage Truck and Can Cleaning Inactive Septic Systems Surface Disposal Airport Building Outfalls
16. SWMU Group 0-1 6th Street Warehouse Area (6 SWMUs)	5/96	5.2	0-004 0-010(b) 0-030(b, l ,m) 0-033	Container Storage Area "Landfill" Septic Systems Soil Contamination Beneath Former Zia Warehouses
17. SWMU Group 26-1 D-Site (4 SWMUs)	6/96	5.15	26-001 26-002(a, b) 26-003	Cayonside Disposal Area Sump Systems Septic System
18. OU 1071 RFI Report	1/97		61 SWMUs	
19. OU 1071 CMS Plan	9/97		15 SWMUs	

The number of SWMUs in the CMS is estimated based on currently available information.

include one or more of the 15 SWMUs listed in Table I-3 or, possibly but very unlikely, some other SWMUs not listed.

TABLE I-3

SWMUs THAT MAY BE INCLUDED IN THE CMS

SWMU Number	SWMU Title
0-031(a and b)	Soil Contamination Beneath Former Service Stations
0-032	Soil Contamination Under Former Motorpool Facility
0-027	DP Road Storage Area
0-017	Waste Lines
0-034(a and b)	"Landfills"
0-019	Decommissioned Wastewater Treatment Plant
0-010(b)	"Landfill"
73-001(a, b, and d)	Landfills
26-001	Canyonside Disposal Area
26-002(a and b)	Sump Systems

5.2 Interim Remedial Measures

Before a CMS is prepared for OU 1071, the Laboratory may choose to implement interim remedial measures.

6.0 SAMPLE ANALYSIS

Table I-4 lists the estimated number and types of analyses during Phase I of the field investigations. The total number of analyses to be collected is 1265-1425.

7.0 ORGANIZATION AND RESPONSIBILITIES OF PROJECT MANAGEMENT

The management structure for the ER Program at the Laboratory is described in Section 2 of the quality Program Plan (QPP) (Annex II, IWP) (LANL 1991, 0553). This section describes the management organization for the OU 1071 RFI. The positions and major responsibilities are described in the following subsections.

7.1 Project Leader

The responsibilities of the OU project leader (OUPL) for OU 1071 include oversight of RFI operations at OU 1071, including preparation of this work plan, field work, reporting, and RFI-related administrative activities. The OUPL will oversee the preparation of quarterly technical progress reports, supervise Laboratory staff and contractors assigned to OU 1071, coordinate with technical team leaders (TTLs), and provide technical oversight for the RFI process. The OUPL ensures compliance with appropriate ER Program, Laboratory, state, and federal regulatory policies and procedures, including Laboratory and ER Program quality assurance health and safety, records management, and community relations requirements. Dr. M. J. Aldrich (EES-1) is the OUPL for OU 1071.

TABLE I-4

ESTIMATED NUMBER OF SAMPLES BY ANALYSIS FOR PHASE I INVESTIGATION AT OU 1071

ANALYSIS	Total	Soil	Water	Sludge	Wipe	Vapor
Gamma Spectrometry	560-610	499-549	0	48	13	0
Tritium	116-128	113-125	0	3	0	0
Total Uranium	332-349	313-325	0-5	19	0	0
Isotopic Plutonium	277-281	258	0-5	19	0	0
Strontium/Ytrium 90	83-88	83	0-5	0	0	0
Americium-241	277-281	258	0-5	19	0	0
Volatile Organics (EPA 8240)	496-579	455-533	0-5	35	0	6
Benzene, Toluene, Ethylbenzene, Xylenes (EPA 8020)	79-115	79-115	0	0	0	0
Semivolatile Organics (EPA 8270)	539-623	494-573	0-5	45	0	0
Total Petroleum Hydrocarbons	104-144	104-144	0	0	0	0
TAL Metals	538-589	490-536	0-5	48	0	0
TCLP Metals	99-102	95-98	0	4	0	0
PCB s and Organochlorine Pesticides (EPA 8080)	532-589	488-540	0-5	44	0	0
HE (explosive materials)	69	69	0	0	0	0
Lead and Chromium	50-86	50-86	0	0	0	0

Twenty-five percent was added to characterization samples described in the work plan in order to estimate additoinal samples for QA/QC.
Gamma spectrometry includes cesium-137 and cobalt-60.
Fractional samples were rounded to the nearest whole number.

7.2 Technical Team Members

The primary disciplines currently represented by the technical team are geology, geochemistry, hydrogeology, statistics, soils science, geomorphology, risk assessment, and decision analysis. The technical team is responsible for providing technical information and advice throughout the RFI/CMS process. They have participated in the development of this work plan and will participate in the field work, data analysis, report preparation, work plan modifications, and planning of subsequent investigations. The composition of the technical team may change as the RFI/CMS progress.

7.3 Field Foreman and Field Team Leaders for OU 1071

The field foreman for OU 1071 schedules and plans RFI field work and oversees field investigations for OU 1071. Field team leaders will direct field activities under the supervision of the field foreman. These personnel will be assigned as the RFI progresses.

7.4 Field Team Members

The field teams will consist of individuals representing numerous disciplines as indicated by the nature and extent of a given field investigation. Field team members may include sampling personnel, geologists, hydrologists, geophysicists, geochemists, soil scientists, geomorphologists, and health physicists. All field teams will include a site safety officer. Field teams are responsible for conducting OU 1071 field work under the direction of the field team leader.

References for Annex I

EPA (US Environmental Protection Agency), April 10,1990. RCRA Permit No. NM0890010515, EPA Region VI, issued to Los Alamos National Laboratory, Los Alamos, New Mexico, effective May 23, 1990, (EPA 1990, 0306)

LANL (Los Alamos National Laboratory), November 1991. "Installation Work Plan for Environmental Restoration," Revision 1, Los Alamos National Laboratory Report LA-UR-91-3310, Los Alamos, New Mexico. (LANL 1991, 0553)

ATTACHMENT I

ESTIMATED COSTS FOR RFI ACTIVITIES IN THE BASELINED PARAMETRIC ESTIMATED COST/SCHEDULE

LANL - JIM ALDRICH FINEST HOUR ADS 1071: TA-0, 19, 26, 73, 74

REPORT DATE 18FEB92 RUN NO. 139 ENVIRONMENTAL RESTORATION STA T DATE 1OCT91 FIN DATE 30APR01
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CLASSIC SCHEDULE REPORT - SORT BY ES, TF DAT DATE 1OCT91 PAGE NO. 1

ACTIVITY ID	ORIG DUR	REM DUR	%	ACTIVITY DESCRIPTION	BUDGET	EARNED	SCHEDULED START	SCHEDULED FINISH
060000	22	22	0	1071:DOE/LANL/VE Review Internal Draft RFI WP	.00	.00	1OCT91	31OCT91
060005	20	20	0	1071: Revise Internal Dft RFI WP & Dev. DOE Dft	225018.00	.00	1NOV91	3DEC91
060010	10	10	0	1071: DOE Review DOE Draft RFI WP	32040.00	.00	4DEC91	17DEC91
060015	30	30	0	1071: Revise DOE Dft RFI WP & Dev EPA/NMED Dft	142800.00	.00	18DEC91	3FEB92
060020	44	44	0	1071: Regulatory Review Draft RFI Work Plan	.00	.00	4FEB92	6APR92
060025	40	40	0	1071: Incorporate EPA/NMED Comments	127901.00	.00	7APR92	2JUN92
060035	250	250	0	1071: Manage ADS During FY-92 (LOE)	229778.00	.00	1OCT91	30SEP92
060040	249	249	0	1071: Manage ADS During FY-93 (LOE)	87278.48	.00	1OCT92	30SEP93
060045	246	246	0	1071: Manage ADS During FY-94 (LOE)	149048.00	.00	1OCT93	26SEP94
060050	244	244	0	1071: Manage ADS During FY-95 (LOE)	157117.35	.00	27SEP94	20SEP95
060055	246	246	0	1071: Manage ADS During FY-96 (LOE)	165655.93	.00	21SEP95	16SEP96

LANL - JIM ALDRICH   FINEST HOUR   ADS 1071: TA-0, 19, 26, 73, 74

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ACTIVITY ID	ORIG DUR	REM DUR	%	ACTIVITY DESCRIPTION / BUDGET	EARNED	SCHEDULED START	SCHEDULED FINISH
060060	245	245	0	1071: Manage ADS During FY-97 (LOE)		17SEP96	10SEP97
				174646.46	.00		
060065	245	245	0	1071: Manage ADS During FY-98 (LOE)		11SEP97	3SEP98
				175018.56	.00		
060070	245	245	0	1071: Manage ADS During FY-99 (LOE)		4SEP98	30AUG99
				175018.56	.00		
060075	155	155	0	Manage ADS During FY-2000		31AUG99	17APR00
				.00	.00		
060100	327	327	0	1071: Conduct RFI PH1 Field Work		16AUG93	7DEC94
				1476921.13	.00		
060105	357	357	0	1071: Conduct RFI PH1 Sample Analysis		16AUG93*	25JAN95
				18264960.00	.00		
060110	367	367	0	1071: Conduct RFI PH1 Data Assessment		12JAN94	30JUN95
				171723.11	.00		
060115	60	60	0	1071: Write Draft RFI PH1 Report/WP Modification		3JUL95	26SEP95
				107915.06	.00		
060120	20	20	0	1071: Demobilize RFI PH1 Field Work		8DEC94	10JAN95
				8212.00	.00		
060125	22	22	0	1071: EPA/NMED Rev PH1 Tech Memo/WP Modification		27SEP95	27OCT95
				14070.74	.00		
060130	22	22	0	1071: DOE/LANL Review PH1 Report/Wp Modification		27SEP95	27OCT95
				14070.74	.00		

LANL - JIM ALDRICH FINEST HOUR ADS 1071: TA-0, 19, 26, 73, 74

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CLASSIC SCHEDULE REPORT - SORT BY ES, TF DATA DATE 1OCT91 PAGE NO. 3

ACTIVITY ID	ORIG DUR	REM DUR	%	ACTIVITY DESCRIPTION	BUDGET	EARNED	SCHEDULED START	SCHEDULED FINISH
060131	20	20	0	1071: DOE/LANL Revise Draft RFI PH1 Report	.00	.00	27SEP95	25OCT95
060135	20	20	0	1071: Write PH2 Contract; Mobilize for RFI	8212.00	.00	27SEP95	25OCT95
060140	327	327	0	1071: Conduct RFI PH2 Field Work	1838135.81	.00	26OCT95	21FEB97
060145	357	357	0	1071: Conduct RFI PH2 Sample Analysis	21914553.00	.00	26OCT95	4APR97
060150	20	20	0	1071: Demobilize RFI PH2 Field Work	8212.00	.00	24FEB97	21MAR97
060155	367	367	0	1071: Conduct RFI PH2 Data Assessment	278586.50	.00	26OCT95	18APR97
060215	100	100	0	1071: Conduct RFI Report Facility Investigation	174477.31	.00	21APR97	10SEP97
060220	110	110	0	1071: Conduct RFI Report Investigation Analysis	723197.49	.00	21APR97	24SEP97
060225	100	100	0	1071: Prepare NEP/Environmental Information	103676.66	.00	30APR93*	21SEP93
060235	132	132	0	1071: Prepare Internal Draft of RFI Report	951928.18	.00	25SEP97	9APR98
060240	20	20	0	1071: LANL/VE Review Internal Draft of RFI Rpt	29929.35	.00	10APR98	7MAY98

LANL - JIM ALDRICH | FINEST HOUR | ADS 1071: TA-0, 19, 26, 73, 74

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ACTIVITY ID	ORIG DUR	REM DUR	%	ACTIVITY DESCRIPTION	BUDGET	EARNED	SCHEDULED START	SCHEDULED FINISH
060245	40	40	0	1071:Incorp.LANL Rev.Comments Intern Dft RFI Rpt	2866[illegible].89	.00	8MAY98	6JUL98
060250	20	20	0	1071: Publish DOE Draft of RFI Report	129[illegible].06	.00	7JUL98	3AUG98
060255	22	22	0	1071: Conduct Review of DO[illegible] Draft of RFI Report	1210[illegible].56	.00	4AUG98	2SEP98
060260	40	40	0	1071:Incorp. [illegible]E Rev. Com[illegible]nts DOE Dft RFI Rpt	12100.56	.00	3SEP98	30OCT98
060265	20	20	0	1071: Publish EPA/N[illegible]D Draft of RFI Report	1299.06	.00	2NOV98	2DEC98
060270	44	44	0	1071: Conduct EPA Review of RFI Report	12713.47	.00	3D[illegible]C98	8FEB99
060275	44	44	0	1071: Conduct NMED Review of RFI Report	12713.47	.00	3D[illegible]C98	8FEB99
060280	245	245	0	1071:Conduct Bench/Pilot Studies for CMS Pl(LOE)	.00	.00	3D[illegible]C98	24NOV99
060285	35	35	0	1071: Establish Current Situation for CMS Plan	6395.98	.00	3D[illegible]C98	26JAN99
060290	35	35	0	1071: Establish CA Objectives for CMS Plan	10073.60	.00	3D[illegible]C98	26JAN99
060295	35	35	0	1071: Develop Screening Technologies for CMS Pl	8941.81	.00	3D[illegible]C98	26JAN99

LANL - JIM ALDRICH FINEST HOUR ADS 1071: TA-0, 19, 26, 73, 74

REPORT DATE 18FEB92 RUN NO. 139 ENVIRONMENTAL RESTORATION START DATE 1OCT91 FIN DATE 30APR0
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CLASSIC SCHEDULE REPORT - SORT BY ES, TF DATA DATE 1OCT91 PAGE NO. 5

ACTIVITY ID	ORIG DUR	REM DUR	%	ACTIVITY DESCRIPTION	BUDGET	EARNED	SCHEDULED START	SCHEDULED FINISH
060300	245	245	0	1071: Develop NEPA Documentation for CMS Plan	5802.69	.00	3DEC98	24NOV99
060305	15	15	0	1071: Develop Alternatives for CMS Plan	8941.81	.00	27JAN99	17FEB99
060310	10	10	0	1071: Develop Internal Draft of CMS Plan	21885.50	.00	18FEB99	3MAR99
060315	10	10	0	1071: LANL/VE Review Internal Draft of CMS Pl	577.65	.00	4MAR99	17MAR99
060320	10	10	0	1071:Incorp. LANL REV Comments Intern Dft CMS Pl	577.65	.00	18MAR99	31MAR99
060325	5	5	0	1071: Publish DOE Draft of CMS Plan	1299.06	.00	1APR99	7APR99
060330	22	22	0	1071: Conduct Review of DOE Draft of CMS Plan	176.43	.00	8APR99	7MAY99
060335	20	20	0	1071:Incorp. DOE Rev.Comments DOE Dft of CMS Pl	176.43	.00	10MAY99	7JUN99
060340	10	10	0	1071: Publish EPA/NMED Draft of CMS Plan	1299.06	.00	8JUN99	21JUN99
060345	44	44	0	1071: Conduct EPA Review of CMS Plan	176.43	.00	22JUN99	23AUG99
060350	44	44	0	1071: Conduct NMED Review of CMS Plan	176.43	.00	22JUN99	23AUG99

LANL - JIM ALDRICH FINEST HOUR ADS 1071: TA-0, 19, 26, 73, 74

REPORT DATE 18FEB92 RUN NO. 139 ENVIRONMENTAL RESTORATION START DATE 1OCT91 FIN DATE 30APR0
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CLASSIC SCHEDULE REPORT - SORT BY ES, TF DATA DATE 1OCT91 PAGE NO. 6

ACTIVITY ID	ORIG DUR	REM DUR	%	ACTIVITY DESCRIPTION / BUDGET	EARNED	SCHEDULED START	SCHEDULED FINISH
060355	245	245	0	1071: Conduct CMS Bench/Pilot Studies (LOE)		14OCT99	5OCT00
				1346320.00	.00		
060360	30	30	0	1071: Conduct Technical Evaluation for CMS Rpt		14OCT99	29NOV99
				47377.67	.00		
060365	30	30	0	1071: Conduct Environmental Eval for CMS Report		14OCT99	29NOV99
				46230.63	.00		
060370	30	30	0	1071: Conduct Human Health Eval for CMS Report		14OCT99	29NOV99
				43922.12	.00		
060375	30	30	0	1071: Conduct Community Relations Eval. CMS Rpt		14OCT99	29NOV99
				40883.39	.00		
060380	30	30	0	1071: Conduct Cost Evaluation for CMS Report		14OCT99	29NOV99
				42941.59	.00		
060385	30	30	0	1071: Develop NEPA Documentation for CMS Report		14OCT99	29NOV99
				84783.70	.00		
060390	10	10	0	1071: Prepare Internal Draft of CMS Report		30NOV99	13DEC99
				27297.13	.00		
060395	10	10	0	1071: LANL/VE Review Internal Draft of CMS Rpt		14DEC99	29DEC99
				1565.66	.00		
060400	35	35	0	1071:Incorp.LANL Rev Comments Intern.Dft CMS Rpt		17AUG00	5OCT00
				1565.66	.00		
060405	10	10	0	1071: Publish DOE Draft of CMS Report		6OCT00	20OCT00
				1299.06	.00		

LANL - JIM ALDRICH | FINEST HOUR | ADS 1071: TA-0, 19, 26, 73, 74

REPORT DATE 18FEB92 RUN NO. 139 | ENVIRONMENTAL RESTORATION | START DATE 1OCT91 FIN DATE 30APR01
10:56

CLASSIC SCHEDULE REPORT - SORT BY ES, TF | DATA DATE 1OCT91 PAGE NO. 7

ACTIVITY ID	ORIG DUR	REM DUR	%	ACTIVITY DESCRIPTION	BUDGET	EARNED	SCHEDULED START	SCHEDULED FINISH
060410	22	22	0	1071: Conduct Review of DOE Draft of CMS Report	866.47	.00	23OCT00	22NOV00
060415	22	22	0	1071:Incorp. DOE Rev Comments DOE Dft CMS Report	866.47	.00	27NOV00	28DEC00
060420	10	10	0	1071: Publish EPA/NMED Draft of CMS Report	1299.06	.00	29DEC00	12JAN01
060425	44	44	0	1071: Conduct EPA Review of CMS Report	866.47	.00	16JAN01	19MAR01
060430	44	44	0	1071: Conduct NMED Review of CMS Report	866.47	.00	16JAN01	19MAR01
060435	245	245	0	1071: Assmt - Conduct VCA (LOE)	.00	.00	1FEB93	24JAN94
060456	22	22*	0	1071: Develop Detailed Field Schedule	55350.00	.00	2JAN92*	3FEB92
060457	32	32	0	1071: Develop General Schedule	94400.00	.00	15OCT91*	2DEC91
060470	62	62	0	1071: Prepare for Field Work	742807.88	.00	8SEP92*	8DEC92
060475	63	63	0	1071: Write PH1 Contract, Mobilize for RFI	121172.00	.00	1FEB93*	29APR93
060485	10	10	0	1071: Issue Final RFI Work Plan	994.00	.00	3JUN92	16JUN92

LANL - JIM ALDRICH FINEST HOUR ADS 1071: TA-0, 19, 26, 73, 74

REPORT DATE 18FEB92 RUN NO. 139 ENVIRONMENTAL RESTORATION START DATE 1OCT91 FIN DATE 30APR01
10:56

CLASSIC SCHEDULE REPORT - SORT BY ES, TF DATA DATE 1OCT91 PAGE NO. 8

ACTIVITY ID	ORIG DUR	REM DUR	%	ACTIVITY DESCRIPTION	BUDGET	EARNED	SCHEDULED START	SCHEDULED FINISH
060495	20	20	0	1071: Incorporate EPA/NMED Comments on RFI Rpt	3054.23	.00	9FEB99	9MAR99
060500	20	20	0	1071: Publish Final RFI Report	1299.06	.00	10MAR99	6APR99
060505	20	20	0	1071: Incorporate EPA/NMED Comments on CMS Plan	176.43	.00	24AUG99	21SEP99
060510	10	10	0	1071: Publish Final CMS Plan	1299.06	.00	22SEP99	5OCT99
060515	5	5	0	1071: EPA Approves CMS Plan	1410.14	.00	6OCT99	13OCT99
060520	20	20	0	1071: Incorporate EPA/NMED Comments on CMS Rpt	866.47	.00	20MAR01	16APR01
060530	10	10	0	1071: Publish Final CMS Report	1299.06	.00	17APR01	30APR01
065010	248	248	0	1071: Conduct VCA (LOE) - FY 93	100000.00	.00	1OCT92*	29SEP93
065015	248	248	0	1071: Conduct VCA (LOE) - FY 94	100000.00	.00	1OCT93*	28SEP94
065020	248	248	0	1071: Conduct VCA (LOE) - FY 95	100000.00	.00	3OCT94*	2OCT95
065025	248	248	0	1071: Conduct VCA (LOE) - FY 96	100000.00	.00	3OCT95*	30SEP96

LANL - JIM ALDRICH FINEST HOUR ADS 1071: TA-0, 19, 26, 73, 74

REPORT DATE 18FEB92 RUN NO. 139 ENVIRONMENTAL RESTORATION START DATE 1OCT91 FIN DATE 30APR01
10:56

CLASSIC SCHEDULE REPORT - SORT BY ES, TF DATA DATE 1OCT91 PAGE NO. 9

ACTIVITY ID	ORIG DUR	REM DUR	%	ACTIVITY DESCRIPTION	BUDGET	EARNED	SCHEDULED START	SCHEDULED FINISH
510000	187	187	0	1071: Conduct VCA (LOE) - FY 97	98017.00	.00	1OCT96*	2JUL97
510005	245	245	0	1071: Conduct VCA (LOE) - FY 98	131900.00	.00	1OCT97*	24SEP98
06N000	0	0	0	1071: RFI WORK PLAN COMPLETED	.00	.00	17JUN92	16JUN92
06N010	0	0	0	1071: START RFI	.00	.00	1OCT91	
06N015	0	0	0	1071: RFI FIELD WORK COMPLETED	.00	.00		21MAR97
06N020	0	0	0	1071: START DEVELOPING RFI REPORT	.00	.00	1OCT91	
06N025	0	0	0	1071: EPA/NMED DRAFT OF RFI REPORT COMPLETED	.00	.00		2DEC98
06N030	0	0	0	1071: RFI COMPLETED	.00	.00		6APR99
06N035	0	0	0	1071: START DEVELOPMENT OF CMS PLAN	.00	.00	3DEC98	
06N040	0	0	0	1071: EPA/NMED DRAFT OF CMS PLAN COMPLETED	.00	.00		21JUN99
06N045	0	0	0	1071: START CMS WORK	.00	.00	14OCT99	

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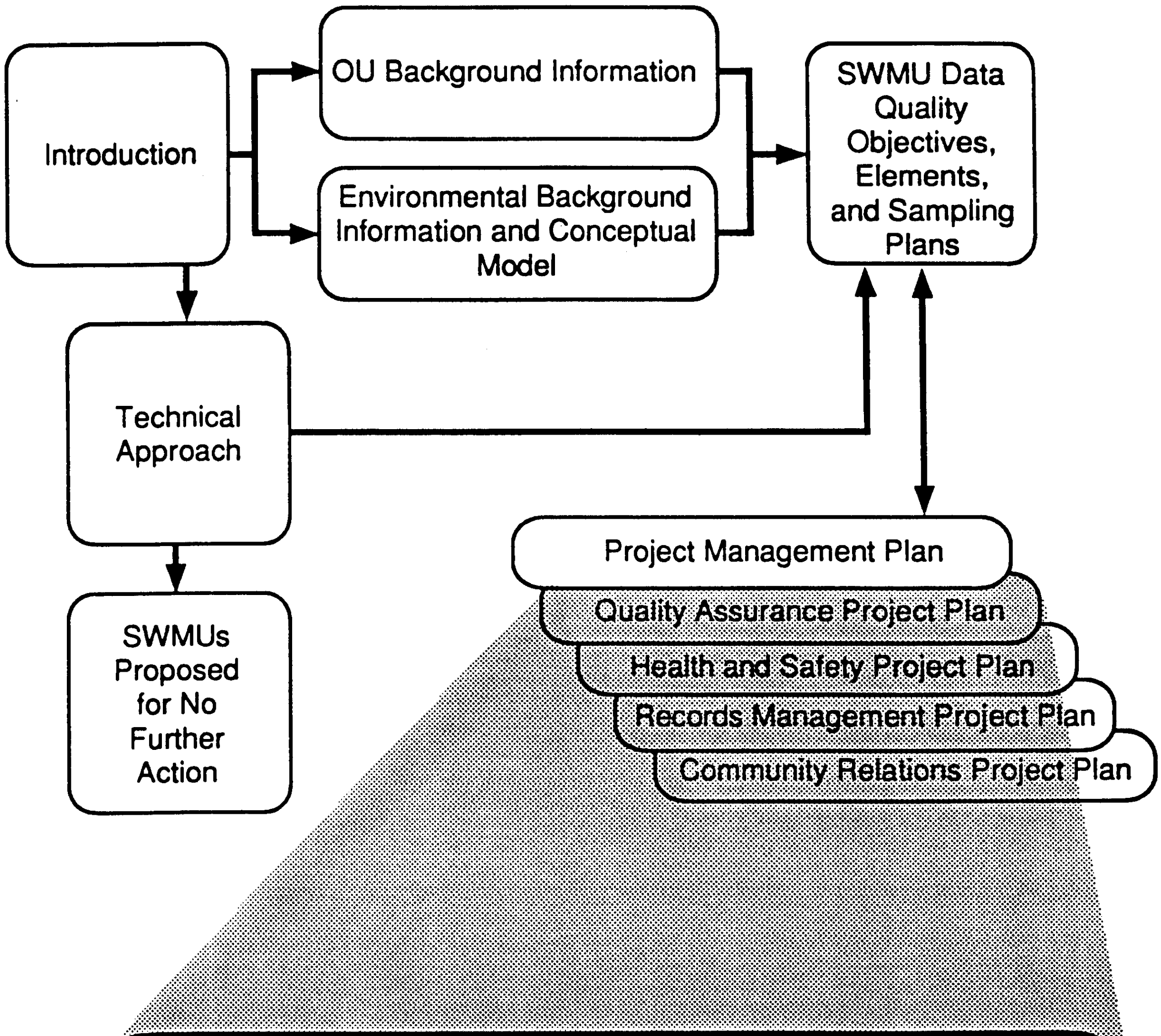
REPORT DATE 18FEB92 RUN NO. 139 10:56 | ENVIRONMENTAL RESTORATION | START DATE 1OCT91 FIN DATE 30APR01

CLASSIC SCHEDULE REPORT - SORT BY ES, TF | DATA DATE 1OCT91 PAGE NO. 10

ACTIVITY ID	ORIG DUR	REM DUR	%	ACTIVITY DESCRIPTION	BUDGET	EARNED	SCHEDULED START	SCHEDULED FINISH
06N050	0	0	0	1071: CMS WORK COMPLETED	.00	.00		5OCT00
06N055	0	0	0	1071: START DEVELOPMENT OF CMS REPORT	.00	.00	14OCT99	
06N060	0	0	0	1071: EPA/NMED DRAFT OF CMS REPORT COMPLETED	.00	.00		12JAN01
06N065	0	0	0	1071: ASSESSMENT COMPLETED	.00	.00		30APR01
06N070	0	0	0	1071: EPA/NMED DRAFT OF PH1 TECH/MEMO COMPLETED	.00	.00		26SEP95
06N075	0	0	0	1071: EPA NOTIFICATION OF CMS REQUIREMENTS	.00	.00		6APR99
06N080	0	0	0	1071: EPA APPROVED CMS PLAN	.00	.00		13OCT99
06N085	0	0	0	1071: EPA/NMED DRAFT OF RFI WORK PLAN COMPLETED	.00	.00	4FEB92	
REPORT TOTAL					51419691.90	.00		

$ X 1000	
EST TO COMPLETION	$51,420
ESCALATION	$459
PRIOR YEARS	$1,028
TOTAL AT COMPLETION	$52,907

ANNEX II



Quality Assurance Project Plan

1.0 SIGNATURE PAGE

Approval for Implementation

1. NAME: Robert Vocke
   TITLE: ER Program Manager, Los Alamos National Laboratory

SIGNATURE: ______________________ DATE: __________

2. NAME: Karen F. Warthen
   TITLE: Quality Program Project Leader, ER Program, Los Alamos National Laboratory

SIGNATURE: ______________________ DATE: __________

3. NAME: Craig Leasure
   TITLE: Group Leader, Health and Environmental Chemistry Group (EM-9), Los Alamos National Laboratory

SIGNATURE: ______________________ DATE: __________

4. NAME: Margaret Gautier
   TITLE: Quality Assurance Officer, Health and Environmental Chemistry Group (EM-9), Los Alamos National Laboratory

SIGNATURE: ______________________ DATE: __________

5. NAME: M. J. Aldrich
   TITLE: Project Leader, Earth and Environmental Sciences (EES-1), Los Alamos National Laboratory

SIGNATURE: ______________________ DATE: __________

6. NAME: Charles Ritchey
   TITLE: Acting Chief of Office of Quality Assurance, Region VI, Environmental Protection Agency

SIGNATURE: ______________________ DATE: __________

2.0 CONTENTS AND LIST OF ACRONYMS

LIST OF ACRONYMS

ASME	American Society of Mechanical Engineers
DOE	US Department of Energy
DQO	Data quality objective
EPA	US Environmental Protection Agency
ER	Environmental Restoration (Group)
IWP	Installation work plan
LANL	Los Alamos National Laboratory
OU	Operable unit
QA	Quality assurance
QAPjP	Quality assurance project plan
RCRA	Resource Conservation and Recovery Act
RFI	RCRA facility investigation
SOP	Standard operating procedure
SWMU	Solid waste management unit

3.0 PROJECT DESCRIPTION

3.1 Introduction

This Quality Assurance Project Plan (QAPjP) for Operable Unit (OU) 1071 supplements the Los Alamos National Laboratory (Laboratory) Environmental Restoration (ER) Program's Quality Assurance Program Plan [Annex II of the Installation Work Plan for Environmental Restoration (IWP)] (LANL 1991, 0553) as specified in the ER Program's generic QAPjP (Appendix T of the IWP). Sections of this QAPjP for OU 1071 are incorporated by reference to the generic QAPjP and to the Resource Conservation and Recovery Act (RCRA) field investigation (RFI) work plan for OU 1071. In these cases, the appropriate document and section are given. The text in this QAPjP provides information specific to OU 1071, as directed by the generic QAPjP. To facilitate cross-referencing, the section titles and numbers in this QAPjP correspond directly to those contained in the generic QAPjP.

This QAPjP integrates the Environmental Protection Agency's (EPA's) guidance on preparing quality assurance (QA) plans (EPA 1980, 0552), as well as the American Society of Mechanical Engineers (ASME) Quality Assurance Program Requirements for Nuclear Facilities (ANSI/ASME 1989, 0018), as specified in Department of Energy (DOE) Order 5700.6B (DOE 1986, 0067).

3.2 Facility Description

A facility description of the Laboratory is presented in Chapter 2 of the IWP. Additional historical information on technical areas in OU 1071 is presented in Chapter 3 of the RFI work plan for OU 1071.

3.3 Environmental Restoration Program

A description of the Laboratory's ER Program is presented in Chapter 3 of the IWP.

3.4 Project Description

3.4.1 Project Objectives

Project objectives are outlined in Chapter 1 of the RFI work plan for OU 1071.

3.4.2 Project Schedule

The schedule for the OU 1071 RFI appears in the project management plan, Annex I, of this RFI work plan.

3.4.3 Project Scope

The technical approach for the OU 1071 RFI appears in Chapter 2 of this work plan, and a description of the RFI tasks, data quality objectives (DQOs), and sampling plans appears in Chapter 5.

3.4.4 Background Information

Background information is presented in Chapter 3 and in various portions of Chapters 5 and 6 of the RFI work plan for OU 1071.

3.4.5 Data Usage

Data collected during the OU 1071 RFI will be used to determine whether a source of contamination is present and, if present, to define the extent of contamination at solid waste management units (SWMUs), SWMU aggregates, or SWMU groups as described in the field sampling plans in Chapter 5 of the RFI work plan for OU 1071. The investigation should provide sufficient data for a baseline risk assessment and corrective measures studies.

4.0 PROJECT ORGANIZATION AND RESPONSIBILITY

The overall organizational structure of the ER Program is presented in Section 2 of Annex II of the IWP, in which ER Program personnel are identified down to the level of technical team leader and personnel responsibilities and line authority are described. In addition, the QA organizational structure is presented, and personnel qualifications are described.

Responsibilities for health and safety issues are described for individuals ranging from deputy division leaders to the field team members in Section 2 of Annex III, the health and safety project plan, of this RFI work plan. Section 3 of Annex III presents the prerequisites for personnel involved in site work for OU 1071.

The records management plan, Annex IV of the RFI work plan for OU 1071, describes the responsibilities for records- and data-handling and retention.

5.0 QUALITY ASSURANCE OBJECTIVES FOR MEASUREMENT DATA IN TERMS OF PRECISION, ACCURACY, REPRESENTATIVENESS, COMPLETENESS, AND COMPARABILITY

These topics are addressed in detail in Section 5 of the generic QAPjP. Details on developing DQOs for OU 1071 appear in Chapter 2 and portions of Chapter 5 of this RFI work plan. Sections 5.-.6 of the field sampling plans and Table III-1 of Annex III of the RFI work plan for OU 1071 present specific sampling and analysis objectives for each SWMU in OU 1071.

6.0 SAMPLING PROCEDURES

The standard operating procedures (SOPs) cited in this section are taken from the ER Program's SOPs (LANL 1992, 0688).

Procedures for collecting samples of soil, water, volatile organics, and sludge will be selected, as applicable to the field investigation, from Environmental Restoration Standard Operating Procedures, Volume II, Sampling Techniques (procedures with a -06 prefix), of the ER Program's SOPs and in Section 6 of the generic QAPjP.

Information on required sample containers, volume, preservation, and holding times is presented in LANL-ER-SOP-01.02, Sample Containers and Preservation, and in Section 6 of the generic QAPjP.

The collection, management, and handling of environmental media samples is described in LANL-ER-SOP-01.04, Sample Control and Field Documentation, and LANL-ER-SOP-01.03, Handling, Packaging and Shipping of Samples. Additional information on proper sample management and coordination is contained in Sections 6 and 7.5 of the generic QAPjP.

6.1 Quality Control Samples

A discussion of quality control samples for the ER Program is presented in Section 6.1 of the generic QAPjP and in LANL-ER-SOP-01.05, Field Quality Control Samples. During the RFI for OU 1071, the frequency and type of field quality control samples identified in the generic QAPjP will be followed for chemical analyses of samples.

6.2 Sample Preservation During Shipment

Information on sample preservation during shipment is presented in LANL-ER-SOP-01.02, Sample Containers and Preservation, and in Section 6.2 of the generic QAPjP.

6.3 Equipment Decontamination

Equipment decontamination is described in Section 6.3 of the generic QAPjP and in LANL-ER-SOP-02.07, General Equipment Decontamination. LANL-ER-SOP-01.06, Management of RFI-Generated Waste, provides information for proper handling and disposal of wash water and other materials generated during equipment decontamination and other RFI field activities.

6.4 Sample Designation

From the time of collection through analysis and reporting, samples will receive a unique alphanumeric identifier to provide chain-of-custody control while they are being transferred. This information is described in detail in LANL-ER-SOP-01.04, Sample Control and Field Documentation.

7.0 SAMPLE CUSTODY

7.1 Overview

Field and laboratory sample chain-of-custody procedures are described in Section 7 of the generic QAPjP. Sampling activities for the OU 1071 RFI will follow these procedures. The LANL-ER-SOP-01.04, Sample Control and Field Documentation, provides additional guidance for chain-of-custody procedures, including examples of chain-of-custody records and tags.

7.2 Field Documentation

Guidance for field documentation procedures can be found in Section 7.2 of the generic QAPjP and in LANL-ER-SOP-01.04, Sample Control and Field Documentation.

7.3 Sample Management Facility

Section 7.3 of the generic QAPjP and Appendix N of the IWP provide a discussion of the activities coordinated by the ER Program's Sample Management Facility.

7.4 Laboratory Documentation

Laboratory custody procedures associated with sample receipt, storage, preparation, analysis, and general security are described in Section 7.4 of the generic QAPjP.

7.5 Sample Handling, Packaging, and Shipping

Sample-handling, packaging, and shipping procedures are described in LANL-ER-SOP-01.03, Handling, Packaging and Shipping of Samples.

7.6 Final Evidence File Documentation

Records documentation is described in Section 7.6 of the generic QAPjP and in the Records Management Program Plan, Annex IV, of the IWP.

8.0 CALIBRATION PROCEDURES AND FREQUENCY

8.1 Overview

Section 8 of the generic QAPjP contains information on the requirements for the calibration of field and laboratory equipment. Additional information can be found in manufacturers' equipment manuals.

8.2 Field Equipment

A list of analytical and health and safety screening procedures that may be used in the field during environmental investigations is presented in Section 8.2 of the generic QAPjP and in Appendix L of the IWP.

8.3 Laboratory Equipment

Section 8.3 of the generic QAPjP contains general information on the calibration procedures and frequency of calibration for laboratory equipment.

9.0 ANALYTICAL PROCEDURES

9.1 Overview

Field and laboratory analytical measurements for RFI samples obtained at OU 1071 will be performed in accordance with the appropriate Laboratory ER Program SOPs.

9.2 Field Testing and Screening

Field testing and screening of samples during the OU 1071 RFI will follow appropriate ER Program SOPs. A general discussion of the analytical levels desired in OU 1071 appears in Section 2.3 of the RFI work plan for OU 1071.

9.3 Laboratory Methods

The analytical methods to be used for the OU 1071 RFI are presented in Section 9.3 of the generic QAPjP.

10.0 DATA REDUCTION, VALIDATION, AND REPORTING

10.1 Data Reduction

Reduction of field and laboratory data for the OU 1071 RFI will follow the protocols described in Section 10.1 of the generic QAPjP.

10.2 Data Validation

Validation of field and laboratory data for the OU 1071 RFI will follow the protocols described in Section 10.2 of the generic QAPjP.

10.3 Data Reporting

Reporting of field and laboratory data for the OU 1071 RFI is described in Section 10.3 of the generic QAPjP.

11.0 INTERNAL QUALITY CONTROL CHECKS

11.1 Field Sampling Quality Control Checks

A discussion of field quality control samples for the ER Program is presented in Section 6.1 of the generic QAPjP.

11.2 Laboratory Analytical Activities

The types and frequency of internal quality control samples for the ER Program are presented in Section 11.2 of the generic QAPjP.

12.0 PERFORMANCE AND SYSTEM AUDITS

Performance and system audits of field and laboratory operations will be conducted during the OU 1071 RFI. These audits will be performed as identified and referenced in Section 12 of the generic QAPjP.

13.0 PREVENTIVE MAINTENANCE

13.1 Field Equipment

Preventive maintenance requirements for RFI field equipment used at OU 1071 will follow the specifications described in Section 13.1 of the generic QAPjP.

13.2 Laboratory Equipment

Preventive maintenance requirements for laboratory equipment used during the RFI for OU 1071 will follow the specifications described in Section 13.2 of the generic QAPjP.

14.0 SPECIFIC ROUTINE PROCEDURES USED TO ASSESS DATA PRECISION, ACCURACY, REPRESENTATIVENESS, AND COMPLETENESS

14.1 Precision

Analytical precision for RFI data obtained at OU 1071 will be calculated according to the formula presented in Section 14.1 of the generic QAPjP.

14.2 Accuracy

Analytical accuracy of RFI data obtained at OU 1071 will be calculated according to the formula presented in Section 14.2 of the generic QAPjP.

14.3 Sample Representativeness

The field sampling plans in Subsections 5.-.6 of the OU 1071 RFI work plan were developed to meet the criteria for sample representativeness described in Section 14.3 of the generic QAPjP.

14.4 Completeness

Completeness of analytical data for the OU 1071 RFI will be calculated according to the formula presented in Section 14.4 of the generic QAPjP.

15.0 CORRECTIVE ACTION

15.1 Overview

The procedures, reporting requirements, and authority for initiating corrective action during the OU 1071 RFI will follow those defined in Section 15.1 of the generic QAPjP.

15.2 Field Corrective Action

Responsibilities regarding the need for field corrective actions are defined in Section 15.2 of the generic QAPjP.

15.3 Laboratory Corrective Action

Responsibilities for laboratory corrective actions are defined in Section 15.3 of the generic QAPjP.

16.0 QUALITY ASSURANCE REPORTS TO MANAGEMENT

16.1 Field Quality Assurance Reports to Management

The OUPL for OU 1071 or a designee will provide a monthly progress report to the Laboratory's ER program manager. This report will consist of the information identified in Section 16.1 of the generic QAPjP.

16.2 Laboratory Quality Assurance Reports to Management

RFI laboratory QA reports for OU 1071 will be prepared as outlined in Section 16.2 of the generic QAPjP.

16.3 Internal Management Quality Assurance Reports

Internal management QA reports, identified in Section 16.3 of the generic QAPjP, will be prepared during the OU 1071 RFI.

References for Annex II

ANSI/ASME (American National Standards Institute/American Society of Mechanical Engineers) 1989. "Quality Assurance Requirements for Nuclear Facilities," NQA-1-1989, 345 East 47th Street, New York, New York. (ANSI/ASME 1989, 0018)

DOE (US Department of Energy), September 23, 1986. "Quality Assurance," DOE Order 5700.6B, Washington, D.C. (DOE 1986, 0067)

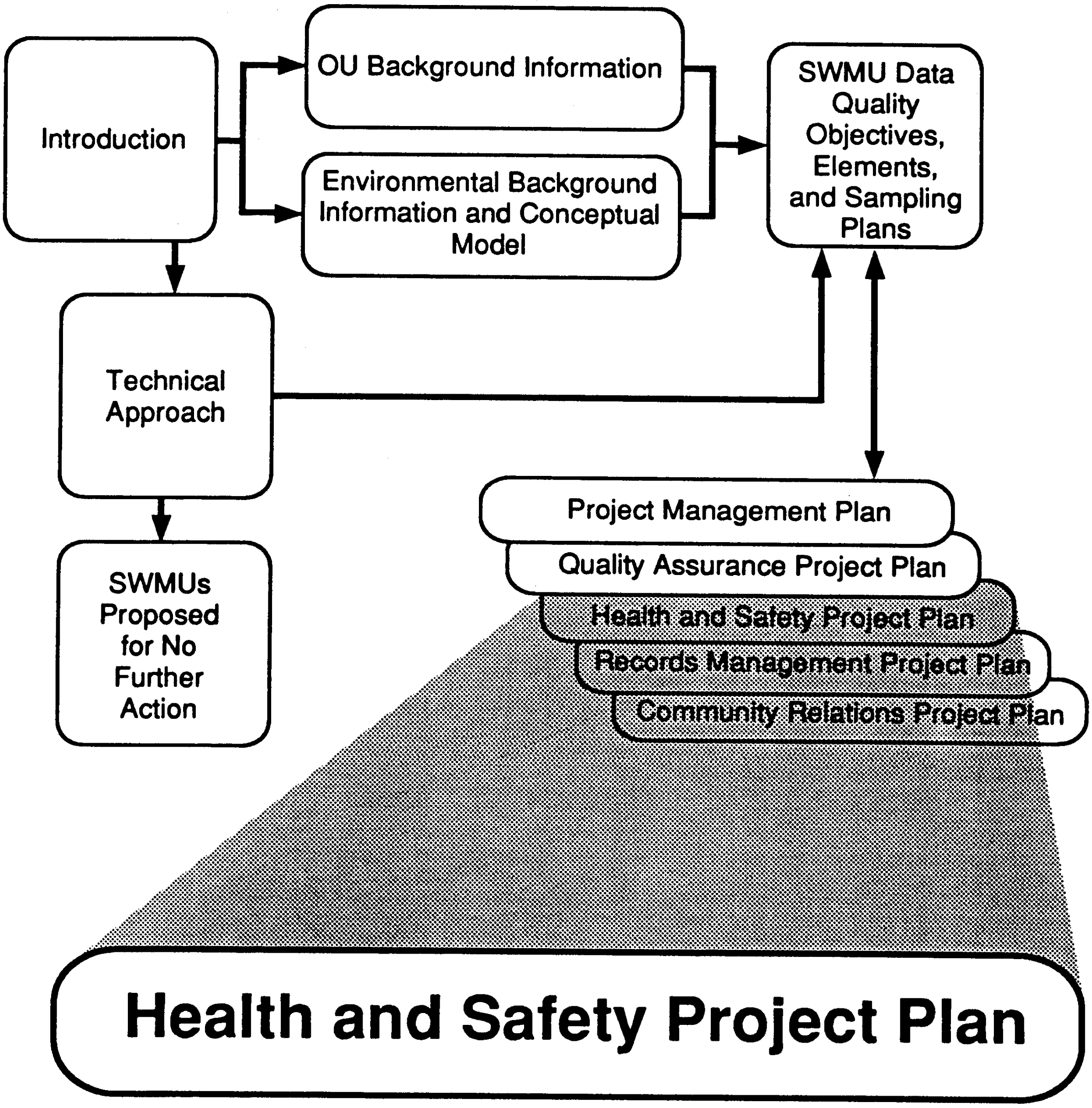
EPA (US Environmental Protection Agency), December 29, 1980. "Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans," QAMS-005/80, Office of Monitoring Systems and Quality Assurance, Office of Research and Development, Washington, DC. (EPA 1980, 0552)

LANL (Los Alamos National Laboratory), May 1991. "Environmental Restoration Standard Operating Procedures," Vols. I, II, and III, Los Alamos, New Mexico. (LANL 1991, 0411)

LANL (Los Alamos National Laboratory), November 1991. "Installation Work Plan for Environmental Restoration," Revision 1, Los Alamos National Laboratory Report LA-UR-91-3310, Los Alamos, New Mexico. (LANL 1991, 0553)

LANL (Los Alamos National Laboratory), March 16, 1992. "Environmental Restoration Standard Operating Procedures," Vols. I and II, Los Alamos, New Mexico. (LANL 1992, 0688)

ANNEX III


Introduction
OU Background Information
Environmental Background Information and Conceptual Model
SWMU Data Quality Objectives, Elements, and Sampling Plans
Technical Approach
SWMUs Proposed for No Further Action
Project Management Plan
Quality Assurance Project Plan
Health and Safety Project Plan
Records Management Project Plan
Community Relations Project Plan
Health and Safety Project Plan

1.0 INTRODUCTION

1.1 Purpose

This Health and Safety (H&S) Project Plan (hereafter referred to as the H&S project plan) has been developed for the Resource Conservation and Recovery Act (RCRA) facility investigation (RFI) to be conducted at Operable Unit (OU) 1071. Implementation of this plan will lead to a safe environment for workers because it establishes health and safety procedures and guidelines for activities specified under the sampling plans for OU 1071 presented in Subsections 5.-.6 of this RFI work plan. This H&S project plan includes an assessment of hazards, provisions for personnel protection requirements, and emergency response procedures.

This document supplements the H&S program plan provided in Annex III of the Installation Work Plan (IWP) (LANL 1991, 0553) (hereafter referred to as the H&S program plan) as health and safety planning applies to OU 1071 and the standard operating procedures (SOPs) prepared for Los Alamos National Laboratory (the Laboratory); therefore, these documents must be in the possession of the field team during all operations of the sampling phase.

This H&S project plan provides the framework within which personnel protection will be provided during the implementation of the RFI at OU 1071. Task-specific H&S plans will be prepared before any field task is initiated. These plans will spell out the specific measures to be taken for personnel protection during implementation of the task. They will also define individual responsibilities that are described in this H&S project plan.

As field investigations progress, more effective measures for personnel protection may be identified than those presented here. Deviations from this H&S project plan will be documented in the task-specific plans, and the reasons for deviations will be given. As changes are required, this plan will be updated.

1.2 Organization of the Health and Safety Plan for OU 1071

This plan addresses all aspects of sampling conducted for the RFI. General responsibilities, as well as individual roles in the implementation of this H&S project plan, are given in Section 2. The prerequisites for personnel involved in the OU investigation are outlined in Section 3. Brief descriptions of the scope of the RFI at OU 1071 and the required sampling tasks are reviewed in Section 4. The assessment of hazards associated with the sampling tasks and the solid waste management units (SWMUs) are summarized in Section 5. To determine hazards that require personnel protection, air monitoring will be performed during the sampling phase of the investigation, as prescribed in Section 6. Personnel protection will be accomplished by implementing a combination of engineering controls, work practices, and use of personal protective equipment (PPE) on a task-specific basis. Personnel protection and safety requirements are discussed in Section 7. The delineation of work zones and provisions for site control are recommended in Section 8. Decontamination procedures for both personnel and equipment are presented in Section 9. The emergency response plan and requirements for notification and documentation are included in Section 10.

1.3 Basis for the Plan

In addition to the general guidance provided by the IWP and the SOPs, this plan is based on Laboratory policies, the Laboratory's Environment, Safety, and Health (ES&H) manual, Department of Energy (DOE) orders, Occupational Safety and Health Administration (OSHA) regulations, National Institute for Occupational Safety and Health (NIOSH) recommendations, American Conference of Governmental Industrial Hygienists (ACGIH) recommendations, Nuclear Regulatory Commission (NRC) regulations, and Environmental Protection Agency (EPA) guidance. These regulations and guidelines have been established to protect workers at sites that contain hazardous and/or radioactive contaminants and therefore apply to personnel engaged in investigating OU 1071. A listing of requirements governing this H&S project plan is presented in Section 2 of the H&S program plan.

2.0 ORGANIZATION OF OPERABLE UNIT FIELD WORK

This section describes the general responsibilities for health and safety prescribed by the Laboratory's Environmental Restoration (ER) Program, as well as the specific responsibilities of the individuals who implement this H&S project plan for the investigation of OU 1071. This section includes a list of the roles in the field organization, an organizational chart, provisions for health and safety audits, and a mechanism for requesting variances from the H&S project plan.

2.1 General Responsibilities

Chapter 1 of the Laboratory's ES&H manual delineates managers' and employees' responsibilities for conducting safe operations and providing for the safety of contract personnel and visitors. The general safety responsibilities are summarized in Section 5 of the H&S program plan. Specific safety responsibilities for personnel involved in this OU investigation are listed in this section.

2.2 Individual Responsibilities

Both Laboratory employees and contractors have health and safety responsibilities for ER Program activities. The field work organization chart, which depicts the line organization, is given in Figure III-1.

2.2.1 Deputy Division Leaders of the Environmental Management and Health and Safety Divisions

The deputy division leaders of the Environmental Management (EM) and Health and Safety (H&S) divisions are responsible for addressing programmatic health and safety concerns. They are also responsible for promoting a comprehensive health and safety program that includes special areas, such as radiation protection, occupational medicine, industrial safety, industrial hygiene, criticality safety, waste management, and environmental protection and preservation.

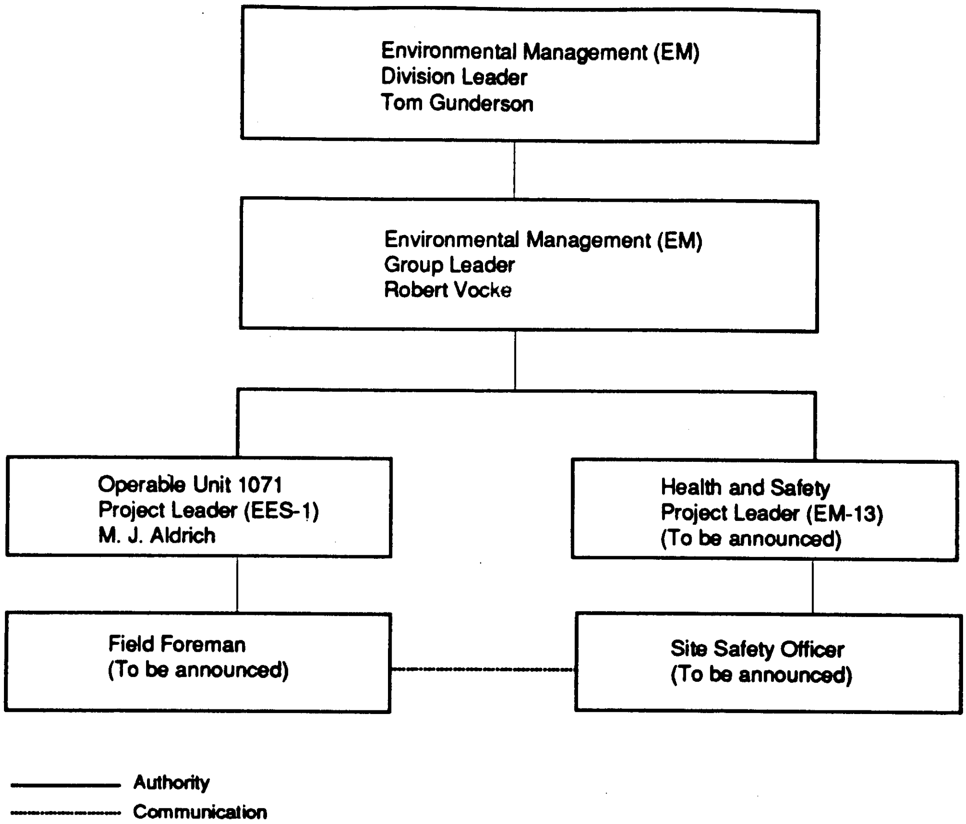


Figure III-1. Organization for health and safety.

2.2.2 EM-13 Group Leader

The group leader of the Environmental Restoration Group (EM-13) is responsible for implementing the ER Program's health and safety program plan (IWP, Annex II). The group leader establishes, implements, and supports H&S measures.

2.2.3 Health and Safety Project Leader

The H&S project leader (H&SPL) is responsible for updating and implementing the H&S program plan and for reviewing the H&S project plans for the 24 OUs at the Laboratory. The H&SPL is also responsible for coordinating with Laboratory personnel in identifying resources to be used for the H&S program and in ensuring Laboratory-wide compliance with all applicable H&S policies and regulations. In conjunction with the foreman, the H&SPL oversees daily H&S activities in the field.

2.2.4 Operable Unit Project Leader

The operable unit project leader (OUPL) is responsible for all RFI activities for his/her assigned OU. Specific safety responsibilities include

- preparing, reviewing, implementing, and revising OU health and safety documents and
- interfacing with the H&SPL to resolve health and safety concerns.

2.2.5 Foreman

The foreman is responsible for implementing the sampling plan, this H&S project plan, and the project-specific quality assurance project plan (QAPjP) (Annex II). Other safety responsibilities include

- ensuring the health and safety of field team members,
- assigning a site safety officer to ensure compliance with this H&S project plan,
- being familiar with emergency response procedures and notification requirements and their implementation,
- acting as a back-up to the site safety officer in an emergency, and
- coordinating field activities with Laboratory personnel and contractors.

2.2.6 Site Safety Officer

The site safety officer has the following responsibilities:

- performing and documenting initial inspections for all site equipment;
- evaluating the potential hazards at a site;
- being informed about the results of sample analysis pertaining to health and safety as the ER site investigation and remediation work progress;
- assisting the foreman in establishing the location of exclusion area boundaries;
- presenting safety briefings to workers;
- determining protective clothing requirements for workers;
- determining personal dosimetry requirements for workers;
- maintaining a current list of telephone numbers for emergency situations;
- having an operating radio transmitter/receiver in case telephone service is not available;

- maintaining an up-to-date copy of the H&S project plan for work at the site;
- maintaining an up-to-date copy of the emergency plan and procedures for the site;
- establishing the safety requirements to be followed by visitors;
- providing visitors with a safety briefing;
- maintaining a logbook of workers and visitors within the exclusion area at a site;
- determining whether workers can perform their jobs safely under prevailing weather conditions;
- taking control of an emergency situation;
- ensuring that all personnel have been trained in the appropriate safety procedures, that all personnel have read and understood this H&S project plan, and that all requirements are followed during OU activities;
- conducting daily health and safety briefings for the foreman and field team members;
- conducting daily health and safety audits of work activities; and
- having authority to require and requiring that field work be terminated if unsafe conditions develop or an imminent hazard is perceived.

The site safety officer will be trained in first aid procedures and in cardiopulmonary resuscitation. The site safety officer will ensure that first aid supplies are available at the site and will know the location of facilities for emergency medical care, including those for injuries that might involve contamination by radioactive materials or hazardous chemicals.

2.2.7 Field Team Members

Field team members are responsible for conducting the assigned work in a manner that ensures that the data collected are technically valid and legally defensible.

2.3 Health and Safety Audits

Health and safety audits will be performed during activities associated with this plan. The frequency of these audits will depend on the characteristics of the site and the equipment used.

The site safety officer will perform an audit of the work area daily, or as conditions change, and will document the audit on the Health and Safety Check List (Attachment III-1). The site safety officer will work with the foreman to correct any deficiencies. The completed audit form must be retained at the work site and be available for inspection by the Environmental Management (EM) and Health and Safety (HS) divisions or by other inspectors. In addition, OU readiness check lists must be completed before starting work. The EM and HS divisions may also conduct health and safety audits separately or concurrently with internal ER Program audits to ensure compliance with the Laboratory's ES&H manual.

2.4 Variances from Health and Safety Requirements

When special conditions exist, the site safety officer may submit a written request for a variance from a specific health and safety requirement to the foreman and the H&SPL. If the foreman and the H&SPL agree with the request, it will be reviewed by the OUPL or a designee. Higher levels of management may be consulted as appropriate. The condition of the request will be evaluated, and, if appropriate, the H&SPL will grant a written variance specifying the conditions under which the requirements may be modified. The variance will become part of this H&S project plan.

3.0 PERSONNEL PREREQUISITES

This section describes the prerequisites for all personnel involved in site work for OU 1071. Further guidance is provided in Sections 10, 11, 12, and 13 of the H&S program plan.

3.1 Training Requirements

The training requirements for ER Program workers at hazardous sites are established in Section 11 of the H&S program plan. The requirements include training in health and safety at hazardous waste sites, respiratory protection, radiation safety, and specialized areas such as cardiopulmonary resuscitation, first aid, and recognition of high-explosive (HE) materials and ordnance.

All site workers must be trained according to 29 CFR 1910.120 (OSHA 1991, 0610) before their initial assignment to any project. All site workers, including subcontractors, will receive a minimum of 40 hours of training off the site and a minimum of 3 days of actual field experience directly managed by a trained, experienced supervisor. Field team members, including subcontractors, whose work is limited to nonhazardous activities must complete 24 hours of off-site training and 8 hours of on-site training.

The foreman must receive a minimum of 8 hours of additional training on program supervision. Each site worker must receive 8 hours of refresher training annually. Certification that training has been completed will be maintained in the project files. Subcontractors must provide certificates of training for the project files for all field team members assigned to the project. Records of training will also be kept at the job site.

3.2 Medical Surveillance Program

Field team members who may be exposed to hazardous materials during ER Program investigations will participate in a medical surveillance program provided by the Laboratory in accordance with the requirements of 29 CFR Part 1910.120 (OSHA 1991, 0610) and DOE Order 5480.8 (DOE 1987, 0731). According to 29 CFR Part 1910.120, a medical examination is required for (1) all employees who are exposed or who may be exposed to substances at or greater than the established permissible exposure limits for more than 30 days/yr, (2) for all employees who wear a respirator for 30 days or more per year, and (3) for members of hazardous materials teams. Such examinations must occur

- before the employee begins the assignment to establish baseline conditions,
- at least every 12 months,
- at termination of employment or reassignment if the employee has not had an examination within 6 months of the reassignment date,
- upon notification that the employee has developed symptoms of exposure, and
- upon the exposure of an unprotected employee and in cases in which the physician recommends a specific schedule for examination. (Suitability of field team members for conducting field sampling activities, including using a respirator, will be evaluated and documented by a physician).

Further details of the medical surveillance program are provided in Section 12 of the H&S program plan. In addition, the program must comply with the Laboratory's Administrative Requirement (AR) 2-1, Occupational Medicine Program; AR 3-6, Personnel Radiation Dosimetry; AR 6-4, Biological Monitoring for Hazardous Materials; and Laboratory Technical Bulletin (TB) 606, Biological Sample Monitoring.

3.3 Documentation

The training and medical records of all ER Program workers will be retained in accordance with the requirements in Section 13.1 of the H&S program plan. In addition, DOE Order 5484.1, Summary of Exposure Resulting in Internal Body Depositions of Radioactive Materials for CY 19___, (DOE 1981, 0052) and DOE Order 5484.6, Annual Summary of Whole Body Exposure to Ionizing Radiation, will be followed, as required. Preparation of these reports will be coordinated with the Health Physics Operations Group (HS-1). Reporting requirements for injuries, exposures, accidents, releases, and unplanned occurrences will be addressed in Section 10 of this H&S project plan.

4.0 SCOPE OF WORK

This section describes the SWMUs in OU 1071 and the tasks to be performed during the sampling phase of the RFI.

4.1 Purpose

The sampling effort supports the RFI by determining the nature and extent of contamination in the SWMUs in OU 1071. This determination includes the identification of sources and environmental receptors associated with each SWMU. The tasks and activities in the sampling phase are described in the sampling plans, Subsections 5.-.6 of this RFI work plan. This H&S project plan establishes procedures for performing activities in a safe manner.

4.2 Description of the Operable Unit

As described in Chapter 3 of this RFI work plan, OU 1071 consists of Technical Areas (TAs) -0, -19, -26, -73, and -74. The SWMUs in OU 1071 are located either inside current TA boundaries, outside current or former TA boundaries, or within the Los Alamos townsite. The SWMUs represent a wide range of locations and potential contaminants that must be considered in this H&S project plan. SWMUs in OU 1071 are located on property owned by Los Alamos County, the Santa Fe National Forest, DOE, the General Services Administration, San Ildefonso Pueblo, businesses, and private residents. Potential waste materials in these areas include radioactive materials, sanitary wastes, HE, building debris, municipal and laboratory wastes, waste oil, diesel fuel, gasoline, animal carcasses, incinerator ash, asphalt manufacturing products, pesticides, and polychlorinated biphenyls (PCBs).

4.2.1 SWMU Sampling Locations

The sampling locations for the SWMUs in OU 1071 are specified in the sampling plans located in Sections 5.-.6 of this RFI work plan.

4.2.2 Topographical Considerations

The environmental setting for OU 1071 is described in Section 4.1 of this RFI work plan. Because some of the SWMUs are located near the edges of mesas, in the canyons, or on the canyon shelves, accessibility and logistics are difficult. Investigating these areas requires special precautions as outlined in Section 7 of this H&S project plan.

4.2.3 Meteorological Considerations

The climate of Los Alamos County is reviewed in Section 4.1.2 of this RFI work plan. Because of the semiarid, temperate mountain climate in Los Alamos, the field teams must be prepared for a wide variety of weather conditions during sampling excursions. Problems such as heat stress, cold stress, and exposure to lightning and slippery surfaces, as well as the equipment necessary to minimize these hazards, are addressed in Section 7 of this H&S project plan.

4.3 Description of Tasks

Three categories of tasks will be performed to determine the nature and extent of contamination:

- field surveys, which include geomorphologic mapping, geophysical surveys, and soil/gas surveys;
- surface sampling, which includes collecting soil or sediment from landfill impoundments, outfall points, refuse aprons, channels, drainage areas, and sediment traps; and
- subsurface sampling, which consists of installing monitoring wells in the vadose zone for the purpose of collecting soil samples; sampling beneath drainlines, storm sewers, underground storage tanks (USTs), septic tanks, and sumps; and coring and trenching.

The hazards associated with each task and the protective measures that address them are described in Sections 5, 6, and 7 of this H&S project plan.

5.0 HAZARD ASSESSMENT

This section presents the hazards that may be encountered by site workers. The tasks and activities scheduled for OU 1071 will be analyzed with respect to these hazards.

5.1 Types of Hazards

5.1.1 Oxygen Deficiency

The oxygen content of normal atmospheres is approximately 21% by volume. Oxygen-deficient atmospheres are defined in 29 CFR Part 1910.120 as atmospheres in which the percentage of oxygen per volume is less than 19.5. As the percentage of oxygen approaches a deficient level, workers exhibit symptoms of oxygen deprivation, which include impaired attention, coordination, and judgment, as well as an increase in breathing and heart rates.

Oxygen-deficient atmospheres may result from the displacement of oxygen by another gas or from the consumption of oxygen during a chemical reaction. Because the sampling activities for OU 1071 will be conducted outdoors, oxygen-deficient atmospheres are not expected. The field team must, however, be aware of the potential for oxygen deficiency in confined spaces or low-lying areas such as natural depressions, excavations, or trenches.

5.1.2 Explosivity and Flammability

There are several potential sources of explosive or flammable hazards in OU 1071:

- disturbance of HE, ordnance, and shock-sensitive and friction-sensitive compounds;
- ignition of explosive or flammable chemicals;
- ignition of materials as the result of oxygen enrichment;
- sudden release of materials under pressure; and
- chemical reactions that may result in explosions, fires, or heat.

These conditions may result in such hazards as intense heat, open flame, smoke inhalation, flying debris, and the release of toxic chemicals. Field team members must be aware of materials, which may vary from SWMU to SWMU, that may contribute to the aforementioned conditions.

Each explosive or flammable gas or vapor has a range of concentrations at which the gas or vapor will explode or burn in the presence of an ignition source. The explosive or flammable limit represents this range for each chemical and is therefore a useful indicator of explosive or flammable hazards.

5.1.3 Radiological Hazards

Radiological constituents emit one or more of the three types of ionizing radiation: alpha, beta, and gamma. Because ionizing radiation can cause biological harm, the field team must be aware of any areas in which radiological hazards exist. Historical evidence from several SWMUs in OU 1071 (Chapter 3 and Sections 5.-.1, and 5.-.2.1 of this RFI work plan) suggests the presence of radioactive wastes.

The primary pathways by which field team members may be exposed to radiological hazards during sampling are

- inhalation of contaminated particulates and vapors,
- inadvertent ingestion of contaminated materials,
- dermal absorption of contaminated particulates or vapors through wounds and unbroken skin,
- injection of contaminated particulates into the body through puncture wounds, and
- direct exposure to gamma radiation from contaminated materials.

Indicators for radiological exposures are exposure rates and concentrations of radiation in soil, water, and air. Exposure rates are expressed in rems, millirems (mrem), and milliroentgens (mR) per hour and can be used to provide an estimate of biological harm. Radiation monitoring is discussed in Section 6.3 of this H&S project plan.

5.1.4 Toxicological Hazards

Exposure to toxic chemicals can result in a wide range of adverse effects that depend on the specific toxicological action of the chemical, the concentration, the route(s) of exposure, the duration and frequency of exposure, and personal factors.

Historical evidence from OU 1071 indicates the presence of chemical wastes in several of the SWMUs. Potential toxicological wastes include radioactive, sanitary, municipal, laboratory, HE, building debris, waste oil and fuels, solvents, incinerator ash, asphalt, acids, PCBs, and unknown waste products. The primary pathways for chemical exposure include

- inhalation of toxic gases, vapors, and contaminated particulates;
- inadvertent ingestion of contaminated materials;
- dermal absorption through contact with vapor, contaminated liquids, or contaminated particulates through wounds and unbroken skin; and
- injection of contaminated liquids or contaminated particulates through puncture wounds.

Information for known contaminants includes permissible exposure limits and symptoms of exposure. The permissible exposure limits consist of those established by OSHA in 29 CFR Part 1910.120 (Subpart Z), the recommended exposure limits set forth by NIOSH in Recommendations for Occupational Health Standards, and the threshold limit values developed by the ACGIH in Threshold Limit Values and Biological Exposure Indices for 1990-91.

Threshold limit values refer to airborne concentrations of substances to which nearly all employees may be repeatedly exposed on a daily basis without adverse effects. They are based on the best available information from industrial experience and animal and human studies. Because of the wide variation in individual susceptibility, a small percentage of workers may experience discomfort from some substances at concentrations lower than recommended values. It has been policy to use these threshold limit values as base guidelines for good hygienic practices; however, whenever appropriate, stricter guidelines may be used.

Currently, exposure guidelines to pesticides and other chemical substances are regulated by OSHA. These exposures are based on the time-weighted average concentration for a normal 8-hr workday and a 40-hr workweek. Several chemical substances have short-term exposure limits or ceiling values that allow a maximum concentration to which workers can be exposed continuously for a short time without suffering irritation, chronic or irreversible tissue damage, or narcosis of a sufficient degree to result in accidental injury, impair self rescue, or substantially reduce work efficiency.

The short-term exposure limit is defined by ACGIH and OSHA as a 15-min time-weighted average exposure that should not be exceeded within a 2-hr period during a workday, even if the 8-hr time-weighted average is within applicable limits. OSHA requires that the 15-min ceiling concentration never be exceeded for certain chemical constituents, which are denoted by the letter "C" following the chemical name.

A "skin" notation may appear under certain chemical substance listings. This notation refers to the potential contribution to the overall exposure by the cutaneous route, including mucous membranes and eyes, by either the air pathway or direct contact. Few quantitative data are available that describe absorption as a function of the concentration to which the skin is exposed. Biological monitoring may be considered to determine the relative contribution of dermal exposure to the total dose.

ACGIH and OSHA have recognized from epidemiological studies, toxicological studies, and, to a lesser extent, case histories, that certain chemical substances have the potential to be carcinogenic in humans. Because of the long latency period for many carcinogens, it is often impossible to base timely risk management decisions on the results of such information. Two categories of carcinogens, human carcinogens and suspected human carcinogens, are designated, based on the most current literature. These chemical categories are based either on limited epidemiologic evidence and experience taken from clinical reports of a single exposure or on demonstration by appropriate methods of carcinogens in one or more animal species. In the case of a known human carcinogen, the worker who is at risk of exposure must be properly equipped to ensure virtually no contact with the chemical constituents. In the case of a suspected human carcinogen, worker exposure by all routes must be carefully controlled by the use of personal and respiratory protection and administrative or engineering controls.

The symptoms associated with exposure depend on the chemical and the conditions of exposure. Table III-1 lists many of the suspected wastes present at the SWMUs in OU 1071. Table III-2 shows the exposure limits for potential contaminants in OU 1071. Any adverse physiological reaction should be considered extremely serious and should be reported to the foreman immediately.

5.1.5 Corrosive Hazards

Corrosive materials such as acids and bases can destroy tissues on contact. Depending on the strength of the corrosive, symptoms range from skin or eye irritation to severe burns. Corrosives can also damage equipment and protective gear. One indicator of the corrosive nature of a material is its pH. Another indicator is the strength or concentration of the material.

Historical evidence indicates the disposal of acids in several of the SWMUs. Field personnel must be cognizant of opportunities for exposure to corrosive materials through generation of vapor and gas clouds, splashing of contaminated liquids, or contact with contaminated soils and sludges.

5.1.6 Biological Hazards

Field team members are likely to encounter biological hazards in some areas of OU 1071. One hazard is contact with animals and insects such as rattlesnakes, rodents, mosquitoes, ticks, spiders, and fleas. Another is infectious agents, which can be transmitted via objects such as broken glass, scrap metal, and other debris as a result of abrasions or puncture wounds. A third group is biological agents conveyed through unhygienic practices such as failing to sanitize respirators and drinking and

TABLE III-1

SUMMARY OF POTENTIAL WASTE MATERIALS CONTAMINANTS AND REQUIRED INITIAL LEVELS OF PROTECTION FOR OPERABLE UNIT 1071

Area and Potential Waste Materials	Required Levels of Protection											
	Task 1 Activity				Task 2 Activity				Task 3 Activity			
	1	2	3	4	1	2	3	4	1	2	3	4
TA-0												
SWMU 0-003 Decommissioned Container Storage Area	D	D	-	-	D	-	-	-	D	D	D	-
Waste oil Algicide (unknown) Descaling chemicals Corrosion inhibiting chemicals Chemicals used in wastewater analysis Chemicals used in water analysis												
SWMU No. 0-004 Active Container Storage Area	D	D	C	-	C	-	-	-	C	C	C	-
Methylene chloride Toluene Acetone Xylenes 4 Chlorobenzaldehyde Methyl ethyl ketone Hetron Solvents Volatiles Semivolatiles Silica gel Lauric Carbon Norit Sodium sulfate Trans-1,2-Dibenzoylethylene Asphalt Lubricants Pesticides Herbicides Methyl ethyl ketone peroxide												
SWMU No. 0-011(a-e) and AOC C-0-020, Mortar Impact Areas	D	D	-	-	D	-	-	-	D	D	D	-
HE Metallic shell residuals												
SWMU No. 0-012 Western Steam Plant	D	D	-	-	D	-	-	-	D	D	D	-
Descaling chemicals Corrosion inhibiting chemicals Algicide Chemicals used in water and waste water analysis Diesel fuel												
SWMU 0-016 Inactive Firing Range	D	D	-	-	D	D	-	-	-	-	-	-
Spent lead bullets and shot Concrete Metal Casings												

Area and Potential Waste Materials	Required Levels of Protection											
	Task 1 Activity				Task 2 Activity				Task 3 Activity			
	1	2	3	4	1	2	3	4	1	2	3	4
SWMU 0-017 Waste Lines	D	D	-	-	B	B	B	-	B	-	-	-
Note: Task 4, Subsurface Sampling, will be conducted in Level B Protection												
Acids; Uranium; Radioactive waste materials; Solvents; Metals; Semivolatile organics; Volatile organics												
SWMUs 0-018(a and b) Active Wastewater Treatment Plants	D	-	-	-	B	B	-	-	-	-	-	-
Sanitary wastes; Unknown wastes												
SWMU 0-019 Decommissioned Wastewater Treatment Plant	D	-	-	-	B	B	-	-	-	-	-	-
Unknown wastes; Sanitary wastes												
SWMU 0-027 DP Road Storage Area	D	D	D	-	D	-	-	-	D	D	D	D
Lubricants; Diesel fuel; Gasoline; Fuel oil												
SWMUs 0-028(a and b) Los Alamos County Recreation Areas	D	-	-	-	C	-	-	-	-	-	-	-
Radioactive wastes; Laboratory chemicals; Sanitary waste effluent												
SWMUs 0-029(a through c) Leakage from PCB Transformers	D	D	-	-	C	C	-	-	C	-	-	-
Polychlorinated biphenyls; Oil												
SWMU 0-030(a) Septic System	D	D	C	-	D	-	-	-	D	D	D	D
Lubricants; Diesel fuel; Gasoline; Fuel oil												
SWMUs 0-030(b, l, m) Septic Systems	D	D	B	-	B	-	-	-	B	B	B	-
Sanitary waste; Laboratory chemicals; Unknown wastes												

Area and Potential Waste Materials	Required Levels of Protection											
	Task 1 Activity				Task 2 Activity				Task 3 Activity			
	1	2	3	4	1	2	3	4	1	2	3	4
TA-26 (D-Site)												
SWMU 26-001 Canyonside Disposal Area SWMUs 26-002(a and b) Sump Systems SWMU 26-003 Septic System	D	D	-	-	C	C	C	C	C	C	C	-
HE Concrete debris Tritium ^{235}Uranium ^{233}Uranium Plutonium Radioactive material or equipment used for the atomic bomb												
TA-73												
SWMU 73-001(a) Landfill	D	D	B	-	B	B	B	-	B	B	B	B
Radioactive waste Solid waste Unknown hazardous waste HE Uranium Lead Zinc Barium Beryllium Plutonium Americium												
SWMU 73-001(b) Landfill	D	D	B	-	B	B	B	-	B	B	B	B
Waste oil Unknown waste												
SWMU 73-001(c) Landfill	D	D	D	-	D	D	D	-	D	D	D	D
None												
SWMU 73-001(d) Landfill	D	D	B	-	B	B	B	-	B	B	B	B
Unknown hazardous waste igh-molecular-weight organics Solid landfill waste Possibly materials listed for SWMU 73-001(a) Asphalt												
SWMU73-002 Incinerator/Surface disposal	D	D	-	-	B	B	B	-	B	B	-	-
Rusted cans Debris Unknown incinerated waste												
SWMUs 73-004(a through c) Inactive Septic Systems	D	D	-	-	D	D	D	-	D	D	-	-
Sanitary waste												
SWMU 73-041(d) Inactive Septic System	D	D	B	-	B	B	B	-	B	B	B	B
Sanitary waste Possibly materials listed for SWMU 73-001(a) Asphalt												

Area and Potential Waste Materials	Required Levels of Protection											
	Task 1 Activity				Task 2 Activity				Task 3 Activity			
	1	2	3	4	1	2	3	4	1	2	3	4
SWMUs 0-030(c through k and n through q) Septic Systems	D	D	-	-	B	-	-	-	B	B	-	-
Sanitary waste Unknown radioactive waste Unknown chemical wastes Plutonium												
SWMU0-031(a) Soil Contamination Beneath Former Service Station	D	-	-	-	D	-	-	-	-	-	-	-
Lubricants Solvents Gasoline Waste oil Antifreeze												
SWMU 0-031(b) Soil Contamination Beneath Former Service Station	D	-	-	-	D	D	D	D	-	-	-	-
Lubricants Solvents Antifreeze Waste oil Detergents												
SWMU0-032 Soil Contamination Under Former Motorpool Facility	D	-	-	-	D	D	D	D	-	-	-	-
Sanitary waste Unknown radioactive waste Unknown chemical wastes Plutonium												
SWMU 0-033 Soil Contamination Beneath Former Zia Warehouses	D	D	B	-	B	-	-	-	B	B	B	-
Descaling chemicals Fuel oil Unknown waste												
SWMUs 0-034(a and b) "Landfills"	D	D	D	B	B	-	-	-	B	-	-	-
Unknown waste												
TA-19												
SWMU19-001 Septic System	D	D	-	-	D	D	D	-	D	D	D	-
Sanitary wastes												
SWMU19-002 Surface Disposal	D	D	-	-	D	D	D	-	D	D	D	-
Concrete and other rubble Asbestos Batteries												
SWMU 19-003 Drainline and Outfall	D	D	-	-	D	D	D	-	D	D	D	-
Sanitary wastes												

TABLE III-2

EXPOSURE LIMITS FOR POTENTIAL CONTAMINANTS IN OU 1071

Location	Contaminants	OSHA Ceiling (ppm mg/m3)		OSHA PEL[a] (ppm mg/m3)		OSHA STEL[b] (ppm mg/m3)		OSHA TWA[c] (ppm mg/m3)		OSHA STEL[d] (ppm mg/m3)	
TA-0											
	Cyanide	--	--	--	5.0	--	--	--	5.0	--	--
	Oil	--	--	--	5.0	--	--	--	5.0	--	10.0
	Uranium	--	--	--	0.2	--	0.6	--	0.2	--	0.6
	PCBs	--	--	--	1.0	--	--	--	1.0	--	2.0
	Methylene Chloride[d]	100 0	--	500	--	--	--	50	174	--	--
	Toluene	--	--	100	375	150	560	100	377	150	565
	Acetone	--	--	750	180	100	240	750	178	100	238
	Xylenes	--	--	100	435	150	655	100	434	150	651
	Methyl ethyl ketone	--	--	--	--	--	--	200	590	300	885
	Silica gel	--	--	--	80	--	--	--	--	--	--
	Carbon	--	--	--	3.5	--	--	--	3.5	--	--
	Asphalt	--	--	--	--	--	--	--	5.0	--	--
	Methyl ethyl ketone peroxide	0.7	5.0	--	--	--	--	0.2	1.5	--	--
	Diesel fuel	--	--	5.0	--	--	--	--	0.05	--	10.0
	Lead	--	--	--	0.05	--	--	--	0.15	--	--
	Gasoline	--	--	300	--	500	--	10.0	--	--	--
	Fuel oil	--	--	--	5.0	--	--	--	50	--	10.0
	Asphalt	--	--	--	--	--	--	--	5.0	--	--
TA-19											
	Concrete (silica)	--	--	--	--	--	--	--	0.05	--	--
	Asbestos[d]	1.0 fiber/cc		0.2 fiber/cc		1.0 fiber/cc		0.2 fiber/cc		--	--
	Uranium	--	--	--	0.2	--	--	--	0.002	--	--
	Concrete (silica)	--	--	--	--	--	--	--	0.05	--	--
TA-73											
	Uranium	--	--	--	0.2	--	0.6	--	0.2	--	0.6
	Lead	--	--	--	0.05	--	--	--	0.15	--	--
	Zinc[d]	--	--	--	5.0	--	--	--	0.01	--	--
	Barium	--	--	--	0.5	--	--	--	0.5	--	--
	Beryllium[d]	--	0.005	--	0.002	--	--	--	0.002	--	--
	Concrete	--	--	--	--	--	--	--	0.05	--	--
	PCBs	--	--	--	1.0	--	--	--	1.0	--	2.0
	Asphalt	--	--	--	--	--	--	--	5.0	--	--
	Gasoline	--	--	300	--	500	--	300	--	500	--

a. PEL = Permissible exposure limit
b. STEL = Short-term exposure limit.
c. TWA = Time-weighted average.
d. Suspected or confirmed carcinogen.

eating on the site. Finally, there is evidence that sanitary wastes and animal carcasses have been deposited in some of the SWMUs in OU 1071.

5.1.7 Physical Hazards

OU 1071 sampling activities may present a number of potential physical hazards, including

- general physical exposures,
- noise,
- working in confined spaces,
- working around potentially energized electrical equipment,
- working around heavy equipment and machinery,
- inadequate housekeeping,
- using mechanical and flame cutting equipment,
- handling materials,
- temperature extremes,
- excavations,
- underground hazards,
- traffic,
- compressed gases and systems,
- breaking concrete,
- topography, and
- lightning.

5.1.7.1 General Physical Hazards

A variety of chemicals and materials will be handled during sampling. The primary physical hazards will be exposure to acids, caustics, and various waste streams that may contain petroleum or solvent sludge. Exposure to these materials presents the potential for inhalation, skin absorption, and ingestion of contaminants. Physical hazards to personnel also include encounters with energized and pressurized equipment, waste materials, and work conditions that may cause slips, trips, falls, or cuts.

5.1.7.2 Noise

The operation of the vehicles, machinery, and equipment necessary to conduct sampling activities can create a noise level exceeding 85 dBA. This noise level may lead to temporary or permanent hearing loss.

5.1.7.3 Working in Confined Spaces

A confined space is defined as a work location that has limited access/egress or inadequate natural ventilation. Personnel may need to enter such areas for inspection and sampling. Potential hazards associated with confined spaces include higher-than-normal concentrations of chemical contaminants, flammable atmospheres, possible asphyxiation, and physical exposures.

5.1.7.4 Working Around Potentially Energized Electrical Equipment

The human body conducts electricity. Contact with an electric circuit, combined with simultaneous contact with a grounded object, such as damp concrete, steel, or other metal, will cause the current to flow through the body. Current will also flow through the body if any two body parts come in contact with any two wires that are part of the same electrical system. In addition to burning skin, electric current frequently interferes with the normal rhythm of the heart and can cause it to stop beating. The heart does not automatically start beating even after the body is removed from the electric current; therefore cardiopulmonary resuscitation must be administered. The effects of electric shock on the human body are listed in Table III-3.

TABLE III-3

EFFECTS OF ELECTRIC SHOCK

Amperes	Effect
1 mA	Effects are barely perceptible and pose no real danger.
3 to 9 mA	Exposure may cause involuntary muscular reactions that could result in bruises, fractures, or even death, if the reaction causes a collision or fall.
9 to 75 mA	Exposure may cause involuntary muscular reactions or possible respiratory paralysis.
75 mA to 4 A	Exposure may cause fibrillation.
4 A or greater	Exposure can cause immediate cardiac arrest.

Shock from high voltage and current sources can cause severe external and internal burns. There is also a potential ignition source from sparking electrical contacts.

5.1.7.5 Working Around Heavy Equipment and Machinery

The size of the equipment, the driver's limited range of vision, and underfoot and overhead hazards can lead to crushing, tripping, falling, cuts, and punctures. The high noise levels created by the equipment can also cause personnel injury.

5.1.7.6 Inadequate Housekeeping

Inadequate housekeeping can lead to congestion, disorder, dirt, waste, trash, and obstacles and can cause slipping, tripping, and falling, which can result in strains, sprains, broken bones, bumped heads, fractured ribs, and fatalities.

5.1.7.7 Using Mechanical and Flame Cutting Equipment

Welding and cutting operations can create sources of ignition and airborne contaminants. Cutting equipment and cylinders of compressed gas present potential physical, electrical, tripping, and flammable hazards, such as welding flash and welding burns.

5.1.7.8 Materials Handling

Handling materials manually can lead to cuts, bruises, splinters, mashed fingers and toes, fractures, and a variety of strains and sprains from lifting, handling, and/or dropping loads. Wire rope used in rigging and lifting may have broken strands and frayed ends, which can cause punctures and cuts. Banding wraps used to secure loads could snap, leading to crushing, lacerations, and puncture wounds.

5.1.7.9 Temperature Extremes

Site activities may take place during either excessively hot or cold weather, creating the following heat- and cold-related problems:

- heat rash, which causes irritation and decreases a person's ability to tolerate heat and is aggravated by chafing clothing.
- heat cramps, which are caused by a chemical electrolyte imbalance brought on by profuse perspiration combined with inadequate water intake, resulting in muscle spasm and pain in the extremities and abdomen.
- heat exhaustion, which occurs when stress on various organs to meet increasing demands to cool the body results in shallow breathing; pale, cool, moist skin; profuse sweating; and dizziness and lassitude.
- heat stroke, which is the most severe form of heat stress. It must be treated immediately by cooling the body, or death may

result. Symptoms include red, hot, dry skin; no perspiration; nausea; dizziness and confusion; strong, rapid pulse; and coma.

- frostbite, which is characterized by pain, reddening of tissue, loss of dexterity, and tingling or lack of sensation in the affected extremities.

- hypothermia, whose symptoms include pain and loss of dexterity in the extremities; severe or uncontrollable shivering; inability to maintain normal rate of activity; and excessive fatigue, drowsiness, or euphoria. Severe hypothermia leads to clouded consciousness, low blood pressure, cessation of shivering, dilated pupils, unconsciousness, and possibly death.

5.1.7.10 Excavations

At some SWMUs, it may be necessary to enter an excavation to collect samples, thereby potentially exposing personnel to contaminants in the soil or air. An excavation that has been improperly dug or a shored excavation can collapse, and any excavation presents a fall hazard.

5.1.7.11 Underground Hazards

Underground hazards are those that occur when subsurface structures, such as gas utilities, power lines, product lines, concrete vaults, and tanks, are encountered during drilling or excavation. Unexpected encounters with these structures creates the potential for electrocution, explosion, contact with hazardous spills and releases, or other injuries to the crew.

5.1.7.12 Traffic

The possibility of vehicle-related injury or accident is inherent in all aspects of field work. Vehicle-related accidents may occur during travel to or from the site, as well as during on-site activities. Accidents involving vehicles are highly likely, given the fairly continuous Laboratory activities and the use of heavy equipment during several of the planned sampling tasks. Additionally, work may take place in or near roadways on which there is heavy vehicle traffic.

5.1.7.13 Compressed Gases and Systems

The following hazards are associated with compressed gas cylinders and systems such as compressor systems:

- flying objects such as dust, dirt discharged from a cylinder valve opening, and a whipping compressor hose;

- explosion and/or fire caused by a leaking system; and

- a damaged cylinder valve that causes the cylinder to become a missile.

5.1.7.14 Breaking Concrete

Gaining access to sampling areas will sometimes require breaking through a concrete pad, which may present the following hazards:

- increase in airborne concentration of site contaminants, particularly if the ground is heavily saturated,
- exposure to dust created by using concrete saws,
- flying debris,
- noise,
- vibration of the hands and body of an employee operating a jackhammer, and
- increased likelihood of electrical shock to an employee operating a jackhammer.

5.1.7.15 Topography

Injuries from slips, trips, and falls in OU 1071 may occur around uneven terrain, slippery surfaces, embankments, cliffs, excavations, heavy equipment, and areas littered with debris.

5.1.7.16 Lightning

Fire is the most common danger associated with lightning, but explosions, falling trees, power outages, and momentary blindness caused by flash are other examples. Field personnel hit by lightning will almost certainly be severely injured or killed. Lightning is a significant hazard at Los Alamos during the summer.

5.2 Assessment of Task-Specific Hazards

Three major sampling tasks will be conducted during this sampling effort, each of which will occur at one or more SWMUs. The details for the tasks are described in Subsections 5.-.6 of this RFI work plan. Potential hazards associated with these tasks are evaluated in the following subsections. Protective measures to be used during the tasks are outlined in Section 7 of this H&S project plan.

5.2.1 Field Surveys

The types of surveys that will occur at OU 1017 are geomorphologic mapping and geophysical surveys, which are relatively low-risk activities, and soil gas surveys. Geomorphologic mapping will require walking through the site. Geophysical surveys will use magnetic and electromagnetic conductivity (EMC) instrumentation. Ground-penetrating radar will also be used at some of the SWMUs. Oxygen-deficient and flammable hazards are not expected during these surveys, although field team members should be aware of the potential for such hazards in low-lying areas. HS-1 will be responsible for the radiation surveys.

It is possible that field team members will encounter radiation and chemical hazards by contacting contaminated surface soil and dust or by inhaling dust. Biological hazards may be encountered through poisonous or infectious agents and unhygienic practices. Physical hazards include the potential for slips, trips, and falls while surveying uneven terrain or at the edges of a mesa; the potential for heat and cold stress when working outdoors for a prolonged time; and lightning strikes.

The aforementioned cautions, as well as some additional concerns, apply to soil gas surveys. A "slam-bar" or similar device will typically be used to drive the soil gas well into place. It may be necessary at some sampling locations to drill through asphalt or concrete. Both techniques will disturb potentially contaminated soil. Drilling increases the likelihood of exposure to contaminants in the soil because soil cuttings are generated. Contact with soil and dust and inhaling dust are possible hazards. Both techniques provide the potential for encountering HE and ordnance. Electrical hazards exist in the form of overhead and underground utility lines, as well as any electrical connections associated with the drill rig. Potential hazards involved in the drilling procedure include noise and creating pinch points in electrical cables.

5.2.2 Surface Sampling

The surface sampling program includes, but is not restricted to, collecting soil or sediment samples from grid points, outfall points, refuse aprons, drainages, and sediment traps. Surface sampling of soil and sediment is typically a low-risk activity. Oxygen deficiency and explosive or flammable vapor/gas hazards are generally not a problem unless the sampling point is in a low-lying area, where gases and vapors can accumulate. Radiological and chemical contaminants may be present in the top 6 in. of soil. Dermal contact with contaminated soil, sediment, and dust and inhalation of dust are possible. Field team members will exercise caution in the presence of biological hazards such as animals and rodents, infectious agents, and infectious waste. Physical hazards such as slips, trips, and falls are site-specific. Working extended hours and/or wearing protective clothing on hot days can lead to heat-related hazards. Survey personnel should also be aware of the possibility of lightning strikes.

5.2.3 Subsurface Sampling

The subsurface sampling program will consist of collecting soil samples, which includes

- sampling and potentially removing USTs, septic tanks, and sumps;
- coring in specified areas;
- sampling beneath drainlines and storm sewers; and
- installing vadose zone monitoring wells in landfills.

Subsurface sampling activities involving drainline and storm sewers, USTs, septic tanks, and trenches may be associated with oxygen-deficient atmospheres. Operations at all of these locations may create explosive and/or flammable conditions because of the potential presence of solvents, gasoline, and fuels. Drilling and excavation activities may volatilize these materials, as well as increase the potential for contact with HE and ordnance. The potential for accumulation of explosive and/or flammable gases and vapors will be greatest in excavated areas and trenches. In some cases, boreholes will be drilled into the tanks; a possible hazard in this case is release of the tank's contents, which are under pressure.

Because the SWMUs in OU 1071 have a history of radionuclide and chemical disposal, the potential for radiation and toxic hazards exists. Because some of the sampling locations will be chosen on the basis of the results of field surveys, soil samples may contain high concentrations of contaminants. Moreover, corrosive hazards may have resulted from acid disposal in some of the SWMUs. The primary exposure pathways are potential contact with contaminated soil, sediment, dust, or waste and inhalation of contaminated dust and volatiles as a result of disturbing the soil during drilling, backhoeing, and excavating.

All of the activities in this task involve potential biological hazards, including contact with animals, insects, infectious agents, and infectious waste.

Using drill rigs and backhoes presents possible physical hazards such as noise, pinch points, and the failure of safety systems. It is imperative that the locations of overhead and underground utilities be identified in advance of such operations. Other electrical hazards may involve short circuits in equipment and shock from using electrical gear in wet conditions.

Field team members must be aware of slip, trip, and fall hazards around cliffs, slippery surfaces, uneven terrain, excavations, and trenches. Excavated areas and trenches may collapse if they are not properly prepared.

5.3 Assessment of SWMU-Specific Hazards

Table III-1 lists the suspected chemical and radiological contaminants in each of the SWMUs of OU 1071. The initial level of protection required is also listed.

6.0 AIR-MONITORING PROGRAM

In accordance with 29 CFR Part 1910.120, an air-monitoring program will be implemented during the sampling activities required by this RFI work plan. The objectives of the air-monitoring program will be to identify and quantify levels of hazardous substances in the air, to determine the appropriate level of personnel protection, to delineate the boundaries of work zones, to ensure that decontamination procedures are effective, and to protect public health and safety. In addition to initial monitoring at the site, periodic monitoring is required when

- work begins in a different portion of the site;
- contaminants other than those previously identified are being handled;

- a different type of operation is initiated (e.g., monitoring volatile materials at a soil boring versus at a drum opening); and
- working with leaking drums, containers, or areas with obvious liquid contamination.

Instruments should be read at ground, waist, and head levels to obtain representative readings of the ambient air. Appropriate measurements will also be made in enclosed spaces and in boreholes, wellheads, and drum openings.

This section provides a brief description of the monitoring equipment used to detect hazards posed by various airborne contaminants and to determine the action levels that will be observed during work in OU 1071. The subsections are presented according to the importance of the hazards they describe. Additional guidance is available in Sections 8 and 9 of the H&S program plan.

6.1 Oxygen Deficiency

An oxygen indicator will be used to measure oxygen levels to detect oxygen-deficient conditions in confined spaces, in low-lying areas, and in spaces that are not ventilated frequently. The action level for oxygen is 19.5%. Areas in which levels are below 19.5% must be evacuated and ventilated. In addition, oxygen-rich atmospheres create an increased potential for fires; therefore, the affected areas will be evacuated if levels exceed 25%. If evacuation is necessary, the area will be ventilated, and the site safety officer will continue monitoring the oxygen levels.

6.2 Explosivity and Flammability

A combustible gas indicator will be used to monitor for explosive and flammable atmospheres. The presence of residual flammable and combustible liquids, such as gasoline or solvents, is possible at several SWMUs in OU 1071. The potential for explosion or fire occurs during drilling and trenching. Field team members should be cautious in enclosed areas in which flammable and combustible gases could collect. The action level for explosive and flammable gases is 20% of the lower explosive limit. If this action level is exceeded, all activities in the area will cease, the work area will be evacuated, and appropriate safety measures (such as removing ignition sources and ventilating the area) will be implemented. The site safety officer will obtain continuous combustible gas indicator readings. Because combustible gas indicators do not detect HE or ordnance, those hazards will need to be screened by appropriately trained personnel.

6.3 Radiological Hazards

A variety of radiation survey meters will be used to determine the presence of ionizing radiation. A microroentgen (gamma scintillator) meter or a Geiger-Muller detector will be used to measure gamma exposure. Alpha scintillators will be used to screen soil cores and to scan personnel leaving the contaminated zone. This monitoring program will comply with the requirements of DOE/AL Order 5480.1A, Chapter XI (DOE/AL 1982, 0729).

Field team members should monitor the area before commencing sampling activities. Continuous monitoring should be conducted because objects such as drums, tanks, and scrap metal provide a certain amount of shielding against radioactive emissions. Conditions may change as these objects are moved or otherwise disturbed. Resuspension of contaminated soil can also result in inhalation hazards.

An action level for gamma radiation of 1 mR/hr is recommended in the EPA's Standard Safety Operating Guides (EPA 1988, 0609). If 1 mR/hr is encountered, the area will be evacuated (or isolated), and the assistance of a radiation health physicist will be obtained before work on the site is resumed.

Radiation exposures will be monitored through the use of thermoluminescent dosimeters; radiation exposures will be as low as reasonably achievable (ALARA) in accordance with DOE policy.

6.4 Toxicological Hazards

Because no single instrument can detect all toxic materials, a variety of instruments will be used to determine the presence of potentially toxic airborne constituents. Although some of these instruments can be calibrated to identify and quantify a particular substance, the field team will most likely encounter mixtures of substances in the SWMUs. In these cases, the instruments will be used as survey tools, and the measurements will represent a gross indication of the materials present. As more information on SWMU contents becomes available, chemical-specific detectors and laboratory analysis can be used for qualitative and quantitative purposes.

6.4.1 Photoionization Detector

A photoionization detector is a portable, nonspecific vapor and gas detector that uses a source of ultraviolet radiation to ionize chemical constituents. The detector is capable of detecting a variety of organic and inorganic chemicals, depending on the chemical-specific ionization potential of each constituent.

For most SWMUs, the photoionization detector will be used as a survey tool to indicate total volatile organics and inorganics in air. The data will be used to indicate possible "hot spots" on the site; to monitor operations such as drilling, soil borings, and sampling monitor wells; and to aid in decisions on PPE. Because the exact concentrations of each constituent in the mixture will not be known, the generic guidelines recommended by EPA for the selection of protective equipment under unknown conditions will be used. These guidelines are discussed in Section 9.1 of the H&S program plan.

In cases in which a single constituent has been identified at a SWMU, the photoionization detector may be calibrated for that particular chemical and used for quantitative measurements. If specific calibration is not possible, the relative response of the compound can be used to estimate the concentration. Relative response is the instrument's response to the chemical of interest compared with the instrument's response to the chemical used for calibration. The relative response is expressed as a percentage. Other options for quantitative instrumentation are described in the following text. The action level will be the most protective exposure level for a given chemical.

6.4.2 Flame Ionization Detector

A flame ionization detector ionizes organic materials via a hydrogen flame. This instrument is capable of detecting a wide range of organic constituents, including methane. As in the case of the photoionization detector, it is useful to know the relative response factor for suspected contaminants. A flame ionization detector can be used both in the survey and quantitative modes.

6.4.3 Colorimetric Tubes

A colorimetric tube is a glass tube that is typically packed with reagent that has been impregnated with a chemical gas. This chemical reagent is specific for a given chemical or group of chemicals. When a specified volume of air is drawn through the tube, the airborne contaminant reacts with the reagent to produce a stain. The tubes are calibrated so that the length of the stain corresponds to an approximate concentration. These tubes may be used in cases in which the presence of a chemical is suggested by the site's history or in which the chemical has been identified by other means. Colorimetric tubes are especially useful for chemicals, such as cyanides or carbon monoxide, that are not easily detected by a photoionization or a flame ionization detector.

6.4.4 Electrochemical Gas Detectors

Electrochemical gas sensors detect toxic inorganic gases. One of the more common types of electrochemical sensors is the mixed-oxide semiconductor. This detector is typically used for inorganic gases that are toxic at relatively low concentrations and cannot be reliably detected by other means. At SWMUs whose history indicates a potential for the presence of hydrogen cyanide, specific detectors will be used. During drilling and excavation, the sampling crew will use electrochemical gas monitors that are set to give an audible alarm at the permissible exposure limit for the chemical of interest.

6.4.5 Real-Time Aerosol Monitors

The real-time aerosol monitor is designed to monitor respirable particulates (<10 microns). The instrument detects scattered electromagnetic radiation as airborne particles pass through a sensor. The response is converted to concentration units of milligrams per cubic meter (mg/m^3). The measurements are useful if there are known concentrations of radionuclides, metals, PCBs, and other particulates such as asbestos. Soil samples will be analyzed, and the results will be used to determine action levels for the constituents that are present.

6.5 Personal Monitoring

Personal exposure data will supplement the results of monitoring the ambient air. Monitors will be provided to field team members whose functions make them likely to receive the highest doses. Thermoluminescent dosimeters will be issued to field team members as a means of monitoring the radiation exposure of individual team members. Personal monitoring devices will be used as necessary for other materials identified during sampling.

6.6 Air Samplers

High- and low-volume air samplers are available to measure ambient atmospheres and personal breathing zone concentrations of particulates, vapors, and gases. The selection of the samplers, collection media, and analyses will depend on those materials identified at the site.

7.0 PERSONNEL PROTECTION AND SAFETY REQUIREMENTS

This section establishes the protective measures to be used for site workers during the OU 1071 investigation. These controls are categorized as engineering control work practices and PPE.

OSHA regulations state that, whenever feasible, engineering controls and work practices will be instituted to reduce and maintain employee exposure levels to a point below the permissible exposure limit. Engineering controls are mechanical means for reducing the hazards to workers; work practices are administrative controls for minimizing exposure. If engineering controls and work practices are not successful in bringing exposure below permissible limits, PPE must be used. The OU 1071 investigation will use a combination of these controls.

7.1 Engineering Controls and Work Practices

7.1.1 Oxygen Deficiency

An oxygen-deficient atmosphere is defined as an atmosphere in which the percentage of oxygen by volume is less than 19.5. Field team members will not be permitted to work in oxygen-deficient atmospheres. The most common means of restoring normal oxygen levels is ventilation, which can be achieved and maintained mechanically or naturally. Logistics in the field may make it difficult to use mechanical devices. Natural ventilation is effective but depends on current wind conditions.

7.1.2 Fire and Explosion Hazards

Explosive or flammable atmospheres are defined as atmospheres in which the concentration of combustible vapors is greater than 20% of the lower explosive limit. Site workers will not be permitted to work in any area in which this condition exists. Ventilation can be used to reduce the concentrations of explosive and flammable gases and will be used at OU 1071 whenever possible.

An additional means of preventing explosion or fire is to ensure that there are no ignition sources on the site. Intrinsically safe devices and nonsparking tools will be used at all times. Field team members will be trained to recognize and avoid hazards. Distance and shielding can be used to protect field team members if a fire or explosion occurs. Some activities, such as opening drums, can be conducted with remote techniques. Shielding for heavy equipment, such as backhoes, can be provided by explosion-proof cabs.

Further guidance for handling flammable materials is available in LANL AR 6-5, Flammable and Combustible Liquids; and in TBs 601, Flammable Liquids; 602, Flammable Gases; 603, Solvents; and 604, Epoxies. Section 9.4 of the H&S program plan requires a fire and explosion prevention and control program at sites that contain flammable and reactive materials.

Air-monitoring equipment will not detect the presence of HE or ordnance. In accordance with Section 9.4 of the H&S program plan, all field activities in areas potentially contaminated with HE and/or ordnance will be reviewed by Laboratory explosives safety personnel.

7.1.3 Radiation Hazards

In any ER Program work involving areas of known or potential radioactive contamination, the OUPL and the site safety officer must prepare a work request specific to the site and submit it to the Health Physics Operation Group (HS-1) for review. If work is approved, HS-1 will issue a special work permit for radioactive work. The OUPL must obtain this permit before initiating work on the site.

The primary methods for protecting field team members from radiation hazards are time, distance, and shielding. Both radiation survey monitors and personal dosimeters will be used to track exposures of site workers over time. In accordance with Section 8 of the H&S program plan, administrative limits will be used to ensure that site workers do not exceed the quarterly or annual limits specified in DOE Order 5480.11, Attachment I (DOE 1988, 0076). Restrictions will be placed on employees whose exposures have exceeded the allowable limits. Radiation levels will be maintained ALARA.

The action level for radiation is 1 mR/hr (EPA 1988, 0609). If this level is exceeded, field team members must evacuate the area to a distance at which radiation is at background level. The assistance of a radiation health physicist will be obtained before the site is re-entered.

Avoiding contact with contaminated materials and controlling contaminated dust are the most effective means of protecting individuals from contamination. However, the nature of the sampling process precludes total avoidance; thus, thorough monitoring and decontamination procedures will be the primary means of reducing radiation hazards.

7.1.4 Chemical Hazards

Chemical hazards are to be monitored while duties are performed in contaminated zones. If concentrations of toxic materials exceed the action limit (which is one-half the permissible exposure limit or threshold limit value), personnel will be removed from the area until natural or mechanical ventilation reduces the levels to background values.

Airborne dust and particulates pose two problems: nuisance dust, for which standards have been established at 10 mg/m^3, and adsorption of hazardous substances on soil particles. During drilling and other dust-generating activities, water can be sprayed to suppress the dust. The effectiveness of dust control measures depends on the size of the area to be sprayed and the rate of evaporation. Frequent applications may be required to achieve optimal results.

7.1.5 Corrosion Hazards

The most effective means of controlling exposure to corrosion hazards is to avoid contact with these materials. Although neutralizing the acids in corrosives is an ideal remedy for reducing the hazard, the choice of a neutralizing agent depends on the corrosive substances. Because corrosive materials in OU 1071 are likely to be unknown, engineering controls for corrosive material cannot be selected until the corrosive materials have been identified.

7.1.6 Biological Hazards

7.1.6.1 Animals and Insects

Site workers may be exposed to a variety of snakes, insects, and rodents. Rattlesnakes may be encountered in the high grasses on the mesas and near outfalls and wastewater treatment plants. When field team members need access to grassy areas, they will either wear snake leggings or cut the grass.

Insect repellents can be used to avoid bites from some insects; however, field team members should be aware that repellents may affect sample analyses. Field team members will check for ticks after working in grassy and wooded areas.

Controls for exposure to rodents are limited. Workers should be aware of potential habitats for rats and mice. If an individual is bitten by a rodent, the animal should be captured, if possible, to be tested for rabies, and the victim should be transported to a medical facility.

7.1.6.2 Poisonous Plants

Field team members should be able to identify poisonous plants, such as poison ivy (*Toxicodendron radicans*), death camas (*Zigadenus spp.*), water hemlock (*Cicuta douglasii*), and poison hemlock (*Conium maculatum*). Contact with these plants will be avoided, and no wild plant will be eaten. If these plants are present at the sampling location, they will be removed in an appropriate fashion.

7.1.6.2.1 Poison Ivy (*Toxicodendron radicans*)

Poison ivy contains a toxic oil (urushiol) that causes painful swelling and eruptions on the skin after external contact. Sensitivity varies between people. Cases of severe reaction should be treated by a physician.

Poison ivy is usually found in moist habitats such as canyon bottoms. It is recognized by its deep-green, shiny, trifoliate leaves, which have distinct, irregularly sized teeth along the margins. The leaf shape may resemble box elder, a tree common in the canyons near Los Alamos. The plant bears white or yellowish-white berries.

7.1.6.2.2 Death Camas (*Zigadenus spp.*)

Death camas contains a toxic substance, zygadenin, that can cause serious illness or death when ingested. If poisoning is suspected, medical help should be sought immediately.

Death camas is found in the pinon-juniper woodlands and pine forests of northern New Mexico. It is a small plant, typically less than 2 ft high, that resembles a wild onion in that its long, grass-like leaves originate from an underground bulb. When in bloom, its small, lily-like flowers are greenish white and typically arranged in branching clusters along a central stalk. The most common cause of poisoning is mistaken identification with wild onions. The bulbs of the death camas do not have an onion-like odor.

7.1.6.2.3 Water Hemlock (*Cicuta douglasii*)

Water hemlock contains a toxic substance, cicutoxin, that affects the central nervous system of mammals when ingested. Symptoms of poisoning include vomiting, colicky pains, staggering, unconsciousness, and convulsions. Severe cases can be fatal, and no antidote is known. Immediate medical attention should be sought if this plant is ingested.

Water hemlock is found in wet ground and along streams. It is a tall plant that reaches 6 ft in height with longitudinal ribs on the stem. The leaves are one to three times pinnately divided. The leaflets are coarsely toothed, and the lateral veins end between the teeth. The small white flowers are arranged in umbels at the top of the plant (similar to the flower arrangements of carrots, parsley, and dill).

7.1.6.2.4 Poison Hemlock (*Conium maculatum*)

Poison hemlock is highly toxic when ingested. Suspected poisoning should receive immediate medical attention. Ingestion of water hemlock or poison hemlock is often the result of confusing the plants with the many edible members of the same family, including celery, carrots, parsley, dill, cilantro, anise, cumin, and fennel.

Poison hemlock is found in damp ground, near streams, and occasionally on moist slopes. The plants may be as tall as 10 ft, with stout, sometimes branching stems. The stems are longitudinally ribbed and have purple spots or streaks near the base. The leaves have multiple pinnate divisions and resemble celery leaves. The small white flowers are arranged in umbels at the top of the plant and at the ends of the branches.

7.1.6.3 Infectious Agents

If the sampling area is littered with debris such as sharp objects, broken glass, and items with jagged edges, field team members will clear it before proceeding with work. Cuts, abrasions, and puncture wounds will be treated immediately by an individual certified in first aid. Medical personnel will be consulted in the case of severe wounds to determine the necessity for tetanus inoculation.

7.1.6.4 Hygiene Practices

Because it is suspected that biological wastes have been disposed in OU 1071, contact with potentially contaminated materials will be avoided. Hygienic practices will be followed on the site at all times. Eating, drinking, smoking, and chewing gum and tobacco will be prohibited. The hands and face must be washed upon leaving a contaminated area, as well as before drinking, eating, and smoking. These practices are consistent with Section 9.4 of the H&S program plan.

7.1.7 Physical Hazards

This section outlines the controls necessary to reduce the severity of the physical hazards listed in Section 5.1.7 of this H&S project plan.

7.1.7.1 General Physical Exposure

Failure of field project management staff and site workers to recognize, evaluate, and control site hazards can result in exposure to contaminants via skin contact or inhalation; burns; blowouts; slips, trips, and falls; and other hazards. The project's goal is to avoid accidents completely.

Pinch points are associated with activities that involve using equipment that has turning or moving parts, such as drill rigs, backhoes, and some hand tools. Machinery and equipment, along with their operating procedures, should be reviewed in advance so that pinch points can be identified. The potential for pinch points and entanglement is reduced by installing guards to shield moving parts. Field team members must ensure that such guards are in place before operating the equipment. If the guards have been broken, worn, or removed, the tool or equipment should be tagged and should remain out of service until the guard has been replaced. The site safety officer will be responsible for maintaining a check list for inspection purposes. OSHA requires most equipment to be inspected annually. Inspections are typically conducted by the manufacturer, representative, or dealer. Documentation of these inspections must accompany the equipment at all times.

Potential physical exposures will be identified and evaluated for consistency with Laboratory and OSHA requirements. To the extent feasible, physical exposures will be reduced to an acceptable level through engineering and work practice controls. Additionally, personnel will be properly protected in accordance with Laboratory and OSHA requirements concerning PPE. PPE will be provided to effectively eliminate the potential for skin contact and to reduce potential inhalation to less than the permissible exposure limit.

The minimum protection for any person who enters the job site consists of

- a hard hat;
- safety glasses with side shields or goggles;
- appropriate work clothing, including shirt with sleeves and durable pants such as jeans;

- gloves whenever materials are being handled: chemical-resistant gloves whenever there is a potential for contact with site contaminants (e.g., residue) and cotton gloves for manual tasks such as loading and unloading supplies or handling or moving equipment and materials; and
- steel-toed safety shoes made either of leather or a chemical-resistant material.

All field team members will work together to establish and maintain site control. Field managers will prohibit entry to personnel who lack minimum acceptable training and medical and safety equipment.

Chemical and physical hazards associated with this project will be eliminated as much as possible by engineering controls before work activities begin. These controls will include, as appropriate, barricading, guarding, posting signs, and verbally warning site personnel. None of the planned operations is inherently dangerous when performed by trained and experienced personnel working under safe conditions. The work crews will endeavor to maintain good working conditions through organization and recognition of hazards before they result in injury and loss. Laboratory SOPs provide guidance to employees executing specific operations. When possible, all field team members will recognize, evaluate, and control physical hazards.

7.1.7.2 Noise

Hearing protection will be worn in areas in which noise levels are suspected or shown to exceed 85 dBA. Field managers will be responsible for identifying areas with high noise levels (continuous or intermittent), and on-site personnel will wear hearing protection devices in these areas. Warning signs will be posted.

7.1.7.3 Working in Confined Spaces

All systems to be entered will be locked out/tagged out and electrically and/or mechanically de-energized, lines entering and leaving will be broken or blanked off, and appropriate signs and personnel (safety watch) will be posted before any entry.

All workers entering confined spaces will have received training in confined-space procedures before entry. The space will be evaluated and cleared by a designated "qualified person." The qualified person will have had training in confined-space procedures, will undergo supervised field training in the evaluation of confined spaces, and will have experience in evaluating confined spaces.

An initial hazard assessment will be conducted that includes atmospheric testing for oxygen deficiency, concentration of flammable gas, toxic contaminants, and physical hazards. No entry will be made unless (1) the oxygen concentration is between 20% and 22%, (2) the flammable gas concentration is less than 10% of the lower exposure limit, (3) the concentrations of toxic contaminants are less than half of the permissible exposure limit, and (4) physical hazards are controlled by engineering or administrative methods or by PPE.

Persons entering a confined space will establish and review communications procedures with an outside standby crew member before entering the space. A tailgate safety meeting with all crew members will be conducted before entry. Chemical, physical, and confined space hazards that require PPE and emergency response procedures will be addressed.

7.1.7.4 Working Around Potentially Energized Electrical Equipment

All electrical tools and equipment used will be Underwriters-Laboratory- (UL-) approved for the potential hazards at locations in which the tools are used. Electrical tools and equipment will be double-insulated. All electrical connections will be made through a ground fault circuit interrupter. Fire extinguishers will be available in sufficient numbers and locations to allow site personnel to extinguish fires.

Each electrical connection and electric wire will be treated as live. Electric equipment and wires will not be touched with wet hands or by a person standing on a wet surface. Electric cords will be disconnected from the outlet by grasping the plug, not by pulling or jerking the cord. Electric wires, extension cords, light cords, conduits, etc., will be located so that they cannot be tripped over, walked on, or otherwise damaged by pedestrian or other traffic. Extension cords will be protected from damage by routing them overhead away from traffic areas. Electric tools and equipment will be kept from fuel sources, especially flammable liquids.

Drilling, trenching, and sampling activities may involve the potential for electrical shocks. The source of this hazard may be overhead and underground utilities, portable equipment, and digging or hand auguring into underground utilities. In addition, the following practices will be used to decrease the potential for shock:

- only qualified and licensed personnel will be permitted to operate electrical equipment;
- heavy equipment and energized tools will be inspected by a competent person before use and will meet all applicable local, state, and federal standards;
- while in use, drill rigs will maintain a 35-ft minimum horizontal distance from overhead power lines; in transit, with the boom lowered, the closest approach to a power line will be 16 ft;
- all areas to be drilled will be cleared through the Laboratory's utilities manager before drilling activities begin;
- any cord with the grounding stem removed will be taken out of service and repaired or discarded; and
- ground fault circuit interrupters will be used on all portable electrical equipment.

7.1.7.5 Working Around Heavy Equipment and Machinery

All heavy equipment will have a functioning back-up alarm, which must be capable of producing sound at a frequency and intensity sufficient to overcome background noise and to be clearly audible to employees wearing hearing protection. Heavy stationary equipment will be barricaded at a distance sufficient to permit ground personnel to avoid swinging cabs, counter weights, and booms.

The number of passengers will not exceed the number of functional seat belts available. Seat belts will be used at all times. Personnel will not ride on or in vehicles or equipment not designed for conveying people, nor will they ride in an inappropriate manner. All equipment will be used in the manner for which it was intended. Drivers will operate the equipment in accordance with the manufacturer's instructions and in adherence to federal, state, and local regulations.

Weights for all items lifted will be calculated before the item is lifted. The boom angle, cable, and auxiliary lines will have a rated load margin of at least 20% greater than the weight of any lift. All rigging material used for a particular lift will represent a 50% margin of lift capability greater than the weight of the particular load.

Hand signals instead of radio will be used to signal the operator of a crane. All heavy equipment will carry at least a 5-lb, multipurpose, dry-chemical fire extinguisher.

A hazard associated with drilling is the potential failure of the wire rope. If the rope breaks under tension, it may cause severe injuries. The wire rope and its related parts will be included in the inspection program.

7.1.7.6 Housekeeping

Work areas will be kept sufficiently clean and orderly so that work can proceed efficiently, safely, and in a manner that will produce and maintain quality. The work areas will be adequately lighted, ventilated, protected, and accessible as appropriate for the activity. Machinery and equipment will be arranged and stored in a manner that permits work to be conducted safely and efficiently and that provides ease in cleaning. Tools and accessories will be safely stored out of traffic areas.

Sufficient waste containers and receptacles will be provided in appropriate locations and will be emptied frequently and regularly. Work areas and floors will be maintained free of debris, obstructions, foreign materials, or slippery substances, such as oil, water, and grease.

Aisles, traffic areas, and exits will be maintained free of materials and debris. Combustible materials will be stored in approved containers and disposed properly. Waste rags will be stored in metal containers. All flammable liquids will be stored in safety cans. Dangerous materials will be stored outside of the work area.

Site workers will be held accountable for keeping their work areas free of housekeeping hazards.

7.1.7.7 Using Mechanical and Flame Cutting Equipment

Cutting, welding, and similar operations that produce heat, sparks, or open flames will be isolated from any potential combustible source. The area surrounding the activity will be inspected to ensure that there are no combustible materials close by, or, if there are and it is impractical to remove them, they will be shielded or otherwise protected.

Oil- and grease-free clothing will cover the entire body. Flame-retardant and -resistant aprons, vests, leggings, capes, and gauntlet gloves will be worn, as appropriate. Collars and cuffs of shirts and jackets will be buttoned and pants cuffs will be turned up to the inside. Pockets will be eliminated or have button flaps.

Welding helmets will have the proper shade of welding lens. Safety goggles or spectacles with tinted lenses will be worn under the welding helmet.

The welding or cutting area will be adequately ventilated. Shields will be placed to protect other workers from welding arc rays. A fire extinguisher will be assigned to the welding area.

7.1.7.8 Materials Handling

Gloves will be worn whenever materials are lifted. Two or more workers may be required to lift heavy or bulky items. A firm grip on material being moved and secure footing when lifting or handling a load is required. Fingers and toes should be in the clear before an item is set down. Material must be transported and stored in a stable manner to prevent falls, rolls, and slips. Material should be lifted with the legs and not the back. The movement of long objects must be controlled when they are carried through congested areas, on stairways, in passageways, or around blind corners. Pinch points should be avoided. Whenever practical, heavy items should be handled by mechanical or powered equipment. Workers should stay clear of material-handling equipment and the load being transported.

7.1.7.9 Temperature Extremes

High temperatures require personnel to be closely monitored for signs of heat exhaustion or heat stroke. Shaded areas and cool water will be provided. In winter, it may be necessary to protect personnel from the effects of cold temperatures and wind, as well as from becoming wet during field operations. Throughout each day, field managers will evaluate the impacts of exposure to the elements on personnel and operations. Special care will be taken during the first days of operation to allow site workers to become acclimated.

One or more of the following control measures can be used to help control heat-related disorders:

- providing adequate liquids to replace lost bodily fluids. Employees must replace water and salt lost in perspiration; therefore, they must be encouraged to drink more than the amount required to satisfy thirst, which is not an accurate indicator of adequate salt and fluid replacement. Replacement fluids can be a 0.1% salt water solution. Commercial beverages that replace fluid and nutrients are also effective.

- establishing a work regimen that provides adequate rest periods for cooling down, which may require adding shifts and using cooling devices, such as Vortex tubes or cooling vests worn beneath protective garments. All breaks are to be taken in a cool rest area (77°F is best).

- informing all employees of the importance of adequate rest, acclimation, and proper diet in the prevention of heat stress.

Procedures for recognizing and avoiding cold stress must be implemented when the ambient temperature is less than 40°F. If cold stress symptoms are observed, the patient should be moved to a warm, dry place, and any wet clothing should be removed. The affected extremities should be warmed with moist, lukewarm compresses, gradually increasing the temperature until normal circulation and temperature return. If the patient is conscious and alert, he/she should gradually drink warm liquids, but no caffeine. Medical attention should be sought for all but minor cold stress cases.

7.1.7.10 Excavations

All excavations will be performed from a stable position on the ground. A person trained in excavation safety will inspect the excavation daily. The inspector will determine the likelihood of cave-in, and remedial action, such as sloping or shoring, will be taken if the walls appear unstable.

All spoil will be placed at least 2 ft from the edge of the excavation so that it does not fall back into the excavation. Barricades or caution tape will enclose the excavation on all sides at least 2 ft from the edges.

All field team members will participate in daily tailgate safety meetings and will be instructed on the following requirements:

- Before excavation begins, the location of underground pipes, electrical equipment, and gas lines will be determined, if possible, by contacting the appropriate utility company and/or property owner to mark the location of the lines. If the property owner's knowledge of the area is incomplete, an appropriate device, such as a cable-avoiding tool, will be used to locate the service line.

- Combustible gas readings of the general work area will be made regularly.

- No ignition sources will be permitted if the ambient airborne concentration of flammable vapors exceeds 10% of the lower exposure limit during excavation. A combustible gas indicator will be used to make this determination.

- Operations must be suspended and the area must be vented if the concentration of airborne flammable substances reaches 10% of the lower exposure limit in the area of an ignition source (e.g., internal combustion engine, exhaust pipe).

- If excavating equipment is located near overhead power lines, a horizontal distance of 15 ft must be maintained between the lines and any point on the equipment. If the lines have appreciable sag or if windy conditions exist, this distance will be 20 ft.

Trenches in the SWMUs must be excavated to a depth of less than 5 ft whenever possible; trenches with depths greater than 5 ft require protection, such as sloping, benching, or shoring. In addition, trenches at depths of 4 ft or more must have a means of egress every 25 ft. The air in the trench must be monitored. Tools and soil piles and other debris must be stored at least 2 ft from the edge of the excavation. All excavations must be marked to restrict access when the area is not occupied.

Field team members must be aware of conditions inside the trench, as well as any activities taking place outside the excavation.

7.1.7.11 Underground Hazards

Field managers must take any steps necessary to ensure that all belowground utilities (i.e., electrical power sources and gas lines) are located and to ensure that all utilities to the site area have been neutralized. Drilling and digging where there may be unidentified buried utilities involve unacceptable risks.

Every effort will be made to notify utility companies and to obtain their assistance, along with that of Laboratory personnel, to identify subterranean hazards. Additionally, drilling and digging operations will progress only if there is reasonable assurance that objects, utilities, product lines, and other obstacles in the excavation have been identified and located. A magnetometer or similar device will be used to assist in identifying subterranean hazards that are not adequately identified by other means. Drillers will dig the first 3 ft of postholes manually before inserting the drill auger. These measures should minimize the potential for encountering buried physical hazards.

If unmapped or unneutralized utilities are discovered or encountered during drilling and digging activities, work will stop immediately and will not resume until the hazard has been eliminated.

The various manholes, ventilation pipes, and entrances to belowground areas represent hazards to personnel and vehicles traveling across the site. All of these hazards will be marked with stakes and warning tape as necessary to prevent personnel and equipment from standing on or driving over manholes or running into vertical vent pipes. Open manholes or similar openings will be effectively roped off or barricaded.

7.1.7.12 Traffic

Traffic control will be maintained in and around the job site at all times to avoid personnel injuries and prevent equipment damage. So that equipment operators will not run into pedestrians or workers, work areas will be delineated by barricades, warning signs, warning lights, traffic cones, etc. Personnel will wear fluorescent orange and/or reflective clothing, vests, etc., when working in and around traffic areas.

Pedestrians have the right-of-way. When working around heavy equipment, ground personnel should always make eye contact with operators of moving vehicles and wait for a signal to proceed before passing close to or in front of operating equipment.

All drivers and operators will adhere to speed limits, signs, and road markings. Equipment operators and ground personnel will be especially careful when air line respirators are in use because of the potential for injury if an air line were to become tangled in the track or wheel of a vehicle or equipment. Under no circumstances will breathing air systems that supply air to the respirators of ground employees be attached to vehicles or equipment.

Sufficient parking will be provided. Vehicles not in active use will be parked so that they do not interfere with traffic. When a vehicle is being maneuvered in a confined area in which visibility is limited, personnel positioned outside the vehicle will assist the operator.

7.1.7.13 Compressed Gases and Systems

Compressed gases will be used according to the supplier's instructions, Compressed Gas Association guidelines, and the requirements of this H&S project plan. Additionally, these gases will be used in a manner that precludes human exposure.

Segments of compressor hose will be secured by chains and/or locking pins. In addition, the pressurized hose will be connected to the compressor through a pressure-sensing device that will discharge the pressure if the pressure system fails (e.g., if a hose is cut).

Personnel are required to wear safety glasses and gloves when handling and hooking up compressed-gas cylinders and systems.

7.1.7.14 Breaking Concrete

Continuous real-time air monitoring must be provided throughout the operation. Controls will be used as necessary to establish and maintain an acceptable level of exposure to concrete dust. If monitoring is inconclusive, PPE will be provided to exposed employees.

The operation will be kept wet to reduce dust. Eye, face, and respiratory protection will be used as necessary. Eye and face protection includes goggles, safety glasses with side shields, and/or a face shield that extends past the throat and attaches to a hard hat.

Hearing protection will be worn as needed. If earplugs do not offer enough protection, earmuff-type hearing protectors and plugs will be used.

To combat the damaging effects of jackhammer vibration, rubber hand grips and gloves that are padded to absorb vibration will be used. Low back protection, such as a belt designed for this purpose, will be required.

Pressure hoses that supply jackhammers will have a conductive pressure hose to limit the potential for electrical shock injuries to personnel in the event that an active electrical source is unexpectedly encountered.

7.1.7.15 Topography

To reduce hazards associated with topography, the site safety officer will inspect each site for potential hazards. Some of these hazards can be alleviated by such methods as removing any obstacles in immediate work areas, clearing icy surfaces, and placing tools in an accessible but protected area. Boundaries surrounding excavations, trenches, and boreholes will be marked. Field team members who conduct site activities near the edge of a mesa will not be permitted to work closer to the edge than 5 ft. Barrier tape will be used to designate this restricted area. One exception to this requirement is sampling outfalls. In this instance, the worker will be tied off before descending over the edge. All field team members will be informed of potentially hazardous locations and the appropriate controls. Field team members will also be expected to observe good housekeeping practices for the duration of the work in each area.

7.1.7.16 Lightning

Lightning strikes the tallest object in an area and takes the fastest route to the ground via the best conductor; therefore, buildings or vehicles provide better protection than being in the open. A large building with a metal structure is the safest shelter because electric current runs along the outside metal frame and into the ground. An automobile with a metal roof serves the same purpose; however, convertibles or fabric-topped cars are not safe because lightning can burn through the fabric.

Wood or brick buildings that are not protected by lightning rods have high potential for conducting a strike, which travels down natural conductors such as wiring or pipes. Any contact with an ungrounded conductor can be dangerous. Telephones, faucets, electrical equipment, and metal fences are examples of ungrounded conductors.

A person in the open during a lightning storm should crouch to avoid being the tallest object. A tingling sensation or hair standing on end signals that lightning is about to strike and that a crouching position must be assumed immediately. The safest crouching position is to place the hands on the knees and keep the knees and feet together while remaining as low as possible. Stretching out flat on damp soil could cause the body to attract current running into the ground from a nearby tree. Keeping feet and knees spread or placing the hands on the ground could complete a circuit and cause high-voltage current to run throughout the body. A grove of trees affords more protection than remaining in the open or taking shelter under a single tree. Lower ground is also safer; however, ditches and ravines present the danger of floodwaters.

Side strikes injure more people than direct strikes. Side strikes occur when electric current jumps from its present conductor to a more effective conductor. The human body is a better conductor than a tree trunk; therefore, a person should stay 6 ft from a tree to avoid a side strike. A group of people taking shelter under a grove of trees should stand 6 ft apart to avoid side strikes from one person to another.

The force of electrical current temporarily disrupts the nervous system; therefore, even if breathing and heartbeat have stopped, a lightning victim may not be dead. Many victims can be revived by artificial respiration and cardiopulmonary resuscitation. Once the lightning flash is over, current is no longer running through the body; therefore it is safe to touch a lightning victim. Even a victim who seems only slightly stunned should receive immediate medical attention because internal organs may have been damaged.

7.2 Personal Protective Equipment

If engineering controls and work practices do not provide complete protection against hazards in OU 1071, field team members will be required to use PPE. PPE shields or isolates individuals from chemical, physical, biological, and some radiological hazards that may be encountered on the site. PPE protects the respiratory system, skin, eyes, face, hands, feet, head, body, and hearing. Two important criteria to be followed in selecting this equipment are the potential hazards on the site and the type of work to be performed. The choices are also influenced by the hazards associated with the equipment itself, such as reduced mobility, dexterity, vision, and communication and increased heat stress. Field team members must be able to communicate when wearing hearing protection.

The EPA has established four levels of protection for workers involved with potentially hazardous materials. These levels are based on the degree of dermal and respiratory protection appropriate to the hazards at the site. Level A consists of maximum dermal and respiratory protection through the use of a fully encapsulating suit and an air-supplying respirator. Level B maintains the maximum respiratory protection but with less dermal protection than that provided by Level A. Level C provides respiratory protection via an air-purifying respirator. Level D is a basic work uniform.

Further information on the components of Levels of Protection A, B, C, and D, and the selection criteria and limitations of each, are presented in the next section. OU 1071 investigations will be conducted according to Laboratory AR 12-1, Personal Protective Equipment; and LANL TB 1201, Eye and Face Protection; TB 1202, Protective Clothing; and TB 1203, Respiratory Protective Equipment. The site-specific special work permit for work in radioactive areas will specify the appropriate protective clothing and equipment to be used on sites with known or suspected radioactive contamination.

7.2.1 Selection of Personal Protective Equipment

This section describes PPE to protect field team members from the various hazards discussed in this H&S project plan. PPE required at individual SWMUs in OU 1071 is based on the types of work to be conducted and the known, suspected, or unknown contaminants present. Table III-1 lists the levels of protection required for each SWMU.

Selecting the appropriate PPE is a complex process that takes into consideration a variety of factors, including identification of hazards or suspected hazards, their routes of transmission to employees (inhalation, skin absorption, ingestion, and injection), and the performance of the PPE materials (and seams) in providing a barrier. The amount of protection provided by PPE varies—the materials used in protective equipment will protect well against some hazardous substances and poorly, or not at all, against others. In many instances, materials that provide continuous protection from a particular hazardous substance cannot be found. In these cases, the time it takes for the material to show signs of wear should exceed the time the PPE is in use.

In some cases, layers of PPE may be necessary to provide sufficient protection or to protect expensive PPE inner garments, suits, or equipment. The more that is known about the hazards at the site, the easier it is to select PPE. As more information about the hazards and conditions becomes available, the foreman can decide to upgrade or downgrade the level of PPE to match the tasks at hand.

The following are guidelines that the foreman can use to select the appropriate PPE; however, they do not fully address the performance of specific PPE materials in relation to specific hazards at the job site. PPE selection, evaluation, and reselection are a process that goes on until sufficient information about the hazards and PPE performance is obtained. The four levels of protection afforded by PPE are described below.

7.2.1.1 Level A

Level A protection is worn when (1) a hazardous substance has been identified that requires the highest level of protection for the skin, eyes, and respiratory system based on a measured or potentially high concentration of atmospheric vapors, gases, or particulates; (2) site operations and work functions involve a high potential for splash, immersion, or exposure to unexpected vapors, gases, particulates, or materials that are harmful to skin or that are capable of being absorbed through the skin; (3) substances with a high degree of hazard to the skin are known or suspected to be present and skin contact is possible; and (4) operations are being conducted in confined, poorly ventilated areas in which the absence of conditions requiring Level A protection has not yet been determined.

Level A protection is not expected to be required during OU 1071 field investigations; therefore, no description of Level A PPE is given.

7.2.1.2 Level B

Level B protection will be specified for situations in which self-contained breathing apparatus is required and in which the identity and quantity of contaminants are unknown. These respirators will be used when

- oxygen levels are less than or equal to 19.5%;
- chemical concentrations exceed the permissible exposure limit;
- the chemicals of concern do not have adequate warning properties;
- cartridges and canisters are not available for the chemicals and/or concentrations of concern; and
- the identity of the contaminant is not known.

Level B protection will consist of

- a full-face, positive-pressure, self-contained breathing apparatus [Mine Safety and Health Administration (MSHA)/NIOSH-approved];
- contaminant-resistant clothing such as Saranex or polyvinyl chloride to protect against dust and splash from chemicals of concern;
- inner gloves of latex surgical material;
- outer gloves of rubber, polyvinyl chloride, or nitrile, depending on the suspected contaminants;

- rubber, steel-toed safety boots with disposable boot covers;

- hard hat for protection from overhead hazards and hoods for splash protection; splash shields are optional, depending on the activity and conditions; and

- hearing protection when the noise level exceeds 85 dBA.

The foreman is responsible for ensuring that workers adhere to the recommended level of PPE, and he/she may upgrade or downgrade the level of protection as additional information about site hazards becomes available.

7.2.1.3 Level C

Level C protection will be considered in instances in which a known chemical contaminant has exceeded the specific permissible exposure limit. An air-purifying respirator will be selected if the following criteria are met:

- oxygen levels are greater than 19.5%,

- chemical concentrations do not exceed levels immediately dangerous to life and health,

- the chemical container has adequate warning labels, and

- cartridges and canisters are designed for the chemicals and concentrations of interest.

Level C protection will include

- full-face, air-purifying respirator (MSHA/NIOSH-approved) with combination organic vapor/particulate cartridges or canisters capable of filtering out the chemicals of concern;

- contaminant-resistant clothing made of such materials as Saranex or polyvinyl chloride for dust and splash protection against chemicals of concern;

- inner gloves of latex surgical material;

- outer gloves of rubber, polyvinyl chloride, or nitrile, depending on suspected contaminants;

- rubber, steel-toed safety boots with disposable boot covers for use in wet conditions;

- leather safety boots with disposable boot covers for use in dry conditions;

- hard hat for protection against overhead hazards; splash shields are optional, depending on the activity and conditions;

- hearing protection when the noise level exceeds 85 dBA; and

- escape mask for respiratory protection in the event of a release or respirator failure.

7.2.1.4 Level D

Level D protection will consist of

- cotton or Tyvek coveralls;
- outer gloves made of rubber, polyvinyl chloride, or nitrile for protection against chemicals and particulates;
- leather gloves for protection against abrasions;
- steel-toed safety boots for protection against punctures and crushing;
- optional boot covers for dusty or muddy conditions;
- hard hat with optional splash shield for protection against overhead splash hazards;
- safety glasses for protection against splashes and particulates;
- hearing protection (earplugs or earmuffs) if the noise level exceeds 85 dBA; and
- escape mask for respiratory protection in case of an unsuspected release from which escape is necessary.

7.2.2 Personal Protective Equipment for Task-Specific Hazards

The guidelines given in this section apply to all work performed in OU 1071. Specific health and safety considerations for the activities conducted under the sampling plans in Subsections 5.-.6 of this RFI work plan are discussed in the following text. Levels of protection for activities at each SWMU are outlined in Table III-1.

7.2.2.1 Field Surveys

Levels B, C, or D protection may be provided for the field surveys for the SWMUs in OU 1071, depending on the hazard potential at the individual SWMU. Level D protection is adequate for geomorphologic and geophysical survey.

Level C or D protection will be used for most soil gas survey work unless an undocumented contaminant is suspected, in which case, Level B protection will be used until the situation meets the criteria for Level C or D protection. Level C respiratory protection will include cartridges for both organic vapor and particulates. Leather gloves may be used to protect skin from constant friction during slam-bar action. The sampling effort may involve drilling through asphalt or concrete. During drilling, site workers will wear hard hats, safety glasses, protective shields, and hearing protection, when necessary.

7.2.2.2 Surface Sampling

Surface sampling will involve collecting soil or sediment samples from the first 6 in. of soil. Site workers may wear Level B, C, or D protection, depending on the conditions. Safety harnesses will be used by any member who works less than 5 ft from the edge of a mesa. Under extremely dusty conditions, site workers will take measures to suppress the dust. Air must be appropriately monitored when the sampling point is in a low-lying area.

7.2.2.3 Subsurface Sampling

The subsurface sampling program consists of a variety of activities that involve drilling and excavation. Field team members may wear Level B, C, or D protection during this activity. Regardless of the level of protection in use, field team members will wear gloves, safety boots, hard hats, eye protection, and hearing protection, as required, during drilling operations.

Air monitoring for oxygen and flammable or toxic gases will be performed before drilling and excavation. Continuous monitoring for flammable and toxic gases will be conducted at the borehole during drilling and coring. Excavation and trenching will be monitored when soil is being disturbed. Completed excavations and trenches will be monitored periodically for oxygen and flammable and toxic gases.

The foreman is responsible for selecting the appropriate level of protection based on the results of air-monitoring information. The initial levels of protection for these activities are discussed in the following paragraphs.

The level of protection for the installation of monitoring wells will depend on the type of SWMU. Level B protection will be used for coring in the landfill (SWMU Aggregate 73-A) because of the potential for release of hazardous materials, both known and unknown. A member of the sampling team will wear an electrochemical monitor to detect the presence of hydrogen cyanide. Once the installations are complete, the levels of protection may be downgraded, if conditions permit.

Sampling beneath drains and storm sewers and in the vicinity of USTs, septic tanks, and sumps can be performed in Level C or D protection unless air-monitoring results indicate otherwise. The exception to this guideline will be SWMU Group 0-1, at which septic tanks are to be sampled through a borehole. There may be cases, however, in which septic tanks must be drilled. Level B protection, as well as additional splash gear, will be used. Table III-1 lists the levels of protection required for each of the SWMUs.

7.3 Hazard Communication

In accordance with the provisions of 29 CFR Part 1910.120 (OSHA 1991, 0610) that implement right-to-know legislation, workers must be informed of potential hazards associated with the site before work begins. The following subsections describe the provisions for hazard communication to be observed during work in OU 1071.

7.3.1 Safety Meetings

Pre-entry briefings will be held before initiating any site activity. Any visitors who enter areas in which field work is being conducted will participate in pre-entry briefings. Safety meetings and safety inspections will also be conducted to ensure that this H&S project plan is being followed.

7.3.2 Employee Information

The site safety officer will ensure that the following DOE and Laboratory forms are posted in locations where foreman and field team members can easily read them:

- Form F 5480.2, Occupational Safety and Health Protection;
- Form F 5480.4, Occupational Safety and Health Complaint Form;
- the Laboratory's special work permit; and
- OSHA job safety and health protection form.

The Laboratory's health and safety standard concerning employees' right to know will also be posted at the work site.

7.3.3 Material Safety Data Sheets

Material Safety Data Sheets (MSDSs) provide exposure information and describe the chemical and physical properties, toxicological effects, and appropriate protection for chemicals used in the course of site work. The site safety officer will be responsible for obtaining the necessary MSDSs and for attaching them to this H&S project plan.

8.0 SITE CONTROL

The objectives of site control are to protect employees and the general public from exposure to hazardous substances and conditions and to prevent the spread of contamination. Site control entails the establishment of boundaries based on the nature and extent of contamination at the site as well as on safe access. Three general areas are defined in this H&S project plan: the exclusion zone, the contamination reduction zone, and the support zone. Site access issues are also addressed in Section 7 of the H&S program plan.

8.1 Exclusion Zone

The exclusion zone is the area inside the SWMU in which contamination does or could occur. Because the types of areas in which SWMUs are located in OU 1071, the position of the boundaries for the exclusion zones will vary. The designation of the exclusion zone for each SWMU depends on the following factors:

- the number and distribution of sampling locations;
- types and amounts of contaminants expected (including HE);
- air-monitoring results;
- use of mechanical equipment and heavy equipment (including drill rigs and backhoes);
- proximity to overhead and underground utility lines; and
- topography.

Access to the exclusion zone will be restricted to field team members who have direct responsibilities for sampling in this area and who are wearing the appropriate PPE. Different zones with different requirements for levels of protection can be established within the exclusion zone, if necessary.

The "hotline" is the outer boundary of the exclusion zone. Depending on the location of the SWMU (isolated areas versus residential or commercial), the hotline will be marked in the most appropriate fashion. Barriers such as fences, barrier tape, and signs can be used, depending on the circumstances.

8.2 Contamination Reduction Zone

The contamination reduction zone is the transition area between the contaminated area and the clean area. This zone serves as a buffer and prevents further spread of contamination from the site by providing a specified area for decontamination activities.

The contamination reduction zone will be located upwind of the exclusion zone, if possible. The outer boundary of the zone is the contamination control line and will be indicated accordingly. Because of the potential presence of contamination in this area, support workers in this zone will wear the appropriate level of protection.

8.3 Support Zone

The support zone is the location of administrative and other support functions. This zone will also be located upwind of the exclusion zone, if possible. It is not necessary for personnel to wear PPE in this area.

8.4 Site Control Procedures

To promote adequate security, personnel safety, and smooth operations at the site, the following measures will be instituted, as necessary:

- All information regarding work to be performed, emergency procedures, and health and safety hazards will be reviewed at a daily tailgate safety meeting, which will occur before work begins.

- A copy of this plan will be available at the work site.
- Only authorized personnel will be permitted in the work area. These individuals must have successfully completed a medical exam and must have been properly trained in specific health and safety hazards and in the use of respiratory protective equipment. All visitors must report to the foreman.
- All personnel who enter the site will be thoroughly briefed on hazards, equipment requirements, safety practices, emergency procedures, and communication methods.
- Protective clothing and respiratory protective equipment will be used for various stages of the operation, as needed. The levels of protection are described in Section 7.2 and will depend on the degree of hazard.
- Food, beverages, and tobacco will not be allowed in contaminated areas or potentially contaminated areas. Taking medication, smoking, and applying cosmetics are also prohibited. These activities are allowed only in the established clean room and clean areas.
- Before eating, drinking, or smoking, employees will wash their hands and remove outer protective garments.
- At the end of each work shift and before leaving the site, personnel who worked in contaminated zones will thoroughly shower or wash themselves to remove any contaminants.
- Containers will be moved only with the proper equipment and will be secured to prevent dropping or loss of control during transport.
- Emergency equipment will be located in readily accessible, uncontaminated locations. A complete first-aid kit will be readily available on the site. A fire extinguisher will be located not more than 25 ft from the work activity and will be readily available for the team's use in case of an emergency. An eyewash capable of washing both eyes at once and delivering at least 0.4 gpm for at least 15 min will be readily available. At least one eyewash will be maintained in the contamination reduction zone.
- Employee entrance and exit routes will be planned, and emergency escape routes will be designated. A map that shows emergency escape routes will be posted at the site.
- Work areas will be illuminated to a minimum of 20 ftc. Supplementary lighting may be necessary at night, inside buildings and tanks, and in poorly lit areas.
- All operators of equipment used on the site will be familiar with the requirements for inspection and operation of such equip-

ment. Unfamiliar operations will be discussed with affected employees before work begins. The foreman will be responsible for checking the proficiency of the operator. Perimeter barricades will be placed around the particular equipment used in a fixed location. Audio and/or visual back-up alarms will be used on all heavy equipment on the site.

- Personnel will be transported only by means prescribed for moving personnel. When trucks or other heavy equipment enter or leave the site, an individual will direct the driver.

- Electrical equipment will not be permitted in areas in which a flammable atmosphere may exist. All static ignition sources will be identified and eliminated through use of bonding and grounding techniques.

- Any employee who is unwilling to comply with this or any other H&S procedure will be subject to disciplinary action.

MSDSs will be obtained for every chemical product used on the site. This information will be stored in a central location and will be made readily available to all employees upon request. MSDSs or other applicable information will be available with regard to materials used in collecting soil and drilling. All containers of chemical products will be properly labeled to comply with the OSHA hazard communication standard (29 CFR 1910.1200).

All on-site personnel will use the buddy system. Buddies will maintain visual contact with each other. Personnel must observe each other for signs of heat stress or toxic exposure such as

- changes in complexion,
- changes in coordination or demeanor,
- excessive salivation and pupillary response, and
- changes in speech pattern.

Personnel will inform the foreman of any nonvisual effects of toxic exposure such as

- headaches, dizziness, or blurred vision;
- nausea or cramps; and
- irritation of eyes, skin, and respiratory tract.

Walking and working surfaces may become wet and slippery during these tasks, requiring extra caution. Visible barriers will be erected around any open excavations. Employees will keep the work and support areas neat and orderly and free of trash.

There will be a designated break upwind of the excavation area and outside the contamination reduction zone. The area must be clearly marked, and no contaminated personnel or equipment will be permitted to enter.

If the facility does not have a water supply, potable water will be carried to the site for use in decontamination and employee cleanup. All refuse on the site will be deposited in designated containers. It is the responsibility of the foreman and the site safety officer to ensure that the area is kept clean.

9.0 DECONTAMINATION PROCEDURES

This section outlines the procedures for developing an effective decontamination plan. Decontamination is the process of sequentially removing or neutralizing contaminants that have accumulated on equipment and personnel. The objectives of the decontamination process are to protect workers from exposure to contaminants and to minimize the transfer of contaminants to clean areas.

The degree of contamination expected is based on the tasks to be conducted under the sampling plans in this RFI work plan. Contact with hazardous substances is possible; therefore, it is assumed that all personnel and equipment engaged in field activities are potentially contaminated and that the decontamination is required. The types of materials to be addressed by decontamination procedures for OU 1071 include

- contaminated soil in the form of dust or mud;
- contaminated sediment and sludge;
- contaminated liquid or aerosol resulting from splashing or spraying; and
- raw chemical, radiological, or biological materials from drums or containers.

General guidelines for decontamination are provided in Sections 7 and 10 of the H&S program plan. A decontamination plan will be developed and implemented before personnel are permitted to enter areas in which the potential for contamination exists. Personnel who perform decontamination for the ER Program must certify that they have read and understood decontamination procedures, as well the procedures in the current version of the IWP.

9.1 Preventing Contamination

Effective decontamination is promoted by minimizing contamination at the outset. The following preventive measures are included in the ER Program's SOPs for decontamination:

- avoiding contact with hazardous substances as much as possible;
- using remote sampling, handling, and container-opening techniques;
- encasing instruments and equipment in bags or coatings;

- bagging or coating the exterior of sample containers; and
- using disposable garments and equipment, when appropriate.

9.2 Decontaminating Equipment

All equipment used during field procedures will be subject to decontamination procedures, except disposable items. The types of equipment to be used during sampling include monitoring equipment, sampling tools, heavy equipment, and vehicles. In addition, contamination must be removed from the exterior of sample containers to prevent exposure to field team members and laboratory personnel. Plastic bags must be sealed with a rubber band at the neck of the container to minimize the potential for gross contamination on the site. The contents of the bags can be transferred to clean bags at the outer boundary of the exclusion zone, and any residual contamination can be removed. The decontamination process must be designed to avoid contaminating the sample.

Reusable protective equipment must be decontaminated using a soap and water wash and two successive rinses. All heavy equipment and vehicles suspected of contamination must be steam-cleaned using high-pressure washers. All decontamination rinsate must be collected in approved containers.

9.3 Decontaminating Personnel

Personnel decontamination procedures will accommodate personnel who must use Levels B, C, and D protection, depending on the sampling activities involved. Personnel decontamination should be performed for all levels of protection. The degree of decontamination required depends on the nature and magnitude of contamination.

9.4 Decontamination Support

If the sampling crews need assistance with decontamination, field team members will serve as support. Support team responsibilities include setting up the decontamination line, maintaining supplies, briefing the sampling crews in the decontamination line, and implementing emergency decontamination plans.

During the briefing sessions for the decontamination process, the support team will apprise the sampling crew of the proper steps and activities at each station. In cases in which a relatively involved decontamination line exists, the sampling crews will perform a dry run before the decontamination line begins to operate.

Emergency decontamination may be necessary for persons who must evacuate the site under emergency conditions or because of injury. These procedures are described in Section 10 of the H&S program plan. It is imperative that the support team be prepared to perform these procedures.

The level of protection used by the support team will depend on the degree of contamination anticipated. In general, the support team will use Level C protection when field team members are dressed in Level B or C clothing. A decontamination support team will not be necessary when Level D protection is used.

9.5 Disposal Procedures

Disposable clothing and equipment will not need to be decontaminated but will be considered hazardous waste. In addition, all decontamination solutions and rinse water will be contained, collected, and disposed as suspected hazardous waste. Arrangements will be made with the Laboratory for acquiring and disposing of drums containing soapy water, rinse water, methanol, and trash.

9.6 Verifying Decontamination

HS-1 must approve and oversee the decontamination of any equipment or protective gear to be removed from a contaminated area to a controlled or uncontrolled area. Protective gear and equipment will be visually inspected for the effectiveness of decontamination. Screening will be performed with a radiation detector in accordance with applicable procedures and guidance.

10.0 EMERGENCY RESPONSE PROCEDURES

This section presents the emergency response plan, describes contingency plans for specific types of emergencies, describes the actions required by the Laboratory in the event of a release of radioactive and/or toxic materials, and outlines pertinent requirements for notification and documentation of emergencies. Additional references for this section include Sections 6 and 13.2 of the H&S program plan; Laboratory AR 1-1, Accident/Incident Reporting; AR 1-2, Emergency Preparedness; AR 1-8, Working Alone; and Laboratory TB 101, Emergency Preparedness.

The site safety officer, with the assistance of the foreman, will have responsibility and authority for coordinating all emergency response activities until the proper authorities arrive and assume control. A copy of the emergency response plan will be available at the site at all times, and all personnel working at the site will be familiar with the plan.

10.1 Emergency Response Plan

This section describes the elements of the emergency response plans for OU 1071. These plans will be adjusted for conditions specific to each SWMU.

10.1.1 Emergency Contacts

The names of persons and services to contact in case of emergencies will be provided when the form in Attachment III-2 is completed. This emergency contact form will be copied and posted in a prominent location at the site. Two-way radio communication will be maintained at remote sites, when possible.

10.1.2 Site Mapping

A copy of the site map will be modified to indicate the following areas of importance in the emergency response plan:

- hazardous areas;
- site terrain (topography, buildings, barriers);
- site accessibility by road and air (indicating current detours);
- locations of work zones and work crews;
- surrounding population and land use (residences, businesses, etc.);
- shelters and safe areas; and
- evacuation routes.

10.1.3 Site Security and Control

In an emergency, the foreman (or a designee) is responsible for controlling the entry of personnel into hazardous areas and accounting for all individuals on the site. Depending on the nature and size of the SWMU, a checkpoint will be established in advance for control. The buddy system will remain in effect at all times for personnel working on the site. If a security problem occurs, one short blast will be sounded from an air horn, and field team members will remain in place to await instructions from security.

10.1.4 Communications

Internal communication refers to communication between field team members. The objectives of internal communication are to alert workers of danger, convey safety information, and maintain site control. Routine communications for OU 1071 will depend on the area represented by the work zones and the tasks associated with that area. When there is substantial distance between the workers who provide support and the workers who conduct sampling activities, two-way radio communication will be used. A set of predetermined hand signals will be used if radio communication fails. This contingency is especially important for workers wearing Levels B and C protective equipment.

Emergency communication will also be established for the site. An air horn will be used to notify field team members of the following conditions:

- major fire—two long blasts,
- major release of hazardous substances—two short blasts,
- minor fire or release—one long blast, and
- security problem—one short blast.

A description of all signals will be posted in a prominent location at the site.

External communication will be necessary to request assistance or to notify the appropriate authorities about hazardous conditions that may impact public or environmental safety. The names and phone numbers of appropriate contacts will be posted in a prominent location. If a telephone is not available on the site, the nearest public telephone will be located before sampling begins. All site personnel must be informed of this location.

Communication protocols will be explained at the daily tailgate safety meetings and will be reviewed at least once a week for the duration of sampling activities.

10.1.5 Evacuation Routes and Procedures

If a fire, explosion, or release of potentially hazardous materials occurs, field team members may need to retreat to a safe area or evacuate the site. The procedures for evacuation will depend on the nature and size of the SWMU under investigation.

If the area is relatively small and/or unconstrained, field team members will be able to exit the exclusion zone at the most convenient point, preferably in the upwind direction. Areas that are expected to be safe will be indicated on the site map. At sites in which a relatively large exclusion zone exists or in areas that are constrained in some way (for example, surrounded by a fence, located within a trench, bordered by steep cliffs), evacuation routes will be established in advance and will be illustrated on the site map. In either case, all field team members will report to a designated checkpoint to be accounted for by the foreman. All field team members will be informed of the evacuation procedures specific to each SWMU.

10.1.6 Emergency Equipment and Supplies

The site safety officer (or a designee) will be responsible for maintaining emergency equipment and restocking supplies. The type and amount of emergency equipment will be selected based on the potential hazards.

10.2 Specific Emergencies

10.2.1 Fire and Explosion

Fire extinguishers may be effective for small, contained fires. An air horn will be used to signal one long blast for a minor fire or release. Field team members will meet and be counted at a designated checkpoint. Two long blasts will signal evacuation for a major fire or explosion. Field team members will report to a specified location (such as evacuation vehicles) and move away from the fire. A predesignated individual will locate the nearest phone at a safe distance and call the Los Alamos County Fire Department at 911. If an explosion occurs, all personnel will be evacuated and no one will re-enter the work area until it has been cleared by Laboratory explosives safety personnel.

10.2.2 Radiation and Chemical Exposures

A minor release of potentially hazardous materials will be indicated by one long blast with an air horn. All personnel will assemble at the designated checkpoint and will be counted by the foreman (or a designee). The site safety officer will issue specific instructions.

Two short blasts with an air horn will alert field team members of a major release involving hazardous or radioactive materials. A portable wind sock or streamer will be positioned at each site. Field team members will meet at a checkpoint upwind of the release. If the source of the release is directly upwind, field team members will move to the exit and away from the plume. Once the team achieves a safe distance, the foreman and the site safety officer will account for all site personnel. The site safety officer will determine a further course of action.

Exposure to radiation and/or chemicals will be reported to the Laboratory's Occupational Medicine Group (HS-2). The Los Alamos County Medical Center will be notified of life-threatening or serious exposures. If a worker is exposed to hydrofluoric acid, a special paste must be obtained from HS-2 and applied to the affected area, and the medical center must be notified immediately.

10.2.3 Injuries

Minor injuries may be treated on the site by trained personnel. Seriously injured victims will be transported to a medical facility as soon as possible (Figure III-2). The Los Alamos County Fire Department provides emergency transport services. If an injured person has been contaminated with chemicals, decontamination will be performed only if it will not aggravate the injury. Emergency decontamination is discussed in Section 10 of the H&S program plan.

10.2.4 Vehicle Accidents and Property Damage

In addition to the required police report, a vehicle accident report must be filed in accordance with DOE requirements. These requirements are described in Section 10.4 of this H&S project plan. Injuries incurred in an accident will be treated in the manner described in Section 10.2.3 of this H&S project plan.

10.3 Provisions for Public Health and Safety

Emergency planning is discussed in the Laboratory's ES&H manual and in Section 6 of the H&S program plan. The Laboratory identifies four situations in which hazardous materials may be released to the environment. These categories are based, in part, on emergency response planning guideline (ERPG) concentrations developed by the American Industrial Hygiene Association and are based on the maximum concentration of toxic material that can be tolerated for up to one hour.

The four types of emergencies are defined as follows:

- Unusual event—An event that has occurred or is in progress that normally would not be considered an emergency but that could reduce the safety of the facility. No potential exists for significant releases of radioactive or toxic materials off the site.

- Site alert—An event that has occurred or is in progress that would substantially reduce the safety level of the facility. Off-site releases of toxic materials are not expected to exceed the concentrations defined in ERPG-1.

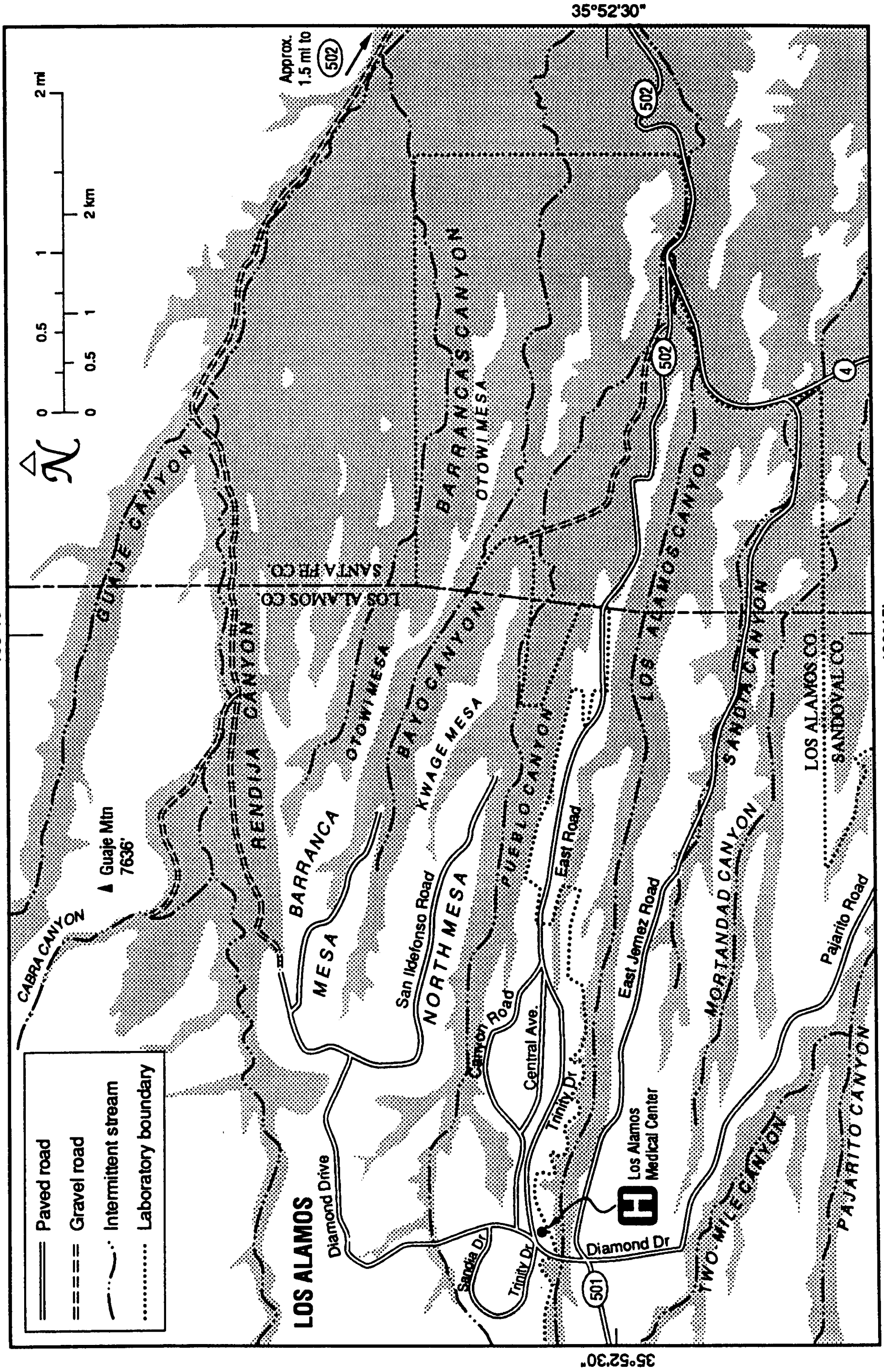


Figure III-2. Evacuation routes to Los Alamos Medical Center.

- Site emergency—An event that has occurred or is in progress and that involves actual or likely major failures of facility functions necessary for the protection of human health and the environment. Releases of toxic materials to areas off the site may exceed the concentrations described in ERPG-2.

- General emergency—An event that has occurred or is in progress that substantially interferes with the functioning of facility safety systems. Releases of radioactive materials to areas off the site may exceed protective response recommendations, and toxic materials may exceed ERPG-3.

The ERPG concentrations, as well as the appropriate emergency response actions, are summarized in Section 6 of the H&S program plan (LANL 1990, 0144).

10.4 Notification Requirements

Field team members will notify the site safety officer of emergency situations. The site safety officer is responsible for notifying the appropriate emergency assistance personnel (e.g., fire, police, ambulance), the OUPL, and the Laboratory's HS Division office in accordance with DOE Order 5500.28B (DOE 1991, 0736), DOE Order 5000.3 (DOE/AL 1991, 0734) and 5500.2B (DOE 1991, 0736). The HS Division Office is responsible for implementing notification and reporting requirements in accordance with DOE Order 5484.1.

10.5 Documentation

An unusual occurrence is any deviation from the planned or expected behavior or course of events in connection with any DOE or DOE-controlled operation if the deviation has environmental protection, safety, or health protection significance. Examples of unusual occurrences include any substantial degradation of a barrier designed to contain radioactive or toxic materials or any substantial release of radioactive or toxic materials. Proper reporting procedures are described in Section 13.2 of the H&S program plan.

The OUPL or his/her designated representative will submit the appropriate completed DOE Order Form 5484.___ for any of the following accidents and incidents, in accordance with Laboratory AR 1-1, Accident/Incident Reporting:

- Occupational injury is any injury, such as a cut, fracture, sprain, or amputation, that results from a work accident or from an exposure involving a single incident in the work environment. Conditions resulting from animal bites, such as insect or snake bites or from one-time exposure to chemicals, are considered injuries.

- Occupational illness of an employee is any abnormal condition or disorder, other than one resulting from an occupational injury, that is caused by exposure to environmental factors associated with employment. It includes acute and chronic illnesses or diseases that may be caused by inhalation, absorption, ingestion, or direct contact with a toxic material.

- Regardless of fault, accidents that cause damage to DOE property, including damage to facilities, inventories, equipment, and properly parked motor vehicles, or accidents in which DOE may be liable for damage to a second party are reportable when damage is $1,000 or more. Damage to or by a DOE vehicle is excluded.

- Accidents involving government motor vehicles that result in damages of $150 or more or that involve an injury are reportable to the DOE unless the government vehicle is not at fault and the occupants are uninjured. Accidents are also reportable to DOE if

  - damage to a government vehicle not properly parked is greater than or equal to $250,

  - damage to DOE property is greater than or equal to $500 and the driver of a government vehicle is at fault,

  - damage to any private property or vehicle is greater than or equal to $250 and the driver of a government vehicle is at fault, and

  - any person is injured and the driver of a government vehicle is at fault.

The H&SPL will work with the OUPL and the foreman to ensure that health and safety records are maintained with the appropriate Laboratory group as required by DOE orders. The pertinent orders are

- DOE/AL Order 5000.3, Unusual Occurrence Reporting System;

- DOE Form F 5484.3, Attachment # I; Supplementary Record of Occupational Injuries and Illnesses, DOE Order 5484.1 (DOE 1990, 0733);

- DOE Form F 5484.4, Tabulation of Property Damage Experience; Attachment 2 DOE Order 5484.1;

- DOE Form F 5484.5, Report of Property Damage or Loss, Attachment 4 DOE Order 5484.1;

- DOE Form F 5484.7, Annual Summary of Exposures Resulting in Internal Body Depositions of Radioactive Materials; Attachment 14 DOE Order 5484.1;

- DOE Form F 5484.8, Termination Occupational Exposure Report, Attachment 10 DOE Order 5484.1;

- OSHA (Form) No. 200, Log of Occupational Injuries and Illnesses; Attachment 7 DOE Order 5484.1;

- DOE Form EV-102A, Summary of Department of Energy and Department of Energy Contractor Occupational Injuries and Illnesses; Attachment 8 DOE Order 5484.1 and DOE 5484.1 Chapter IV; and

- DOE Form F 5821.1, Radioactive Effluent/Onsite Discharges/ Unplanned Releases; Attachment 12, DOE Order 5484.1

Copies of these reports will be stored at the Records-Processing Facility. Specific reporting responsibilities are given in Chapter 1, General Administrative Requirements, of the Laboratory's H&S manual.

References for Annex III

DOE/AL (US Department of Energy, Albuquerque Operations Office), December 13, 1982. "Environmental Protection, Safety, and Health Protection Program for AL Operations," DOE/AL Order 5480.1A, Change 1, Albuquerque, New Mexico. (DOE/AL 1982, 0729)

DOE/AL (US Department of Energy, Albuquerque Operations Office), October 24, 1986. "Unusual Occurrence Reporting System," DOE/AL Order 5000.3, Albuquerque, New Mexico. (DOE/AL 1986, 0734)

DOE (US Department of Energy), November 16, 1987. "Contractor Occupational Medical Program," DOE Order 5480.8, Washington, DC. (DOE 1987, 0731)

DOE (US Department of Energy), June 29, 1990. "Radiation Protection for Occupational Workers," DOE Order 5480.11, Change 2, Washington, DC. (DOE 1990, 0732)

DOE (US Department of Energy), October 17, 1990. "Environmental Protection, Safety, and Health Protection Information Reporting Requirements," DOE Order 5484.1, Change 7, Washington, DC. (DOE 1990, 0733)

DOE (US Department of Energy), April 30, 1991. "Emergency Categories, Classes, and Notification and Reporting Requirements," DOE Order 5500.2B, Washington, DC. (DOE 1991, 0736)

EPA (US Environmental Protection Agency) 1988, "Standard Operating Safety Guides," S0S6,Office of Emergency and Remedial Response, Hazardous Response Support Division, Environmental Response Team, Washington, DC. (EPA 1988, 0609)

LANL (Los Alamos National Laboratory), March 16, 1992. "Environmental Restoration Standard Operating Procedures," Vols. I and II, Los Alamos, New Mexico. (LANL 1992, 0688)

LANL (Los Alamos National Laboratory), November 1991. "Installation Work Plan for Environmental Restoration," Revision 1, Los Alamos National Laboratory Report LA-UR-91-3310, Los Alamos, New Mexico. (LANL 1991, 0553)

NIOSH (National Institute for Occupational Safety and Health), Occupational Safety and Health Administration, US Coast Guard, and US Environmental Protection Agency, October 1985. "Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities," Report 85-115, Washington DC. (NIOSH et al. 1985, 0414)

OSHA (Occupational Safety and Health Administration), July 1, 1991. "Hazardous Waste Operations and Emergency Response," Code of Federal Regulations, Title 29, Part 1910, Washington, DC. (OSHA 1991, 0610)

ATTACHMENT III-1

HEALTH AND SAFETY CHECK LIST

H&S PROJECT PLAN FOR OPERABLE UNIT 1071

HEALTH AND SAFETY CHECK LIST Page 1 of 6		
TRAINING	**YES**	**NO**
Is a daily tailgate safety meeting held and documented?		
Are all visitors to the site properly signed in and given site-specific orientation and safety training?		
Are all persons entering the site informed of the contents of the health and safety project plan and required to sign a statement indicating such?		
Have all persons entering the site received the appropriate hazardous waste training and is this training documented?		
Have all persons entering the site received a respirator fit test and training?		
Have all persons entering the site received training (hazard communication) on all hazards that may be encountered?		
Have all persons entering the site received the required physical examination?		
Is the H&S project plan available for on-site inspection and review by employees, etc.?		
Are emergency reporting and evacuation procedures known by each person on the site and documented on the emergency contact sheet ?		
Are all persons who enter confined spaces properly trained?		
Is the site-specific organizational structure chart posted at the job site?		
Are personnel who work on or near drill rigs instructed in the location and use of the rig's "kill" switch?		
Do operators of heavy equipment and cranes possess appropriate and up-to-date required licenses, certifications, and permits?		
Are copies of all training records kept on the site?		
INSPECTIONS	**YES**	**NO**
Are regulated areas established and defined for each work area in which contaminated materials may be present?		

	YES	NO
Is hearing protection worn in areas in which sound levels are suspected or shown to exceed 85 dBA?		
HEALTH AND SAFETY CHECK LIST Page 2 of 6		
INSPECTIONS (continued)	**YES**	**NO**
Are all persons on the site using the minimum protective equipment (hard hat, safety glasses with side shields or goggles, steel-toed safety shoes) and appropriate clothing for the anticipated hazards?		
Is there a multipurpose dry-chemical fire extinguisher on each piece of heavy equipment?		
Are all fire extinguishers inspected monthly?		
Is the "no smoking" policy enforced?		
Are approved safety containers used to store fuels?		
Do all contaminated scrap, waste, debris, and clothing containers have labels?		
Is the food and beverage consumption prohibition enforced in the regulated area?		
Is soap and water available so that employees can wash their faces and hands before eating and drinking?		
Are contaminated materials stored in tightly closed containersand are they located in well-ventilated areas?		
Does all heavy equipment have a functioning back-up alarm?		
Is the "buddy system" in use throughout the site?		
Is access to the regulated areas controlled so that only authorized personnel are permitted to enter?		
Is a daily log maintained of persons entering the regulated area?		
If benzene is present, are warning signs and benzene hazard signs posted?		
Are MSDSs for the hazardous materials posted at the site?		
Are contact lenses removed before donning respiratory protection?		
Are all persons required to wear respirators clean-shaven before each day's shift?		

HEALTH AND SAFETY CHECK LIST Page 3 of 6		
INSPECTIONS (continued)	**YES**	**NO**
Are adequate potable liquids provided at the job site?		
Is air monitoring conducted periodically?		
Are air-monitoring instruments calibrated daily before use?		
Are emergency services and equipment available at the site and is equipment in appropriate condition?		
Are provisions made for adequate flushing of the skin or eyes in the event of contaminated exposure?		
Are dry-chemical ABC fire extinguishers provided at each site?		
Do all work activities begin after sunrise and end before sunset?		
Are potable water containers clearly marked as to their contents and not used for any other purpose?		
Are outlets for nonpotable water clearly marked?		
If permanent toilet facilities are unavailable, are chemical toilets provided?		
Do employees shower when leaving the hazardous waste site and at the end of their work shift?		
Are appropriate warning signs placed around open excavations?		
Are excavations sloped (1 ft to 1 ft) or shored if more than 4 ft deep?		
Is a standby person available when entry into an excavation is required?		
Are appropriate access methods, such as ladders, used to enter the excavation?		
Are equipment and materials stored and handled at all times so as not to endanger personnel?		
Is a check-in/check-out roster maintained at the site?		
Are crane operators controlling the lift area maintaining a safe perimeter to prevent any site personnel from coming under or within an unsafe distance of a live loa ?		

HEALTH AND SAFETY CHECK LIST

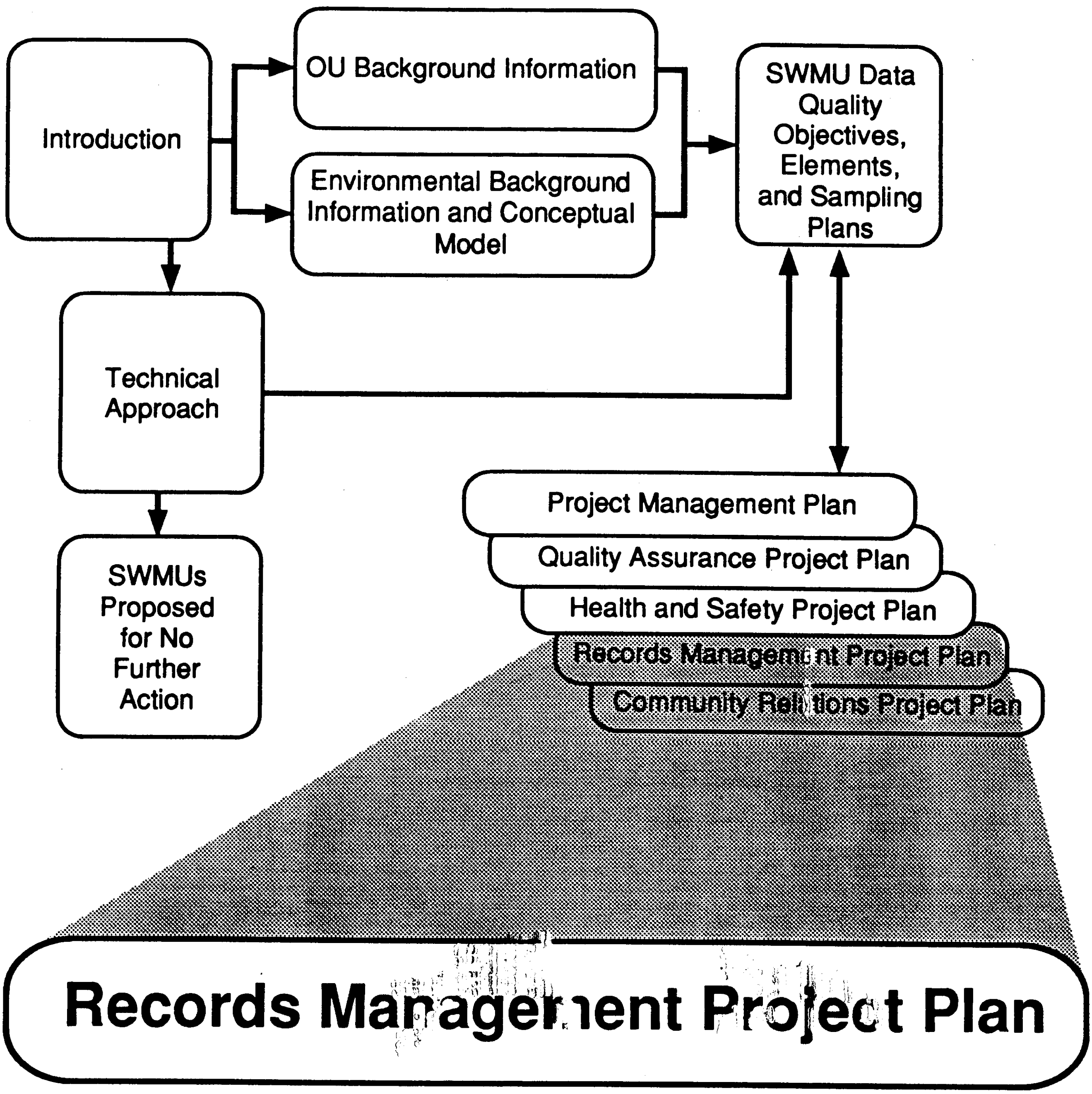
Page 4 of 6

INSPECTIONS (continued)	YES	NO
If personnel are required to work in or near high-traffic areas, are they wearing fluorescent orange and/or reflective clothing or vests?		
Are vehicles not actively used in operations parked so that they do not interfere with work or traffic?		
Are cutting and welding operations not allowed within 300 ft of a potential liquid fuel source or a building?		
Are supplied-air respirators required for employees performing hot work on painted, galvanized, coated, or previously contaminated metal?		
Are two 10-lb or more ABC multipurpose fire extinguishers available in the immediate vicinity of hot work?		
Are seat belts used by persons riding in/on vehicles and equipment?		
Are personnel riding in/on vehicles or equipment in a manner designated for the conveyance of people?		
Is heavy equipment other than cranes used to lift material properly equipped and is it designed to do so?		
Is a safety inspection report for drilling equipment completed by the drilling operator before beginning any site work?		
Is all equipment used to handle or transfer flammable liquids bonded and grounded, sparkproof, and explosionproof, as appropriate?		
Are all fuels stored in approved safety containers?		
Are fuel storage locations marked with the warning signs "Flammable Liquids" and "No Smoking"?		
Are sparkproof hand tools used when working with flammable and combustible materials or when breaking lines?		
Are safety glasses and gloves worn when handling or hooking up compressed gas cylinders?		
Are compressor hose segments secured by chains and/or locking pins?		
Are all electric connections made through a GFCI?		

HEALTH AND SAFETY CHECK LIST Page 5 of 6		
INSPECTIONS (continued)	**YES**	**NO**
Are extension cords routed and stored to prevent damage and tripping hazards?		
Does a second person secure or steady a ladder while an employee is ascending and descending?		
Is stockpiled soil piled at an angle less than 45° and at least 2 ft from the edge of an excavation?		
Is the regulated area isolated from the rest of the work site in a manner that minimizes the number of employees exposed to site containers?		
If heat stress is a concern, has a work/rest regimen been established and implemented, including physiological monitoring?		
If contaminants at the site are unknown, is Level B protection worn?		
Are suitable quantities of absorbent and drums and labels that comply with DOT, OSHA, and EPA regulations on hand at locations in which leaks, spills, or ruptures may occur?		
Have procedures for all phases of decontamination been developed and implemented?		
Is the direction of emergency egress away from high-hazard areas?		
Are means of emergency egress maintained free of obstructions and available for full and instant use?		
Are work areas kept clean and in good repair, with no unnecessary holes or openings?		
Are wastes (noncontaminated) kept in a closed, nonleaking sanitary container and are they removed as often as necessary and appropriate in a manner that avoids creating a health or safety problem?		
Are appropriate labels provided on all chemical containers?		
Are storage areas free of materials that could constitute a hazard from tripping, fire, explosion, or pests?		

	YES	NO
Is vegetation within the site controlled?		
HEALTH AND SAFETY CHECK LIST Page 6 of 6		
INSPECTIONS (concluded)	**YES**	**NO**
Is electrical equipment free of recognizable hazards that could cause injury?		
Are all machines maintained to prevent someone from being in the danger zone during the operating cycle?		
Are electrical equipment, cords, plugs, and cord sets inspected each day for external defects; deformed, broken, or missing pins; insulation damage, and indications of internal damage?		
Are extension cords protected from damage?		
Are flexible cords used only in continuous lengths without splices or tape?		
If compressed air is used, is it reduced to 30 lb/in.^{2} or less with a chip guard?		

ANNEX IV


Introduction
OU Background Information
Environmental Background Information and Conceptual Model
SWMU Data Quality Objectives, Elements, and Sampling Plans
Technical Approach
SWMUs Proposed for No Further Action
Project Management Plan
Quality Assurance Project Plan
Health and Safety Project Plan
Records Management Project Plan
Community Relations Project Plan
Records Management Project Plan

1.0 INTRODUCTION

The Records Management Program Plan (program plan) for the Environmental Restoration (ER) Program at Los Alamos National Laboratory (the Laboratory) is described in Annex IV of the Installation Work Plan (IWP) (LANL 1991, 0553). The purposes of the program plan are to meet the requirements for protecting and managing records (including technical data), to provide an ongoing tool to support the technical efforts of the ER Program, and to function as a support system for management decisions throughout the existence of the ER Program.

The ER Program uses the following statutory definition of a record (44 USC 3301):

> Records are defined as "...books, papers, maps, photographs, machine-readable materials, or other documentary materials, regardless of physical form or characteristics,...appropriate for preservation...because of the informational value of the data in them."

The program plan establishes general guidelines for managing records, regardless of their physical form or characteristics, that are generated and/or used by the ER Program. The program plan will be implemented consistently to meet the requirements of the Quality Assurance Program Plan (Annex II of the IWP) and to provide an auditable and legally defensible system for records management. Another important function of the program plan is to maintain the publicly accessible documentation composing the administrative record required by the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA).

2.0 Implementation of the Records Management Program Plan

Chapter 2 of the program plan describes the implementation of the records management program. Records management activities at Operable Unit (OU) 1071 will follow the guidelines summarized in that chapter. As the program plan develops to support OU needs, additional detail will be provided in annual updates of the IWP.

The program plan incorporates a threefold approach based on records control and commitment to quality guidelines: a structured work flow for records, the use of approved procedures, and the compilation of a referable information base. ER Program records are those specifically identified in quality procedures (QPs), administrative procedures (APs), standard operating procedures (SOPs), ER program and project plans, management guidance documents, and records identified by ER Program participants as being essential to the program. The records management procedure (LANL-ER-AP-02.1) governs records management activities, which include records identification, submittal, review, indexing, retention, protection, access, retrieval, and correction (if necessary). Other procedures, such as LANL-ER-AP-01.3 (Review and Approval of Environmental Restoration Program Plans and Reports), LANL-ER-AP-01.4 (Distribution of Controlled Documents Prepared for the Environmental Restoration Program), and LANL-ER-AP-01.5 (Revision or Interim Change of Environmental Restoration Program Controlled Documents), are also followed.

Records (including data) will be protected in and accessed through the referable information base. The referable information base includes all the information systems maintained at the Records-Processing Facility (RPF) and the Facility for Information Management, Analysis, and Display (FIMAD). RPF personnel receive ER Program records, assign an ER identification number, and process records for delivery to the FIMAD. The RPF will complement FIMAD in certain aspects of data capture, such as scanning. The RPF also functions as an ER Program reference library for information that is inappropriate either in form (e.g., old records) or in content (e.g., Federal Register) for storage at the FIMAD. FIMAD provides the hardware and software necessary for data capture, display, and analysis. The information will be readily accessible through a network of work stations. Configuration management accounts for, controls, and documents the planned and actual design components of FIMAD.

3.0 Use of ER Program Records Management Facilities

The RPF and FIMAD will be used for managing records resulting for work conducted at OU 1071. Interaction with these facilities is described in LANL-ER-AP-2.01, the program plan, and other program procedures and management guidance documents, as appropriate.

4.0 Coordination with the Quality Program

Records will be protected throughout the process, as described in Chapter 4 of the program plan and in LANL-ER-AP-02.1. The originator is responsible for protecting records until they are submitted to the RPF. The level of protection afforded by the originator will be commensurate with the value of the information contained in the record. Upon receipt of a record, the RPF will temporarily store the original of the record in one-hour, fire-rated equipment and will provide a copy of the record to the FIMAD. The RPF will then send the original record to a dual-storage area for long-term storage in a protected environment.

5.0 Coordination with the Health and Safety Program

The Laboratory's Occupational Medicine Group (HS-2) will maintain medical records because of their confidential nature. Training records will be maintained by appropriate custodians in coordination with Laboratory/DOE policy and will take into account the specific needs of the ER Program. The FIMAD will contain information about the completion of training, dates of required refresher training, and similar information, as well as the specific location of training records for program participants.

6.0 Coordination with the ER Program's Management Information System

Specific reporting requirements are ER Program deliverables and, as such, are monitored through the ER Program's management information system. Records resulting from work conducted at OUs contribute to the development of these deliverables.

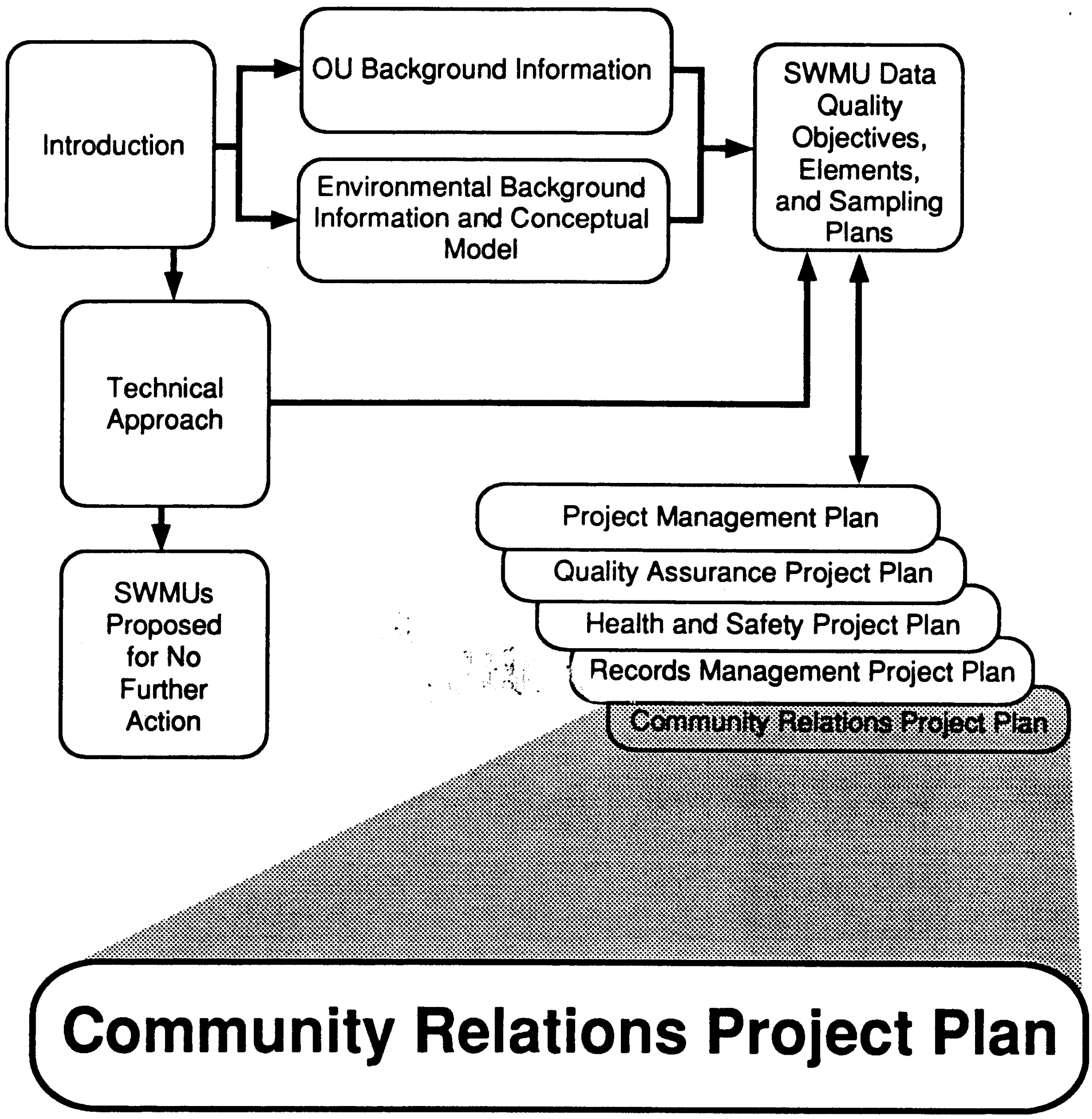
7.0 Coordination with the Community Relations Program

RCRA requires that records be made available to the public; CERCLA requires that administrative records be made available to the public. Two complementary methods of providing information to the public—hard copy and electronic access—are being implemented. The community reading room allows public access to hard copies of key documents. A work station and necessary data links are being prepared to allow public access to the FIMAD data base.

References for Annex IV

Los Alamos National Laboratory, November 1991. "Installation Work Plan for Environmental Restoration," Revision 1, Los Alamos National Laboratory Report LA-UR-91-3310, Los Alamos, New Mexico (LANL 1991, 0553).

ANNEX V


Introduction
OU Background Information
Environmental Background Information and Conceptual Model
SWMU Data Quality Objectives, Elements, and Sampling Plans
Technical Approach
SWMUs Proposed for No Further Action
Project Management Plan
Quality Assurance Project Plan
Health and Safety Project Plan
Records Management Project Plan
Community Relations Project Plan
Community Relations Project Plan

1.0 OVERVIEW OF COMMUNITY RELATIONS PROJECT PLAN

The Community Relations Project Plan specific to Operable Unit (OU) 1071 follows the directives, goals, and regulatory requirements set forth in the Community Relations Program Plan in Annex V of the Installation Work Plan (IWP) for Environmental Restoration (ER) (LANL 1991, 0553). This annex describes the community relations activities for OU 1071 during the Resource Conservation and Recovery Act (RCRA) facility investigation (RFI). The activities are based on current knowledge of public information needs and resources available to the Los Alamos National Laboratory (Laboratory) ER Program staff.

As shown in Figure V-1, public participation is required by regulation during the corrective action process; therefore, the Laboratory will provide opportunities for public participation during the five-year RFI process as described in this project plan and as illustrated in Figure V-2. The Hazardous and Solid Waste Amendments (HSWA) Module of the Laboratory's RCRA facility permit (EPA 1990, 0306) requires that the following be addressed in community relations plans:

- establishing a mailing list of interested parties;
- providing to the public news releases, fact sheets, approved RFI work plans, RFI final reports, special permit conditions reports, phase reports, and quarterly progress reports that explain the progress and conclusions of the RFI;
- creating a repository for public information and a reading room at which up-to-date information is provided;
- conducting informal meetings for the public and local officials, including briefings and workshops, as appropriate;
- conducting public tours and briefings to address individual concerns and questions; and
- establishing procedures for immediate notification of neighboring pueblos and other affected parties of any newly discovered off-site release(s).

These items are addressed in Sections 2.1 through 2.6 of this plan.

All information concerning ER Program activities at OU 1071 will originate with or be provided to the public through the community relations project leader:

Community Relations Project Leader
Environmental Restoration Program
Los Alamos National Laboratory
2101 Trinity Drive, Suite 20
Los Alamos, New Mexico 87545
(505) 665-2127

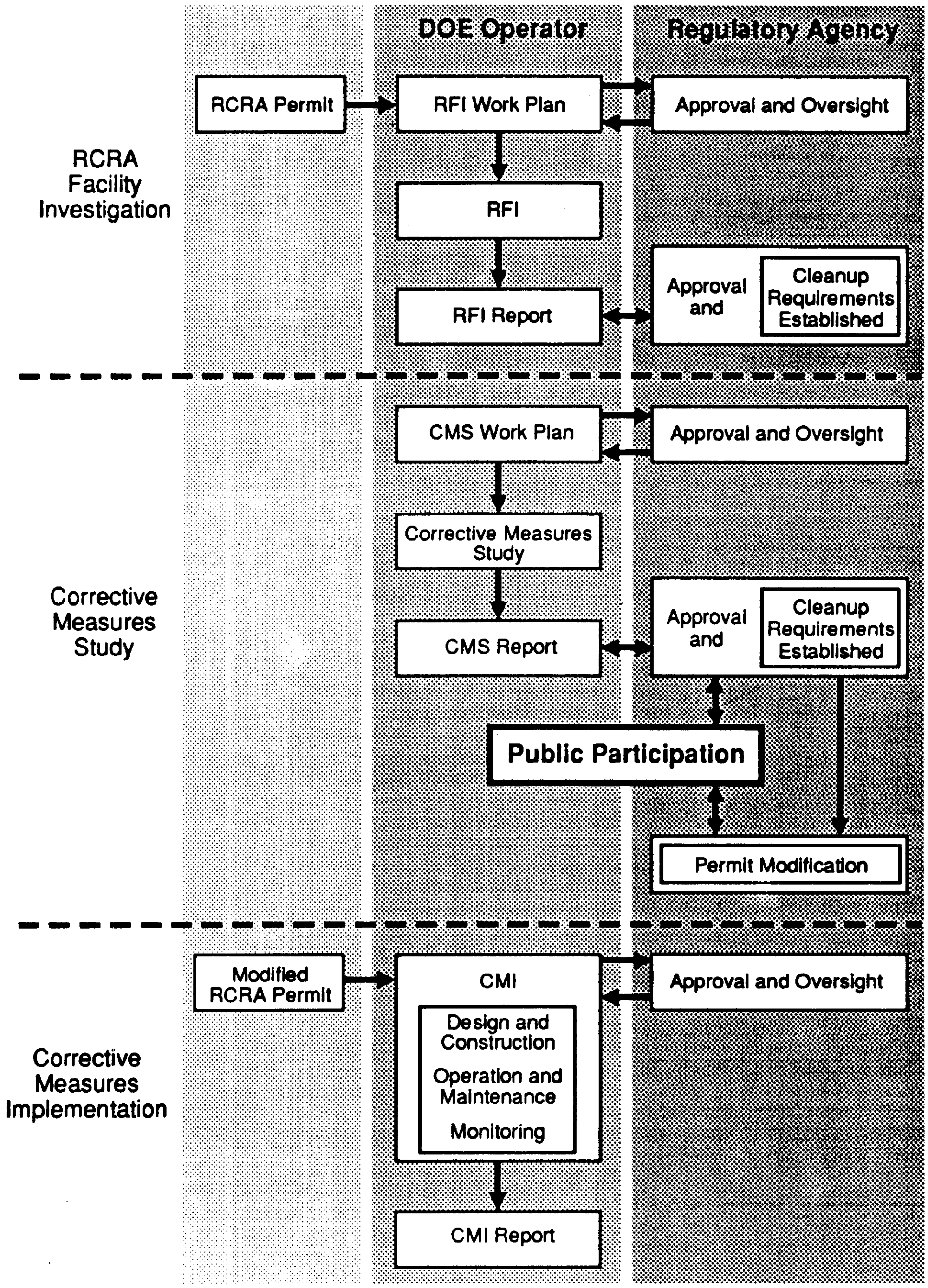


Figure V-1. Opportunities mandated by regulation for public participation during the RCRA corrective action process.

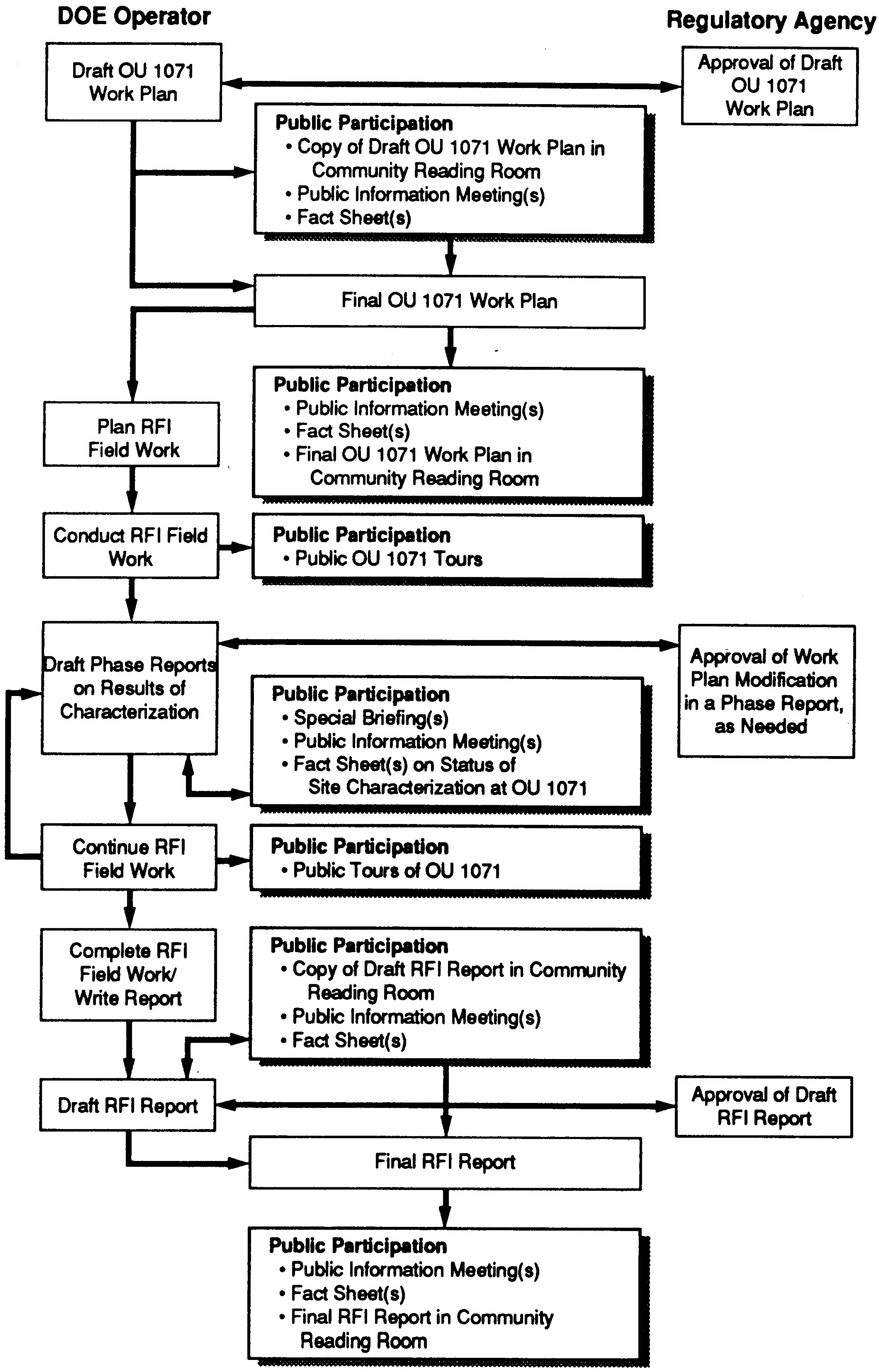


Figure V-2. Opportunities for public participation during the OU 1971 RFI.

2.0 Community Relations Activities

The following subsections provide a brief description of community relations activities to be conducted at OU 1071 during the RFI activities. The scope of each activity can be tailored to respond to public information needs.

2.1 Mailing List

The Community Relations Office will add to the ER Program mailing list any residents and businesses identified as owning property adjacent to OU 1071 and current and former workers at OU 1071 to keep them informed of meetings, activities, and schedules pertaining to the OU.

2.2 Fact Sheets

The Community Relations Office has developed a fact sheet that contains a single map inset and that shows OU 1071 and summarizes site history and use, known contaminants of concern, and planned activities (Attachment 1). The fact sheet was mailed to all affected property owners in August 1991. These fact sheets will be updated to reflect changes in public needs and progress made during the remediation process. A map showing SWMU locations in OU 1071 will be available for public review in the ER Program's public reading room.

2.3 ER Program Reading Room

As they are developed, documents and data associated with OU 1071 (such as the RFI work plan, quarterly technical progress reports, and the RFI report) will be made available to the public at the ER Program Community Reading Room from 9 am to 4 pm on Laboratory business days. A draft copy of the RFI work plan for OU 1071 will be available at the reading room in May 1992.

2.4 Public Information Meetings, Briefings, Tours, and Responses to Inquiries

Public information meetings have been held in Los Alamos to introduce the community to the ER Program and to present a brief overview of the OUs in the townsite. The Laboratory and Department of Energy plan to hold quarterly public information meetings to discuss specific activities and significant milestones during the RFI. Tours will be conducted for interested parties upon request.

If an issue of concern but of limited interest is raised at a public information meeting, a subsequent special briefing or a one-to-one meeting may be necessary. The community relations project leader and the OU project leader will coordinate responses to such inquiries.

2.5 Quarterly Technical Progress Reports

As the RFI for OU 1071 is implemented, the Laboratory will summarize technical progress in quarterly technical progress reports, as required by the HSWA Module (Task V, C, p. 46). These reports will be available at the ER Program Community Reading Room.

2.6 Procedures for Public Notice

The ER Program is preparing an administrative procedure that will be followed to notify property owners of the presence of a solid waste management unit on or near their property. In addition, the ER Program is preparing an administrative procedure pertaining to requesting and obtaining property access agreements for RFI sampling activities on properties not owned by the Department of Energy.

2.7 Informal Public Review and Comment on the Draft RFI Work Plan for OU 1071

The Laboratory will encourage public comment on the field sampling proposed in the draft work plan for OU 1071 after the Environmental Protection Agency has formally approved this document, which was submitted in May 1992. Public comment regarding numbers of samples, types of samples, and quality assurance samples (e.g., duplicate samples) will be incorporated, as appropriate, in the final RFI work plan for OU 1071.

References for Annex V

EPA (US Environmental Protection Agency), April 10, 1990. Module VIII of RCRA Permit No. NM0890010515, EPA Region VI, issued to Los Alamos National Laboratory, Los Alamos, New Mexico, effective May 23, 1990, EPA Region VI, Hazardous Waste Management Division, Dallas, Texas. (EPA 1990, 0306)

LANL (Los Alamos National Laboratory), November 1991. "Installation Work Plan for Environmental Restoration," Revision 1, Los Alamos National Laboratory Report LA-UR-91-3310, Los Alamos, New Mexico. (LANL 1991, 0553)

ATTACHMENT I

FACT SHEET FOR OPERABLE UNIT 1071

Fact Sheet for Operable Unit 1071
(Technical Areas 4, 5, 35, 42, 48, 52, 55, 63, and 66)

- An Operable Unit is a logical grouping of potential contaminated release sites called Solid Waste Management Units (SWMUs). Operable Unit 1071 consists of SWMUs identified in formerly utilized Technical Areas (TAs) 0, 19, 26, 73, and 74. The area encompassed by TAs 19, 26, and 74 is presently not in use by the Department of Energy (DOE) with the exception of environmental surveillance activities for the Laboratory. TA-73, site of the Los Alamos Airport, is operated by Johnson Controls, Inc. for DOE. TA-0 consists of a large number of geographically separated sites located outside current and former Laboratory boundaries. The TA-0 sites are presently under various ownerships (i.e., Los Alamos County, U.S. Forest Service, DOE, commercial industries, and private residences).

- Laboratory operations conducted at TA-0 included the use of surface impoundments, disposal areas, wastewater treatment and septic systems, drum storage, fuel storage tanks, effluent lines, transformers, and firing ranges. Radiation experiments were conducted at TA-19. TA-26 was used to store various radiation sources. Past operations at TA-73 included use of the area for landfills, incineration, steam cleaning, high explosive storage, waste oil disposal, surface disposal, and septic systems. TA-74 has not been used for Laboratory operations and has served as a safety buffer zone.

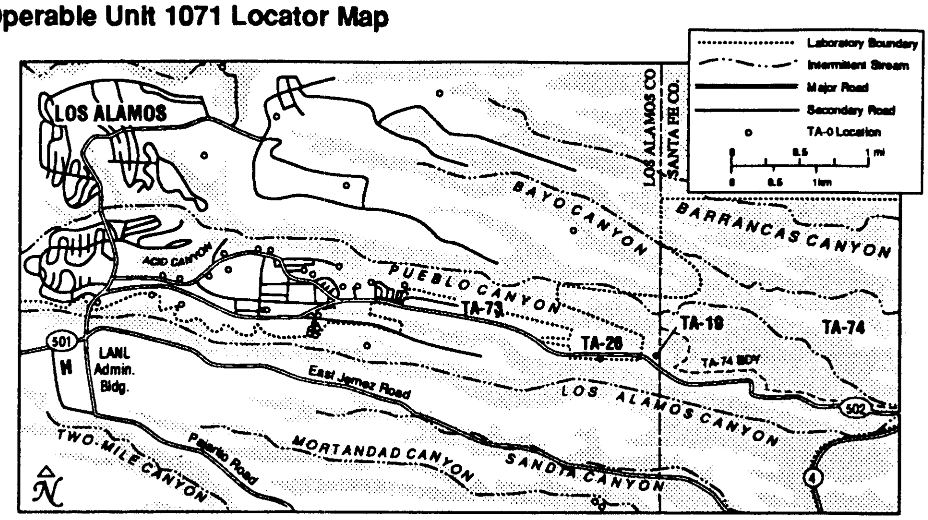
- Laboratory operations at Operable Unit 1071 began in 1943. Although most activities had ceased by 1986, ongoing Laboratory operations include surface impoundments, a firing range, wastewater treatment, and drum storage in TA-0.

- The Laboratory is developing a work plan describing procedures to verify past cleanups or determine specific areas of residual contamination in Operable Unit 1071. Sampling and studies are scheduled to be initiated during 1992.

- For many years, the Laboratory has conducted a comprehensive environmental monitoring and surveillance program in Los Alamos County and throughout Northern New Mexico. The program is designed to identify releases from Laboratory operations which could pose a health risk to individuals living in the communities surrounding the Laboratory. No contamination is known to exist on private property which threatens the health and safety of local residents. This finding is based on assessment of technical data gathered from this program. If an imminent health threat is found, immediate action will be taken by DOE and the Laboratory.

- Contamination of the drinking water supply is unlikely as the main aquifer is at least 700 feet below site surfaces.

Operable Unit 1071 Locator Map



BACKGROUND OF OPERABLE UNIT 1071

Wastes which may have been present in the TAs that comprise Operable Unit 1071 include radioactive materials, laboratory and sanitary wastes, high explosives, building debris, waste oil, diesel fuel, animal carcasses, municipal waste incinerator ash, asphalt manufacturing products, pesticides, and polychlorinated biphenyls (PCBs).

TA-0 is comprised of sites located on land owned by DOE, Los Alamos County, National Forest Service, General Services Administration, and San Ildefonso Pueblo. TA-0 sites include:

- Inactive drum storage areas at the Western Steam Plant and the DP-Road Storage Area
- A study area in Mortandad Canyon
- Inactive impact areas in Rendija Canyon
- Inactive and active firing ranges in Rendija Canyon
- Inactive industrial waste sewer lines beneath the townsite
- The inactive Central Wastewater Treatment Plant
- An inactive cistern on Barranca Mesa
- Inactive effluent discharges to the Los Alamos County Golf Course and the North Mesa Athletic Fields
- Leakage from transformers in Los Alamos and Guaje Canyons, septic systems, and fuel storage tanks as well as active surface impoundments in Mortandad Canyon
- A drum storage area at the 6th Street Warehouse
- The active Pueblo and Bayo Canyon Wastewater Treatment Plants

TA-19, also known as the East Gate Laboratory, lies on DOE land within the current boundaries of TA-72. Beginning in 1944, TA-19 was used for Laboratory activities including spontaneous fission, monkey irradiation experiments, and radioactive source material storage. The site was abandoned in 1974.

TA-26, also known as D-Site, lies within the present boundaries of TA-73 and was the site of a storage vault for radioactive materials from 1946-1966. TA-26 is on DOE land.

TA-73 is located at the site of the Los Alamos Airport on DOE land. Past laboratory activities at TA-73 included incineration, steam cleaning, high explosive storage, waste oil disposal, surface disposal, and landfilling and burning of laboratory and municipal wastes.

TA-74 also known as Otowi Section, is a safety buffer zone located in the northeast corner of the current Laboratory site (see locator map) on DOE land. TA-74 has not been used for any Laboratory operations. Potential contamination is from nearby Laboratory operations.

PREVIOUS CLEANUP IN OPERABLE UNIT 1071

Structures in Operable Unit 1071 were decommissioned through abandonment, relocation, removal to designated disposal areas, or bulldozing over mesa edges into the adjacent canyons. There has been no formal documented decontamination or cleanup activities in Operable Unit 1071 with the exception of the industrial waste sewer lines beneath the townsite which were decontaminated and removed in the 1970s.

FUTURE ACTION AND PROPOSED TIME FRAME

Future action is focused on further assessment of each SWMU in the Operable Unit, the determination of the extent of contamination, and selecting the appropriate action from a spectrum of possible remedial alternatives. The alternatives range from long-term monitoring and institutional controls to excavation and disposal of contaminated soils and restoration. The Hazardous and Solid Waste Amendment (HSWA) module of the Laboratory's Resource Conservation and Recovery Act (RCRA) operating permit specifies the sequence of events by which contaminated areas are identified, characterized, and remediated. The RCRA Facility Investigation (RFI) Work Plan that describes the characterization activities is being developed and is scheduled to be completed by May 1992. RFI characterization activities are scheduled to be initiated by 1992 and completed by 1998. The Corrective Measures Study (CMS), which develops the set of remediation alternatives, is scheduled to begin in 1999 and be completed in 2001.

Ensuring the safe management of past, present, and future waste requires cooperation of government, industry, and the public. The Laboratory's commitment is to provide information to the public, such as this fact sheet, concerning actions taken during investigation and throughout the entire cleanup process. If you have additional questions about Operable Unit 1071 or about the Laboratory's Environmental Restoration Program, please do not hesitate to visit, call, or write:

Environmental Restoration Program
Los Alamos National Laboratory
Box 1663, MS M314
2101 Trinity Drive, Suite 20
Los Alamos, NM 87545
505-665-2127

NAME AND AFFILIATION	EDUCATION AND EXPERTISE	ASSIGNMENT
M. J. Aldrich (EES-1)	Ph.D. Geology 22 years experience in structural geology, tectonics, and related earth sciences; 6 years in geothermal exploration; 2 years in rock mechanics; 2 years in hazardous waste assessment; 3 years in planning and scheduling.	Operable unit project leader
Keith D. Bowers (Roy F. Weston)	M.S. Geochemistry 6 years experience in geologic investigations, drilling operations, hazardous waste assessment, landfill siting studies, UST investigations, and project planning.	Annex I
Gregory P. Brorby (ChemRisk)	B.S. Zoology 8 years experience in toxicology, 3 years in health risk assessment.	Chapters 2, 5
Katherine Campbell (A-1)	Ph.D. Mathematics 11 years experience in statistical sampling, presentation, and evaluation of geochemical, hazardous waste, and chemistry data.	Chapters 2, 5
Robert W. Charles (INC-7)	Ph.D. Geochemistry 25 years experience in geochemistry and related earth sciences, 18 years in hazardous waste assessment.	Chapters 5, 6
Larry M. Coons (Daniel B. Stephens & Associates)	M.S. Civil Engineering 10 years experience in groundwater characterization, conceptual and analytical modeling of groundwater, and applications to engineering designs and compliance with environmental regulations.	Chapters 4, 5
Richard Filemyr (IT Corporation)	M.S. Water Resources Management 3 years experience in hydrology, hazardous waste management, and RCRA permitting.	Chapters 1, 3, 5, 6 Annexes II, III, IV
Charles D. Harrington (EES-1)	Ph.D. Geology 22 years experience in geology and geomorphology, 9 years in environmental geomorphology, including site characterization of hazardous waste sites.	Chapters 4, 5
Peggy Johnson (Daniel B. Stephens & Associates)	M.S. Hydrology 3 years experience in hydrogeology, hydrogeochemistry, groundwater flow and contaminant transport, and environmental characterization and monitoring.	Chapters 4, 5

Les McFadden (University of New Mexico)	Ph.D. Geosciences 15 years experience in soil genesis and applied soil/climate research	Chapters 4, 5
Daniel B. Stephens (Daniel B. Stephens & Associates)	Ph.D. Hydrology 17 years experience in hydrogeology, groundwater monitoring, unsaturated flow, and numerical modeling; 11 years in remediating underground storage tanks, uranium mill tailings licensing, groundwater discharge permits, and solid waste landfill studies.	Chapters 4, 5