Los Alamos Environmental Restoration Records Processing Facility
ER Record I.D.# 0007666

RFI Work Plan for Operable Unit 1129

Environmental Restoration Program

May 1992

A Department of Energy
Environmental Cleanup Program

Los Alamos
NATIONAL LABORATORY

LA-UR-92-800

Received by ER-RPF
JUN 04 1992
YCG

EXECUTIVE SUMMARY

Purpose

This Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) Work Plan is submitted in partial fulfillment of requirements listed in the Hazardous and Solid Waste Amendments (HSWA) Module VIII of Los Alamos National Laboratory's (the Laboratory's) RCRA operating permit. The Laboratory's RCRA Hazardous Waste Permit (NM0890010515), issued by the State of New Mexico, became effective February 19, 1990. HSWA Module VIII, issued by the US Environmental Protection Agency (EPA), became effective May 23, 1990. This Work Plan is being submitted to EPA Region VI by the University of California (UC) and the US Department of Energy (DOE). UC manages the Laboratory's Environmental Restoration (ER) Program for the DOE.

The Laboratory's ER Program implements the requirements set forth in the RCRA operating permit. The ER Program at the Laboratory is patterned after the RCRA corrective action guidance provided by EPA and is guided by specific corrective action requirements in the HSWA Module. This Work Plan is designed to integrate all regulatory requirements that are technically appropriate, including Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), Toxic Substance Control Act (TSCA), National Environmental Policy Act (NEPA), and DOE orders.

The primary purpose of this RFI Work Plan, due to EPA and New Mexico Environmental Division (NMED) on May 22, 1992, is to address a percentage of solid waste management units (SWMUs) listed in Tables A and B of the Laboratory's HSWA Module. The RFI Work Plan for OU 1129 contains 10% (63 of 603) of the SWMUs listed in Table A of the HSWA Module. Twenty-three of the OU 1129 Table SWMUs are also identified in Table B of the HSWA permit as being priority SWMUs. The Tables in the HSWA module are based on the SWMU report prepared by the Laboratory in 1988. The secondary purpose of this Work Plan is to present sampling and analysis plans (SAPs) for characterizing the nature and extent of potential contamination associated with all Table A SWMUs that are not identified as candidates for no further action (NFA).

This Work Plan initially presents an overview of the ER Program and a comparison of HSWA Module SWMUs with those listed in the 1988 and 1990 SWMU reports submitted to EPA. Also presented is a summary of HSWA Module requirements and where they are addressed in the Work Plan, and a brief description of OU 1129 and its SWMUs.

ER Program Documents

The HSWA Module required preparation of an Installation Work Plan (IWP) to describe the Laboratory's site-wide plan to accomplish the RFI/corrective measures study (CMS). The IWP was submitted to EPA on November 19, 1990. Because the OU 1129 Work Plan is based on the IWP, relevant information in the IWP is referenced in this Work Plan.

Other pertinent ER Program documents are referenced in the Work Plan to avoid redundancy and to streamline the OU 1129 RFI Work Plan. Those documents

include the Laboratory's ER Program Generic Quality Assurance Project Plan (QAPjP), the ER Program standard operating procedures (ER-SOPs), quality procedures (QAs), administrative procedures (APs), the Laboratory's health and safety SOPs, and any applicable DOE orders. The EPA Region VI approved the ER Program Generic QAPjP on July 12, 1991.

ER Program Studies

Several technical teams are currently involved in studies that will be used to establish ER Program guidance on important technical issues. Technical teams that are critical to implementation of the OU 1129 RFI include framework studies and risk assessment. The Framework Studies Technical Team will provide geological, hydrogeological, and geochemical data for use in determining the range of site-wide background for a variety of analytical and geotechnical measurements. Results from the framework studies will be available in a November 1992 draft report. The Risk Assessment Technical Team is developing a risk assessment plan that will address trigger/action levels, pathways modeling, and a health risk-based approach for all OU project leaders (OUPLs) to use during the RFI process. Risk assessment guidance is scheduled to be incorporated into the 1992 revision of the IWP. A specific discussion of framework studies with respect to background concentrations of contaminants of concern (COCs) and risk assessment elements will not be specifically addressed in this Work Plan pending further ER Program guidance in these areas.

Background Information

OU 1129 is situated along Pajarito Road within the boundaries of the Laboratory in north-central New Mexico. OU 1129 consists of seven presently existing Technical Areas (TAs-5,-35,-48,-52,-55, -63, and -66); and two former TAs (TAs-4 and -42). OU 1129 is bounded by Mortandad Canyon on the north, Two Mile Canyon and Pajarito Canyon to the south, TA-3 to the west, and the Santa Fe County line to the east. OU 1129 SWMUs are located on the finger-like mesas formed between a branch of Mortandad Canyon and Two Mile Canyon, and a branch of Pajarito Canyon. The characterization studies are focused on this regional and local geology, geochemistry, and geophysics, and their effect on site conditions at OU 1129.

The land on which OU 1129 is situated is under the control of DOE, and all TAs in the OU are currently or were previously used by DOE for Laboratory operations. Operations at OU 1129 TAs began as early as 1944 and continue into the present at most TAs. Potential wastes from the operations conducted in OU 1129 include radioactive materials, heavy metals, photo-processing chemicals, water treatment chemicals, solvents, residual amounts of high explosives, waste oil, diesel fuel, polychlorinated biphenyls (PCBs), and other chemicals. A detailed description of each TA in OU 1129 including site locations, physical descriptions, and historical overviews for OU 1129 SWMUs is included in the Work Plan.

OU 1129 currently contains 190 SWMUs and areas of concern (AOCs) as listed in the 1990 SWMU report. Different types of SWMUs are found in OU 1129 including firing sites, disposal areas, aboveground and underground storage tanks, septic systems, outfalls, industrial waste lines, lagoons, oil spills, container storage areas, waste oil and wastewater treatment facilities, and radioactive liquid waste spills.

Some of the SWMUs at OU 1129 have undergone decontamination and decommissioning (D&D). In general, these D&D activities focused on the removal of radioactive contamination to levels that were within DOE residual radioactivity guidelines at the time of D&D.

Conceptual Model

A conceptual model that determines the mechanisms and pathways by which a release from a SWMU could impact human health and the environment has been developed for OU 1129. The conceptual model describes the physical environment, waste transport and release mechanisms, primary sources, potential wastes and their physical characteristics, migration pathways, and potential receptors. The model introduces the current understanding of the physical environment, site operational practices, institutional controls, and demographics to develop a logical impact scenario and is the basis for a health-risk-based approach to human health and the environment.

The primary contaminant sources and release mechanisms at OU 1129 involve surface, subsurface, and atmospheric releases to the water, soil, and air pathways. At OU 1129, all three pathways are restricted to area residents and visitors because of institutional control. Under the current land use scenario, no pathways are considered to pose a significant risk to potential receptors at OU 1129.

Technical Approach

The OU 1129 technical approach uses Data Quality Objectives (DQOs) combined with a four-step decision process to ensure that any environmental impacts associated with past and present activities are thoroughly investigated in a cost-effective manner. The DQO process is a seven-step process developed by the EPA for planning effective and efficient data collection programs. A well-planned data collection program will ensure that the right type, amount, and quality of data are collected. A four-step decision process assists in the determination of any potential risk to human health or the environment from SWMU releases.

In the four-step OU 1129 decision process, some SWMUs may be initially recommended for NFA without environmental sampling on the basis of existing archival data that proves there is no current or future threat to human health or the environment at the site. Four NFA criteria that are consistent with the terms in Proposed Subpart S to 40 CFR 264 have been developed for the OU 1129 decision process. A SWMU must meet at least one of the criteria to be considered for a NFA recommendation. Sixty-one SWMUs have been recommended for NFA and detailed justifications are provided in this Work Plan. SAPs have not been developed for SWMUs that have been recommended for NFA, and therefore are not included in this Work Plan.

Those SWMUs for which archival data suggests a potential risk to human health or the environment will undergo either a Phase I or Phase II field investigation. NFA may also be recommended if, after the Phase I investigation, it can be demonstrated that the SWMU poses no threat to human health and the environment. SWMUs may again be recommended for NFA after a Phase II field investigation. A health-risk-based assessment will be conducted for all SWMUs that undergo Phase II investigation. The risk assessment combined with action levels/trigger levels will be used as criteria for identifying releases and determining the need for possible remedial

action under a CMS. Using the ER Program Decision Analysis approach, SWMUs that are candidates for voluntary corrective action (VCA) or interim action (IA) will be identified as appropriate within the process.

Sampling and Analysis Strategy

A phased-sampling approach to site characterization that is consistent with EPA guidelines and the Laboratory's IWP is used in the OU 1129 RFI Work Plan. The Phase I sampling strategy involves OU-wide surface and subsurface investigations that focus on determining the presence or absence of COCs at OU 1129. Data collected during the Phase I field investigation will be used in the OU 1129 decision process to identify SWMUs that can be recommended for NFA. If the presence of COCs is confirmed at concentrations above background, the site will undergo a Phase II field investigation to determine the physical-chemical characteristics of the site, and to characterize the nature and extent of contamination. Data collected during the Phase I and Phase II field investigations will be used for contaminant fate and transport modeling, risk assessment, and treatability studies for a CMS, if applicable.

To facilitate field work, the SAPs presented in this Work Plan are primarily arranged in SWMU Aggregates, with specific investigations of individual SWMUs included as necessary. The OU 1129 SAPs were developed judgmentally by evaluating archival information with respect to the suspected original release location, the source term, mitigation effects, and contaminant behavior in the media. Based on this information, the DQO process was used to create a set of data requirements for each SWMU. Sample points were then designated and appropriate methods and analyses defined. For some SWMUs for which abundant archival data exists, a prediction of the plume shape and boundary conditions was made and a three-dimensional model of the area of potential contamination was developed. The SAPs provided in this Work Plan are the basis for the phased field investigation at OU 1129. OU 1129 field operations will be planned and actual field work initiated when this Work Plan is approved by EPA, pending availability of funding.

Because radiological contamination is suspected at OU 1129, it is a primary focus of most SWMU-specific investigations. In many cases, the release of RCRA hazardous constituents has been associated with the release of radioactive materials. During the OU 1129 RFI, Level I/II on-site field instrument surveys (e.g., Micro R meter and FIDLER) and field screening of samples will be conducted to identify gross contamination and to assist in the location of sampling points.

A mobile or fixed analytical laboratory facility will provide Level III/IV data for use in determining the presence or absence of COCs, and in evaluating the need for a Phase II investigation. Analytical suites for the Phase I field investigation at OU 1129 include radionuclides, volatile organic compounds, semivolatile organic compounds, metals, and high explosives.

Annexes I through V contain the following plans associated with this RFI Work Plan: Annex I, Project Management Plan (PMP); Annex II, Quality Assurance Project Plan (QAPjP); Annex III, Health and Safety Project Plan; Annex IV, Records Management Project Plan; and Annex V, Community Relations Project Plan. Appendices A through D contain additional technical information that is pertinent to the Work Plan.

Schedule and Reporting

The start date for the OU 1129 RFI/CMS process was set by the Laboratory's RCRA Part B permit and called out in the IWP. The projected schedule for the corrective action process for OU 1129 is shown in summary form in Table ES-1. A detailed schedule for the implementation of the OU 1129 RFI is presented in Annex I, Figure I-1. This detailed schedule is based on a phased sampling plan as proposed in the IWP. Implementation of RFI activities is contingent upon regulatory review and approval of this OU 1129 RFI Work Plan, and upon available funding.

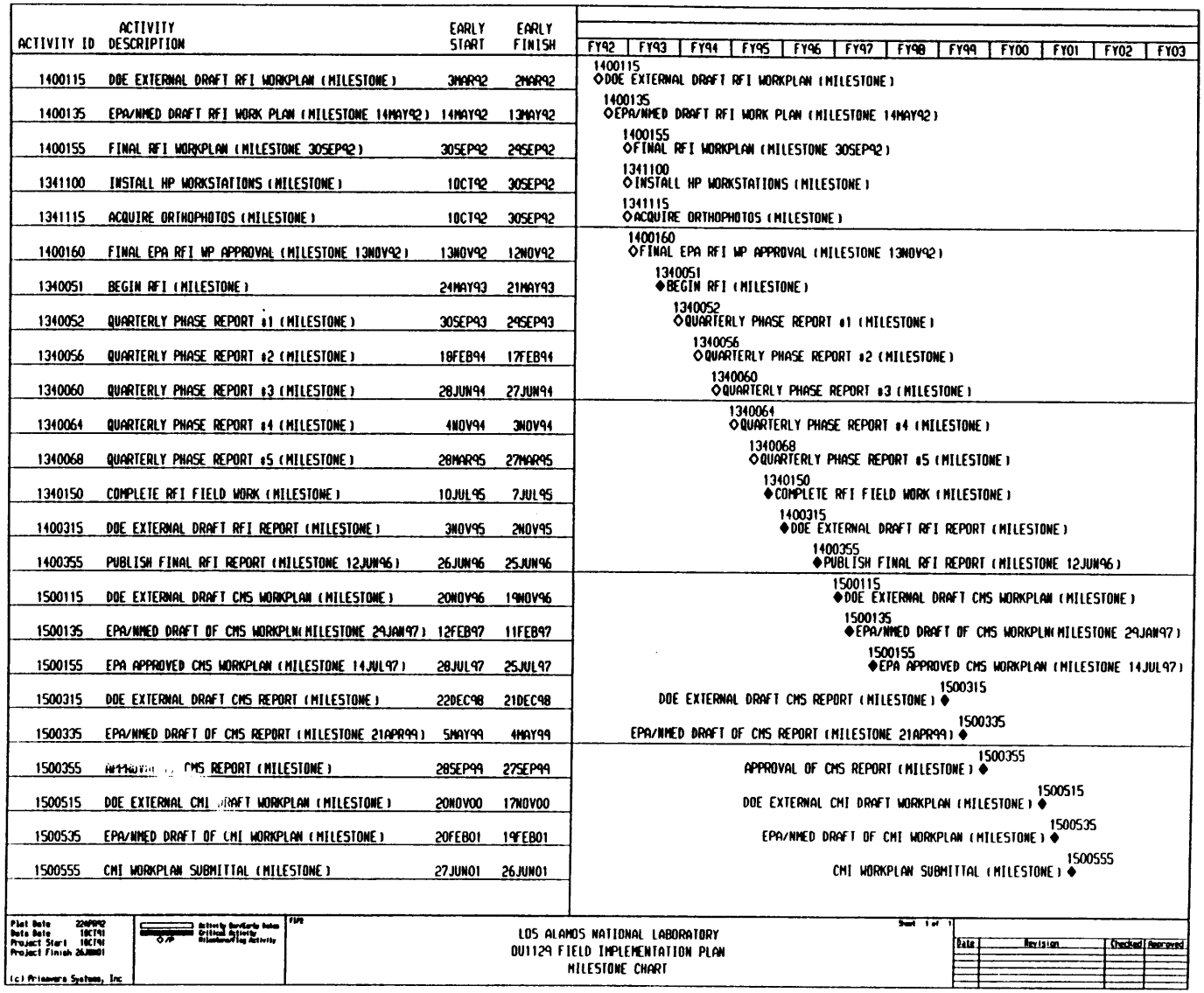
The HSWA Module specifies that certain periodic reports be prepared and submitted during the course of the RFI/CMS. Results of the OU 1129 RFI will be reported in three principal documents: interim reports on a quarterly basis; technical memoranda/work plan modifications; and the RFI Report. A schedule for submission of these reports is also found in both Table ES-1 and Annex I, Figure I-1.

Budget estimates for OU 1129 are presented in summary form in Table ES-2. Detailed integrated budgets are presented in Annex I, Table I-1.

TABLE ES-1

SUMMARY OF PROJECTED SCHEDULE FOR THE OU 1129 REMEDIAL INVESTIGATORY PROCESS

ACTIVITY ID	ACTIVITY DESCRIPTION	EARLY START	EARLY FINISH
1400115	DOE EXTERNAL DRAFT RFI WORKPLAN (MILESTONE)	3MAR92	2MAR92
1400135	EPA/NMED DRAFT RFI WORK PLAN (MILESTONE 14MAY92)	14MAY92	13MAY92
1400155	FINAL RFI WORKPLAN (MILESTONE 30SEP92)	30SEP92	29SEP92
1341100	INSTALL HP WORKSTATIONS (MILESTONE)	1OCT92	30SEP92
1341115	ACQUIRE ORTHOPHOTOS (MILESTONE)	1OCT92	30SEP92
1400160	FINAL EPA RFI WP APPROVAL (MILESTONE 13NOV92)	13NOV92	12NOV92
1340051	BEGIN RFI (MILESTONE)	24MAY93	21MAY93
1340052	QUARTERLY PHASE REPORT #1 (MILESTONE)	30SEP93	29SEP93
1340056	QUARTERLY PHASE REPORT #2 (MILESTONE)	18FEB94	17FEB94
1340060	QUARTERLY PHASE REPORT #3 (MILESTONE)	28JUN94	27JUN94
1340064	QUARTERLY PHASE REPORT #4 (MILESTONE)	4NOV94	3NOV94
1340068	QUARTERLY PHASE REPORT #5 (MILESTONE)	28MAR95	27MAR95
1340150	COMPLETE RFI FIELD WORK (MILESTONE)	10JUL95	7JUL95
1400315	DOE EXTERNAL DRAFT RFI REPORT (MILESTONE)	3NOV95	2NOV95
1400355	PUBLISH FINAL RFI REPORT (MILESTONE 12JUN96)	26JUN96	25JUN96
1500115	DOE EXTERNAL DRAFT CMS WORKPLAN (MILESTONE)	20NOV96	19NOV96
1500135	EPA/NMED DRAFT OF CMS WORKPLN(MILESTONE 29JAN97)	12FEB97	11FEB97
1500155	EPA APPROVED CMS WORKPLAN (MILESTONE 14JUL97)	28JUL97	25JUL97
1500315	DOE EXTERNAL DRAFT CMS REPORT (MILESTONE)	22DEC98	21DEC98
1500335	EPA/NMED DRAFT OF CMS REPORT (MILESTONE 21APR99)	5MAY99	4MAY99
1500355	[illegible] CMS REPORT (MILESTONE)	28SEP99	27SEP99
1500515	DOE EXTERNAL CMI DRAFT WORKPLAN (MILESTONE)	20NOV00	17NOV00
1500535	EPA/NMED DRAFT OF CMI WORKPLAN (MILESTONE)	20FEB01	19FEB01
1500555	CMI WORKPLAN SUBMITTAL (MILESTONE)	27JUN01	26JUN01



Plot Date 22APR92
Data Date 1OCT91
Project Start 1OCT91
Project Finish 26JUN01
(c) Primavera Systems, Inc

Activity Bar/Early Dates
Critical Activity
Milestone/Progress Activity

FSR

LOS ALAMOS NATIONAL LABORATORY
OU1129 FIELD IMPLEMENTATION PLAN
MILESTONE CHART

Sheet 1 of 1

Date	Revision	Checked	Approved

TABLE ES-2

SUMMARY OF ESTIMATED BUDGET
FOR THE OU 1129 REMEDIAL INVESTIGATION PROCESS

LINE	DURA-TION	ACTIVITY DESCRIPTION	BUDGET	SCHEDULED	
				START	FINISH
1	276	RFI Work Plan	868,762.48	1OCT91	13 NOV 92
2	594	RFI Field Phases	26,566,477.98	1OCT91	7 JUL 95
3	832	RFI Report	5,150,779.43	7 JUN 93	25 JUN 96
4	260	CMS Plan	239,217.02	6 MAR 95	14 JUL 97
5	354	Corrective Measures Study	3,776,241.00	21 MAR 96	22 DEC 98
6	366	CMS Report	932,308.40	3 JUL 95	28 SEP 99
7	1,794	ADS Management	1,305,146.27	1 OCT 91	28 SEP 99
8	1,820	Voluntary Corrective Actions	692,970.00	1 OCT 91	27 JAN 99
		Estimate to Completion	39,532,000		
		Escalation	58,000		
		Prior Years	1,002,000		
		TOTAL AT COMPLETION	40,592,000		

EXECUTIVE SUMMARY ES-1

CONTENTS i
List of Figures xxii
List of Tables xxiv

ACRONYMS AND ABBREVIATIONS xvii

CHAPTER 1.0

1.0 INTRODUCTION 1-1
1.1 Overview of the Environmental Restoration Program 1-1
1.2 Hazardous and Solid Waste Amendments Requirements 1-2
1.3 Description of OU 1129 and Its SWMUs 1-2
1.4 Organization of this Work Plan 1-10
REFERENCES 1-13

CHAPTER 2.0

2.0 ENVIRONMENTAL SETTING 2-1
2.1 Environmental Overview 2-1
2.1.1 Topography 2-1
2.1.2 Land Use and Demographics 2-1
2.1.3 Climate 2-1
2.2 Geology, Geochemistry, and Geophysics 2-4
2.2.1 Geology 2-4
2.2.1.1 Tectonic Setting 2-4
2.2.1.2 Volcanism 2-4
2.2.1.3 Pajarito Plateau Stratigraphy 2-7
2.2.1.3.1 Bandelier Tuff 2-7
2.2.1.3.2 Puye Formation 2-10
2.2.1.3.3 Totavi Formation 2-10
2.2.1.3.4 Santa Fe Group 2-10
2.2.1.4 Pajarito Plateau Structure 2-10
2.2.2 Geochemistry 2-11
2.2.3 Geophysics 2-11
2.2.4 Soils 2-13
2.3 Hydrology 2-13
2.3.1 Surface Water Hydrology 2-13
2.3.2 Hydrology of the Vadose Zone 2-14
2.3.2.1 Physical Characteristics of the Bandelier Tuff 2-16
2.3.2.2 Hydrogeologic Properties and Conditions of the Bandelier Tuff 2-16
2.3.3 Hydrology of the Saturated Zone 2-18
2.3.4 Characteristics of Mortandad Mesa 2-18
2.4 Biological Resources 2-18
2.4.1 Laws 2-20
2.4.2 Methodology 2-20
2.4.3 Species Identified 2-21
2.4.4 Results and Mitigation 2-22
2.4.4.1 Threatened and Endangered Species 2-22
2.4.4.2 Wetlands/Floodplains 2-22
2.4.5 Best Management Practices 2-22

REFERENCES 2-24

CHAPTER 3.0

3.0 OPERABLE UNIT DESCRIPTION 3-1
3.1 Description of Former TA-4, Alpha Site 3-2
3.1.1 Site Location and Physical Description 3-2
3.1.1.1 Geographic Location and Local Area Description 3-2
3.1.1.2 Physical Site Description 3-2
3.1.1.3 Ownership Profile and Land Uses 3-2
3.1.2 Historical Overview 3-5
3.1.2.1 Waste Management Activities 3-5
3.1.2.2 Summary of Potential Waste Materials 3-8
3.1.2.3 Past Waste Spills, Releases, and Incidents 3-8
3.1.2.4 Environmental Surveys and D&D Activities 3-8
3.1.3 Regulatory Activities 3-11
3.1.3.1 Permits 3-11
3.1.3.2 Interim Corrective Measures 3-11
3.2 Description of TA-5, Beta Site 3-11
3.2.1 Site Location and Physical Description 3-11
3.2.1.1 Geographic Location and Local Area Description 3-11
3.2.1.2 Physical Site Description 3-11
3.2.1.3 Ownership Profile and Land Uses 3-12
3.2.2 Historical Overview 3-12
3.2.2.1 Waste Management Activities 3-15
3.2.2.2 Summary of Potential Waste Materials 3-18
3.2.2.3 Past Waste Spills, Releases, and Incidents 3-18
3.2.2.4 Environmental Surveys and D&D Activities 3-18
3.2.3 Regulatory Activities 3-22
3.2.3.1 Permits 3-22
3.2.3.2 Interim Corrective Measures 3-22
3.3 Description of TA-35, Ten Site 3-22
3.3.1 Site Location and Physical Description 3-22
3.3.1.1 Geographic Location and Local Area Description 3-23
3.3.1.2 Physical Site Description 3-23
3.3.1.3 Ownership Profile and Land Uses 3-35
3.3.2 Historical Overview 3-35
3.3.2.1 Waste Management Activities 3-36
3.3.2.2 Summary of Potential Waste Materials 3-63
3.3.2.3 Past Waste Spills, Releases, and Incidents 3-63
3.3.2.4 Environmental Surveys and D&D Activities 3-72
3.3.3 Regulatory Activities 3-78
3.3.3.1 Permits 3-78
3.3.3.2 Interim Corrective Measures 3-78
3.4 Description of Former TA-42, Incinerator Site 3-78
3.4.1 Site Location and Physical Description 3-78
3.4.1.1 Geographic Location and Local Area Description 3-78
3.4.1.2 Physical Site Description 3-79
3.4.1.3 Ownership Profile and Land Uses 3-80
3.4.2 Historical Overview 3-80
3.4.2.1 Waste Management Activities 3-81
3.4.2.2 Summary of Potential Waste Materials 83
3.4.2.3 Past Waste Spills, Releases and Incidents 84
3.4.2.4 Environmental Surveys and D&D Activities 84
3.4.3 Regulatory Activities 87

3.4.3.1 Permits 87
3.4.3.2 Interim Corrective Measures 87
3.5 Description of TA-48, Radiochemistry Site 87
3.5.1 Site Location and Physical Description 87
3.5.1.1 Geographic Location and Local Area Description 87
3.5.1.2 Physical Site Description 87
3.5.1.3 Ownership Profile and Land Uses 88
3.5.2 Historical Overview 88
3.5.2.1 Waste Management Activities 88
3.5.2.2 Summary of Potential Waste Materials 104
3.5.2.3 Past Waste Spills, Releases, and Incidents 105
3.5.2.4 Environmental Surveys and D&D Activities 105
3.5.3 Regulatory Activities 107
3.5.3.1 Permits 107
3.5.3.2 Interim Corrective Measures 107
3.6 Description of TA-52, Reactor Development Site 108
3.6.1 Site Location and Physical Description 108
3.6.1.1 Geographic Location and Local Area Description 108
3.6.1.2 Physical Site Description 108
3.6.1.3 Ownership Profile and Land Uses 108
3.6.2 Historical Overview 112
3.6.2.1 Waste Management Activities 112
3.6.2.2 Summary of Potential Waste Material 117
3.6.2.3 Past Waste Spills, Releases, and Incidents 117
3.6.2.4 Environmental Surveys and D&D Activities 117
3.6.3 Regulatory Activities 119
3.6.3.1 Permits 119
3.6.3.2 Interim Corrective Measures 119
3.7 Description of TA-55, Plutonium Processing Facility 119
3.7.1 Site Location and Physical Description 119
3.7.1.1 Geographic Location and Local Area Description 119
3.7.1.2 Physical Site Description 120
3.7.1.3 Ownership Profile and Land Uses 123
3.7.2 Historical Overview 123
3.7.2.1 Waste Management Activities 123
3.7.2.2 Summary of Potential Waste Materials 129
3.7.2.3 Past Waste Spills, Releases, and Incidents 130
3.7.2.4 Environmental Surveys and D&D Activities 131
3.7.3 Regulatory Activities 131
3.7.3.1 Permits 131
3.7.3.2 Interim Corrective Measures 132
3.8 Description of TA-63, Satellite Service Area 132
3.8.1 Site Location and Physical Description 132
3.8.1.1 Geographic Location and Local Area Description 132
3.8.1.2 Physical Site Description 133
3.8.1.3 Ownership Profile and Land Uses 134
3.8.2 Historical Overview 134
3.8.2.1 Waste Management Activities 134
3.8.2.2 Summary of Potential Waste Materials 136
3.8.2.3 Past Waste Spills, Releases and Incidents 136
3.8.2.4 Environmental Surveys and D&D Activities 3-136
3.8.3 Regulatory Activities 3-137
3.8.3.1 Permits 3-137
3.8.3.2 Interim Corrective Measures 3-137
3.9 Description of TA-66, ATAC Facility 3-137

3.9.1 Site Location and Physical Description 3-137
3.9.1.1 Geographic Location and Local Area Description 3-137
3.9.1.2 Physical Site Description 3-137
3.9.1.3 Ownership Profile and Land Uses 3-138
3.9.2 Historical Overview 3-138
3.9.2.1 Waste Management Activities 3-138
3.9.2.2 Summary of Potential Waste Materials 3-138
3.9.2.3 Past Waste Spills, Releases, and Incidents 3-138
3.9.2.4 Environmental Surveys and D&D Activities 3-138
3.9.3 Regulatory Activities 3-138
3.9.3.1 Permits 3-138
3.9.3.2 Interim Corrective Measures 3-138
REFERENCES 3-139

CHAPTER 4.0

4.0 CONCEPTUAL MODEL FOR CONTAMINANT TRANSPORT AND EXPOSURE IN OPERABLE UNIT 1129 4-1
4.1 Introduction 4-1
4.2 Summary of the Physical Environment at OU 1129 4-1
4.2.1 Geologic Conditions 4-1
4.2.2 Hydrologic Conditions 4-3
4.3 Contaminant Transport at OU 1129 4-3
4.3.1 Aeolian Transport at the Soil Surface 4-3
4.3.2 Vapor/Liquid-Phase Transport in the Vadose Zone 4-4
4.3.3 Tectonic and Cooling Fractures 4-5
4.3.4 Infiltration 4-5
4.3.5 Vapor-Phase Migration 4-6
4.3.6 Surface Water Run-off and Erosion 4-6
4.4 Potential Wastes and Waste Characteristics 4-6
4.5 Background Levels 4-7
4.6 Primary Contaminant Sources 4-7
4.7 Primary Release Mechanisms 4-8
4.8 Mobilizing Processes for Contaminant Distribution 4-9
4.9 Present and Future Land Use 4-9
4.10 Identification of Potential Receptors 4-9
4.11 Exposure Pathways 4-10
REFERENCES 4-13

CHAPTER 5.0

5.0 TECHNICAL APPROACH 5-1
5.1 Summary of the OU 1129 Technical Approach 5-1
5.2 OU 1129 Decision Process 5-2
5.2.1 Decision Point 1: 5-5
5.2.2 Decision Point 2: 5-5
5.2.3 Phase I Sampling Process 5-7
5.2.4 Decision Point 3: 5-7
5.2.5 Phase II Sampling and Modeling Process 5-8
5.2.6 Risk Assessment Process 5-9
5.2.7 Decision Point 4: 5-9
5.3 Data Quality Objectives 5-10
5.3.1 Phase I Data Quality Objectives 5-11

5.3.1.1 Problem Statement 5-11
5.3.1.2 Question to be Answered 5-11
5.3.1.3 Decision Inputs/Data Needs 5-13
5.3.1.4 Problem Domain 5-14
5.3.1.5 Decision Rule/Logic Statement 5-14
5.3.1.6 Uncertainty Constraints 5-14
5.3.2 Phase II Data Quality Objectives 5-14
5.3.2.1 Problem Statement 5-16
5.3.2.2 Question to be Answered 5-16
5.3.2.3 Decision Inputs/Data Needs 5-16
5.3.2.4 Problem Domain 5-17
5.3.2.5 Decision Rule/Logic Statement 5-17
5.3.2.6 Uncertainty Constraints 5-17
5.4 Field and Analytical Data Quality Requirements 5-17
5.4.1 Analytical Levels 5-17
5.4.1.1 Phase I Analytical Level 5-18
5.4.1.2 Phase II Analytical Levels 51-8
5.4.2 Analytical Methods and PARCC Parameters 5-19
5.4.3 Sample Collection Quality Requirements 5-20
5.5 Decision Analysis Methodology 5-21
5.6 Natural Resource Damage 5-21
REFERENCES 5-22

CHAPTER 6.0

6.0 SOLID WASTE MANAGEMENT UNITS RECOMMENDED FOR NO FURTHER ACTION 6-1
6.1 Criteria Used to Support a Recommendation of NFA 6-1
6.2 SWMUs Recommended for NFA 6-3
REFERENCES 6-17

CHAPTER 7.0

7.0 SAMPLING AND ANALYSIS PLANS 7-1
7.1 Modeling in OU 1129 Sampling Plan Development 7-1
7.1.1 Choice of Models and Constraints 7-4
7.1.2 Summary of Vadose Zone Modeling 7-4
7.1.3 Results of Vadose Zone Scenarios 1 and 2 7-5
7.1.4 Results of Vadose Zone Scenario 3 7-5
7.1.5 Results of Airborne Radionuclide Emissions Model 7-7
7.1.6 Aqueous Speciation and Mobility of Strontium 7-7
7.2 Radionuclide Deposition Modeling at OU 1129 7-8
7.2.1 Modeling Local Deposition From Stack Releases 7-9
7.2.2 Levels of Local Radionuclide Deposition 7-10
7.3 Three-Dimensional Random Sampling in OU 1129 SAP Development 7-10
7.3.1 Random Sampling Method 7-10
7.3.2 Use of Random Sampling in SAP Development 7-11
7.4 Surveys 7-13
7.4.1 Engineering Survey 7-13
7.4.2 Environmental Survey 7-13
7.5 SWMU Aggregate A, Phase 1 7-15
7.5.1 Sampling Plan Rationale and Objectives 7-15
7.5.2 Phase I Field Activities Investigation 7-17
7.5.3 Sample Screening and Analysis 7-19

7.6 SWMU Aggregate B, Phase I 7-20
7.6.1 Sampling Plan Rationale and Objectives 7-20
7.6.2 Phase I Field Investigation Activities 7-22
7.6.3 Sample Screening and Analysis 7-24
7.7 SWMU Aggregate C, Phase I 7-25
7.7.1 Sampling Plan Rationale and Objectives 7-25
7.7.2 Phase I Field Investigation Activities 7-28
7.7.3 Sample Screening and Analysis 7-31
7.8 SWMU Aggregate D, Phase I 7-33
7.8.1 Sampling Plan Rationale and Objectives 7-33
7.8.2 Phase I Field Investigation Activities 7-35
7.8.3 Sample Screening and Analysis 7-47
7.9 SWMU Aggregate E, Phase I 7-48
7.9.1 Sampling Plan Rationale and Objectives 7-48
7.9.2 Phase I Field Investigation Activities 7-48
7.9.3 Sample Screening and Analysis 7-51
7.10 SWMU Aggregate F, Phase I 7-52
7.10.1 Sampling Plan Rationale and Objectives 7-52
7.10.2 Phase 1 Field Investigation Activities 7-58
7.10.3 Sample Screening and Analysis 7-65
7.11 SWMU Aggregate G, Phase I 7-66
7.11.1 Sampling Plan Rationale and Objectives 7-66
7.7.2 Phase I Field Investigation Activities 7-66
7.11.3 Sample Screening and Analysis 7-69
7.12 SWMU Aggregate H, Phase I 7-71
7.12.1 Sampling Plan Rationale and Objectives 7-71
7.12.2 Phase I Field Investigation Activities 7-73
7.12.3 Sample Screening and Analysis 7-73
7.13 SWMU Aggregate I, Phase I 7-77
7.13.1 Sampling Plan Rationale and Objectives 7-77
7.13.2 Phase I Field Investigation Activities 7-79
7.13.3 Sample Screening and Analysis 7-79
7.14 SWMU Aggregate J, Phase I 7-82
7.14.1 Sampling Plan Rationale and Objectives 7-82
7.14.2 Phase I Field Investigation Activities 7-84
7.14.3 Sample Screening and Analysis 7-98
7.15 SWMU Aggregate K, Phase I 7-99
7.15.1 Sampling Plan Rationale and Objectives 7-102
7.15.2 Phase I Field Investigation Activities 7-105
7.15.3 Sample Screening and Analysis 7-105
7.16 SWMU Aggregate L, Phase I 7-108
7.16.1 Sampling Plan Rationale and Objectives 7-110
7.16.2 Phase I Field Investigation Activities 7-110
7.16.3 Sample Screening and Analysis 7-112
7.17 SWMU Aggregate M, Phase I 7-113
7.17.1 Sampling Plan Rationale and Objectives 7-113
7.17.2 Phase I Field Investigation Activities 7-115
SWMU No. 48-003, Filter Bed - Subsurface Investigation 7-115
7.17.3 Sample Screening and Analysis 7-118
7.18 SWMU Aggregate N, Phase I 7-119
7.18.1 Sampling Plan Rationale and Objectives 7-119
7.18.2 Phase I Field Investigation Activities 7-121
7.18.3 Sample Screening and Analysis 7-124
7.19 SWMU Aggregate O, Phase I 7-125
7.19.1 Sampling Plan Rationale and Objectives 7-125

7.19.2 Phase I Field Investigation Activities 7-127
7.19.3 Sample Screening and Analysis 7-131
7.20 SWMU Aggregate P, Phase I 7-132
7.20.1 Sampling Plan Rationale and Objectives 7-132
7.20.2 Phase I Field Investigation Activities 7-134
7.20.3 Sample Screening and Analysis 7-136
REFERENCES 7-139

ANNEX I PROJECT MANAGEMENT PLAN

1.0 PROJECT MANAGEMENT PLAN I-1
1.1 Schedule I-1
1.2 Cost Estimation I-3
1.3 Reporting I-3
1.3.1 Quarterly Phase Reports I-3
1.3.2 Technical Memoranda/Work Plan Modifications I-3
1.3.3 RFI Report I-3
1.4 Organization I-8
1.4.1 Field Operations Manager I-9
1.4.2 Technical Manager I-9
1.4.3 Field Team Leader I-9
1.4.4 Technical Task Managers I-10
1.4.5 Site Safety Officer I-10
1.4.6 Field Team Members I-10
REFERENCES I-11

ANNEX II QUALITY ASSURANCE PROJECT PLAN

INTRODUCTION II-2
REFERENCES II-7

ANNEX III HEALTH AND SAFETY PROJECT PLAN

1.0 INTRODUCTION III-1
1.1 Purpose III-1
1.2 Organization of the Plan III-1
1.3 Basis for the Plan III-2
2.0 OPERABLE UNIT FIELD WORK ORGANIZATION III-2
2.1 General Responsibilities III-2
2.2 Individual Responsibilities III-2
2.2.1 Environmental Management and Health and Safety Division Leaders III-2
2.2.2 Environmental Restoration Program Group Program Manager III-3
2.2.3 Operable Unit Project Leader III-3
2.2.4 Health and Safety/Health Physics Project Leaders III-4
2.2.5 Quality Program Project Leader III-4
2.2.6 Field Team Manager III-5
2.2.7 Field Team Leader III-5
2.2.8 Site Safety Officer III-6
2.2.9 Quality Program Liaison III-7
2.2.10 Field and Technical Team Members III-7
2.3 Health and Safety Audits III-8
2.4 Variances from Health and Safety Requirements III-8

3.0 PERSONNEL PREREQUISITES III-8
3.1 Training Requirements III-8
3.2 Employee Medical Surveillance Program III-9
3.3 Documentation III-9
4.0 SCOPE OF WORK III-10
4.1 Purpose III-10
4.2 OU Description III-10
4.2.1 SWMU Sampling Locations III-10
4.2.2 Topographical Considerations III-10
4.2.3 Meteorological Considerations III-11
4.3 Description of Tasks III-11
5.0 HAZARD ASSESSMENT III-11
5.1 Types of Hazards III-11
5.1.1 Oxygen Deficiency III-11
5.1.2 Explosivity/Flammability III-12
5.1.3 Radiological Hazards III-12
5.1.4 Toxicological Hazards III-13
5.1.5 Corrosive Hazards III-14
5.1.6 Biological Hazards III-15
5.1.7 Physical Hazards III-15
5.1.7.1 General Physical Exposures III-16
5.1.7.2 Noise III-16
5.1.7.3 Working in Confined Spaces III-16
5.1.7.4 Working around Potentially Energized Electrical Equipment III-16
5.1.7.5 Working around Heavy Equipment and Machinery III-17
5.1.7.6 Inadequate Housekeeping III-17
5.1.7.7 Using Mechanical and Flame Cutting Equipment III-17
5.1.7.8 Materials Handling III-17
5.1.7.9 Temperature Extremes III-17
5.1.7.10 Excavations III-18
5.1.7.11 Underground Hazards III-18
5.1.7.12 Traffic III-18
5.1.7.13 Compressed Gases and Systems III-19
5.1.7.14 Breaking Concrete III-19
5.1.7.15 Topography III-19
5.1.7.16 Lightning III-19
5.2 Task-Specific Hazard Assessment III-20
5.2.1 Field Surveys III-20
5.2.2 Surface Sampling III-20
5.2.3 Subsurface Sampling III-21
6.0 AIR-MONITORING PROGRAM III-21
6.1 Oxygen Deficiency III-22
6.2 Explosivity/Flammability III-22
6.3 Radiological Hazards III-22
6.4 Toxicological Hazards III-23
6.4.1 PID III-23
6.4.2 FID III-24
6.4.3 Colorimetric Tubes III-24
6.4.4 Electrochemical Gas Detectors III-24
6.4.5 Real-Time Aerosol Monitors III-24
6.5 Personal Monitoring III-24
6.6 Air Samplers III-25
7.0 PERSONNEL PROTECTION AND SAFETY REQUIREMENTS III-25
7.1 Engineering Controls/Work Practices III-25
7.1.1 Oxygen Deficiency III-25

7.1.2 Fire/Explosion Hazards III-25
7.1.3 Radiation Hazards III-26
7.1.4 Chemical Hazards III-26
7.1.5 Corrosive Hazards III-27
7.1.6 Biological Hazards III-27
7.1.6.1 Animals/Insects III-27
7.1.6.2 Poisonous Plants III-27
7.1.6.3 Infectious Agents III-28
7.1.6.4 Hygienic Practices III-29
7.1.7 Physical Hazards III-29
7.1.7.1 General Physical Exposures III-29
7.1.7.2 Noise III-30
7.1.7.3 Working in Confined Spaces III-30
7.1.7.4 Working around Potentially Energized Electrical Equipment III-31
7.1.7.5 Working around Heavy Equipment and Machinery III-32
7.1.7.6 Housekeeping III-32
7.1.7.7 Using Mechanical and Flame Cutting Equipment III-33
7.1.7.8 Materials Handling III-33
7.1.7.9 Temperature Extremes III-33
7.1.7.10 Excavations III-34
7.1.7.11 Underground Hazards III-35
7.1.7.12 Traffic III-36
7.1.7.13 Compressed Gases and Systems III-36
7.1.7.14 Breaking Concrete III-37
7.1.7.15 Topography III-37
7.1.7.16 Lightning III-37
7.2 PPE III-38
7.2.1 Selection of PPE III-39
7.2.2 PPE for Task-Specific Hazards III-42
7.2.2.1 Field Surveys III-42
7.2.2.2 Surface Sampling III-42
7.2.2.3 Subsurface Sampling III-42
7.3 Hazard Communication III-43
7.3.1 Safety Meetings III-43
7.3.2 Employee Information III-43
7.3.3 Material Safety Data Sheets III-43
8.0 SITE CONTROL III-44
8.1 Exclusion Zone III-45
8.2 CRZ III-45
8.3 Support Zone III-45
8.4 Site Control Procedures III-45
9.0 DECONTAMINATION PROCEDURES III-48
9.1 Contamination Prevention III-48
9.2 General Equipment Decontamination III-49
9.3 Personnel Decontamination III-49
9.4 Decontamination Support III-49
9.5 Disposal Procedures III-50
9.6 Decontamination Verification III-50
10.0 EMERGENCY RESPONSE PROCEDURES III-50
10.1 Emergency Response Plan III-51
10.1.1 Emergency Contacts III-51
10.1.2 Site Mapping III-51
10.1.3 Site Security and Control III-51
10.1.4 Communications III-51
10.1.5 Evacuation Routes/Procedures III-52

10.1.6 Emergency Equipment and Supplies III-52
10.2 Specific Emergencies III-53
10.2.1 Fire/Explosion III-53
10.2.2 Radiation/Chemical Exposures III-53
10.2.3 Injuries III-53
10.2.4 Vehicle Accidents/Property Damage III-54
10.3 Provisions for Public Health and Safety III-54
10.4 Notification Requirements III-54
10.5 Documentation III-55

ANNEX IV RECORDS MANAGEMENT PROJECT PLAN

1.0 INTRODUCTION IV-1
2.0 IMPLEMENTATION OF THE RECORDS MANAGEMENT PROGRAM PLAN IV-1
3.0 USE OF ER PROGRAM RECORDS MANAGEMENT FACILITIES IV-2
4.0 COORDINATION WITH THE QUALITY PROGRAM IV-2
5.0 COORDINATION WITH THE HEALTH AND SAFETY PROGRAM IV-2
6.0 COORDINATION WITH THE ER PROGRAM'S MANAGEMENT INFORMATION SYSTEM IV-2
7.0 COORDINATION WITH THE COMMUNITY RELATIONS PROGRAM IV-3
REFERENCES IV-4

ANNEX V COMMUNITY RELATIONS PROJECT PLAN

1.0 OVERVIEW OF COMMUNITY RELATIONS PROJECT PLAN V-1
2.0 COMMUNITY RELATIONS ACTIVITIES V-4
2.1 Mailing List V-4
2.2 Fact Sheets V-4
2.3 ER Program Community Reading Room V-4
2.5 Quarterly Technical Progress Reports V-4
2.6 Procedures for Public Notice V-5
REFERENCES V-6
ATTACHMENT I V-7

APPENDIX A SUMMARY OF ARCHIVAL RELEASE INFORMATION FOR SWMUS REQUIRING SAMPLING A-1

APPENDIX B FIELD OPERATIONS PLAN

1.0 INTRODUCTION B-1
2.0 GENERAL FIELD OPERATIONS AND SAMPLING METHODS B-2
2.1 Level I Field Screening B-2
2.2 Soil/Rock Field Sampling Methods B-3
2.2.1 Stainless-Steel Trowel B-3
2.2.2 Hollow-Stem Auger/Split-Spoon Sampler B-3
2.2.3 Hand Auger B-4
2.2.4 Test Pitting/Trenching B-5
2.2.5 Split-Barrel Core Sampler B-5
2.3 Liquid and Sludge Field Sampling Methods B-7
2.3.1 Composite Liquid Waste Sampler (Coliwasa) B-7
2.3.2 Weighted Bottle Sampler B-7
2.4 Field Measurements for Liquid Samples B-8

3.0 SAMPLE MANAGEMENT B-8
3.1 Sample Identification B-8
3.2 Sample Handling, Packaging, and Shipping B-8
3.2.1 Sample Handling B-8
3.2.2 Sample Packaging B-10
3.2.3 Sample Shipping B-11
3.3 Field/Sample Documentation B-12
3.3.1 Daily Activity Log B-12
3.3.2 Sample Collection Log B-13
3.3.3 Chain-of-Custody/Request for Analysis Form B-15
3.3.4 Variance Log B-16
3.3.5 Photograph Log B-16
4.0 EQUIPMENT DECONTAMINATION B-17
4.1 Standard Decontamination Materials B-17
4.2 Decontamination of Sampling Equipment for Inorganic and Organic Compounds B-17
4.3 Decontamination of Sampling Equipment for Radionuclides B-18
4.4 Decontamination of Drilling Rigs B-19
4.5 Decontamination of Miscellaneous Equipment B-19
5.0 QUALITY CONTROL SAMPLES B-19
5.1 Duplicate Samples B-20
5.2 Blank Samples B-22
5.2.1 Bottle Blank Samples B-22
5.2.2 Trip Blank Samples B-22
5.2.3 Rinsate Blank Samples B-23
5.2.4 Glove, Wipe, and Solvent Blank Samples B-24
5.2.5 Radiation Smear Blank Samples B-24
5.2.6 Method Blanks B-25
5.2.7 Reagent Blanks B-25
REFERENCES B-26

APPENDIX C SUPPLEMENTAL INFORMATION ON TRANSPORT MODELING

PREVIOUS CLEANUP IN OPERABLE UNIT 1129 ..... C-9
FUTURE ACTION AND PROPOSED TIME FRAME C-9
COMMENTS ON AQUEOUS SPECIATION AND MOBILITY OF STRONTIUM AT LOW TEMPERATURES C-7
REFERENCES C-13

APPENDIX D LIST OF CONTRIBUTORS D-1

LIST OF FIGURES

1-1	Location map of Los Alamos National Laboratory	1-7
1-2	Location of OU 1129	1-9
2-1	General geographic location and topographic features in the vicinity of Los Alamos	2-2
2-2	Land ownership in the Los Alamos Area	2-3
2-3	(a) Summer (June-August) mean precipitation at Los Alamos; (b) annual mean precipitation at Los Alamos	2-5
2-4	Meteorological tower stations at Los Alamos National Laboratory during 1988	2-6
2-5	Generalized cross section showing stratigraphy and structure of the Pajarito Plateau from the Sierra de los Valles to the Rio Grande	2-8
2-6	Schematic Stratigraphy of the Tshirege Member in the TA-55 Area	2-7
2-7	Locations of fault traces and intensely fractured zones along Pajarito Road near TAs 48, 55, and 35	2-12
2-8	Location of major surface water drainages, springs, test holes, and stock and supply wells in the Los Alamos area	2-15
2-9	Generalized potentiometric surface and groundwater flow map for the main aquifer	2-19
3-1	Locations of structures and SWMUs at former TA-4	3-3
3-2	Locations of structures and SWMUs at TA-5	3-13
3-3	Locations of structures and SWMUs at TA-35	3-33
3-4	Locations of structures and SWMUs at TA-35	3-34
3-5	Locations of structures and SWMUs at TA-35	3-40
3-6	Locations of structures and SWMUs at TA-35	3-49
3-7	Locations of structures and SWMUs at TA-42	3-80
3-8	Locations of structures and SWMUs at TA-48; SWMU No. 48-001 is surface deposition of airborne releases surrounding TA-48-1	3-91
3-9	Locations of structures and SWMUs at TA-48	3-101
3-10	Locations of structures and SWMUs at TA-52	3-109
3-11	Locations of structures and SWMUs at TA-55	3-120
3-12	Locations of structures and SWMUs at TA-63	3-135
3-13	Locations of structures and SWMUs at TA-55	3-159
3-14	Locations of structures and SWMUs at TA-63	3-171
4-1	Conceptual block diagram of OU 1129	4-2
4-2	Conceptual model of surface contaminant transport to potential receptors within OU 1129	4-11
4-3	Conceptual model of subsurface contaminant transport to potential receptors within OU 1129	4-12
5-1	Decision process for OU 1129	5-3
5-2	Data quality objectives for Phase I	5-12
5-3	Data quality objectives for Phase II	5-15
7-1	Schematic stratigraphy of the Tshirege Member in the TA-55 Area	7-1
7-2	Vadose Modeling Results	7-6
7-3	3-D Modeling	7-12
7-4	Schematic sample location map for SWMU Aggregate A	7-16
7-5	Decision logic for the sampling and analysis of SWMU Aggregate A	7-18
7-6	Schematic sample location map for SWMU Aggregate B	7-21
7-7	Decision logic for the sampling and analysis of SWMU Aggregate B	7-23
7-8	Schematic sample location map for SWMU 5-004	7-26
7-9	Schematic sample location map for SWMU 5-005(a)	7-27
7-10	Decision logic for the sampling and analysis of SWMU Aggregate C	7-29
7-11	Decision logic for the sampling and analysis of SWMU Aggregate D	7-36
7-12	Schematic sample location map for SWMU Aggregate D [SWMUs 35-003(a,b,c,n)]	7-37

LIST OF FIGURES (continued)

7-13	Schematic sample location map for SWMU Aggregate D (SWMU Nos. 35-003[d,l,q])	7-38
7-14	Schematic sample location map for SWMU Aggregate D (SWMU Nos. 35-003[e,f,g,m, and o])	7-39
7-15	Schematic sample location map for SWMU Aggregate D (SWMU Nos. 35-003[misc])	7-40
7-16	Schematic sample location map for SWMU Aggregate D (SWMU Nos. 35-003[r])	7-41
7-17	Schematic sample location map for SWMU Aggregate E	7-49
7-18	Decision logic for the sampling and analysis of SWMU Aggregate E	7-50
7-19	Schematic sample location map for SWMU 35-009 (a)	7-53
7-20	Schematic sample location map for SWMU 35-009(b)	7-54
7-21	Schematic sample location map for SWMU 35-009(c)	7-55
7-22	Schematic sample location map for SWMU 35-009(d)	7-56
7-23	Decision logic for the sampling and analysis of SWMU Aggregate F	7-57
7-24	Schematic sample location map for SWMU Aggregate G	7-67
7-25	Decision logic for the sampling and analysis of SWMU Aggregate G	7-68
7-26	Schematic sample location map for SWMU Aggregate H	7-72
7-27	Decision logic for the sampling and analysis of SWMU Aggregate H	7-74
7-28	Schematic sample location map for SWMU Aggregate I (SWMUs 35-003[j and k], 35-014[d], and 35-015[b])	7-78
7-29	Decision logic for the sampling and analysis of SWMU Aggregate I	7-80
7-30	Location map and grid boundary for SWMU Aggregate J	7-83
7-31	Decision logic for the sampling and analysis of SWMU Aggregate J	7-85
7-32	Schematic sample location map for SWMUs 42-001(a-c) and 42-002(a)	7-88
7-33	Schematic sample location map for SWMU 42-002(b)	7-94
7-34	Schematic sample location map for SWMU 42-003	7-96
7-35	Schematic sample location map for SWMU Aggregate K (SWMU 48-001)	7-100
7-36	Isopleth map showing the distribution of Sr-90 at SWMU 48-001, TA-48 stack FE54	7-103
7-37	Isopleth map showing the distribution of Cs-137 at SWMU 48-001. TA-48 stack FE54	7-104
7-38	Decision logic for the sampling and analysis of SWMU Aggregate K	7-106
7-39	Schematic sample location map for SWMU Aggregate L (SWMUs 48-002[a and b])	7-109
7-40	Decision logic for the sampling and analysis of SWMU Aggregate L	7-111
7-41	Schematic sampling map for SWMU Aggregate M	7-114
7-42	Decision logic for the sampling and analysis of SWMU Aggregate M	7-116
7-43	Schematic sampling map for SWMU Aggregate N	7-120
7-44	Decision logic for the sampling and analysis of SWMU Aggregate N	7-122
7-45	Schematic sample location map for SWMU Aggregate O	7-126
7-46	Decision logic for the sampling and analysis of SWMU Aggregate O	7-128
7-47	Schematic sampling map for SWMU Aggregate P	7-133
7-48	Decision logic for the sampling and analysis of SWMU Aggregate P	7-135
I-1	OU 1129 RFI Schedule	I-2
I-2	Basic Organization for OU 1129 RFI Operations	I-8
II-1	OU 1129 QAPjP	II-3
V-1	Opportunities mandated by regulation for public participation during the corrective action process	V-2
V-2	Opportunities for public participation during the OU 1129 RFI	V-3
C-1	OU 1129 Soils	C-1
C-2	Activities of Aqueous Strontium Species	C-8

LIST OF FIGURES (concluded)

C-3	Log Molalities of Total Strontium	C-9
C-4	Log Molalities of Total Strontium	C-10
C-5	Log Molalities of Total Strontium	C-11
C-6	Saturation indices for celestite and strontianite	C-12

LIST OF TABLES

ES-1	Summary of Projected Schedule for the OU 1129 Remedial Investigation Process	ES-6
ES-2	Summary of Estimated Budget for the OU 1129 Remedial Investigation Process	ES-7
1-1	Current Listing of Operable Unit 1129 SWMUs as of 1990	1-3
1-2	Recommended Changes to 1990 SWMU List for OU 1129 RCRA	1-6
1-3	RFI Guidance from HSWA Module VIII of the Laboratory's RCRA Operating Permit	1-11
3-1	Description of Structures at TA-4	3-4
3-2	TA-4 SWMUs	3-6
3-3	TA-4 Structures Addressed During LASCP	3-9
3-4	TA-4 Radioactive Contamination Survey Measurements, April 1988	3-10
3-5	Description of Structures at TA-5	3-14
3-6	TA-5 SWMUs	3-15
3-7	Soil Contamination Beneath Former Buildings (SWMU No. 5-006)	3-17
3-8	TA-5 Structures Addressed During LASCP	3-19
3-9	Radioactivity Detected at TA-5 Structures in 1985	3-20
3-10	TA-5 Radioactive Contamination Survey Measurements, April 1988	3-22
3-11	Description of Structures at TA-35	3-24
3-12	TA-35 SWMUs	3-37
3-13	Structures at TA-35 Wastewater Treatment Plant	3-41
3-14	Container Storage Areas	3-44
3-15	Septic Systems at TA-35	3-48
3-16	Sanitary-Waste Treatment System	3-49
3-17	Operational Releases at TA-35	3-53
3-18	Drains and Outfalls at TA-35	3-56
3-19	Potential Release Sites at TA-35	3-62
3-20	Radioactivity in Ten Site Canyon Sediments	3-64
3-21	Radioactivity in Ten Site Canyon Sediments	3-66
3-22	Wastewater Treated at the TA-35 Treatment Facility (1955-1963)	3-68
3-23	Airborne Releases of Radionuclides from TA-35-2, 1967 through 1969 and 1971	3-71
3-24	Atmospheric Releases of Radionuclides from TA-35, 1974 Through 1988	3-71
3-25	Uranium Concentration in TA-35 Peaches	3-73
3-26	Tritiated Water Content of TA-35 Peaches	3-73
3-27	^{90}Sr Content of TA-35 Peaches	3-74
3-28	Plutonium Content of TA-35 Peaches	3-74
3-29	Description of Structures at TA-42	3-79
3-30	Description of Structures at TA-48	3-89
3-31	TA-48 SWMUs	3-93
3-32	Total Discharge of Airborne Radioactivity at TA-48 for 1967 Through 1970	3-94
3-33	Air Emissions of Radionuclides at TA-48 for 1971	3-95
3-34	Atmospheric Releases of Radionuclides from TA-48,1974 Through 1988	3-95
3-35	Sumps and Tanks at TA-48	3-99
3-36	Radioactive Waste Lines at TA-48	3-100
3-37	Outfalls at TA-48	3-101
3-38	Description of Structures at TA-52	3-110

LIST OF TABLES (continued)

3-39	TA-52 SWMUs	3-112
3-40	UHTREX Equipment	3-113
3-41	Septic Systems at TA-52	3-115
3-42	Description of Structures at TA-55	3-121
3-43	TA-55 SWMUs	3-124
3-44	TA-55 Outfalls	3-129
3-45	Atmospheric Releases of Radionuclides from TA-55,1978 Through 1988	3-130
3-46	Description of Structures at TA-63	3-133
3-47	Description of Structures at TA-66	3-137
4-1	Conceptual Model Primary Contaminant Sources	4-8
5-1	Term Definitions	5-4
5-2	Criteria Used for a Recommendation of NFA at Decision Point 1	5-6
5-3	Instrumentation and Methods for Proposed Analytical Levels	5-19
5-4	Summary of Analytical Methods for the Analysis of Samples Collected at OU 1129	5-20
6-1	SWMUs Recommended for NFA at Decision Point 1	6-5
7-1	Listing of HSWA Module and Non-HSWA Module Phase I SAPs for OU 1129	7-3
7-2	Phase I Sampling Summary for OU 1129 SWMU Aggregate C	7-32
7-3	Phase I Sampling Summary for OU 1129 SWMU Aggregate D [SWMU Nos. 35-003(a,b,c,n)]	7-42
7-4	Phase I Sampling Summary for OU 1129 SWMU Aggregate D (SWMU Nos. 35-003[d,l,q])	7-43
7-5	Phase I Sampling Summary for OU 1129 SWMU Aggregate D [SWMU Nos. 35-003(e,f,g,m, and o)]	7-45
7-6	Phase I Sampling Summary for OU 1129 SWMU Aggregate D [SWMU Nos. 35-003(Misc.)]	7-46
7-7	Phase I Sampling Summary for OU 1129 SWMU Aggregate D [SWMU No. 35-003(r)]	7-47
7-8	Phase I Sampling Summary for OU 1129 SWMU Aggregate E (SWMU No. 35-008)	7-51
7-9	Phase I Sampling Summary for OU 1129 SWMU Aggregate F (SWMU Nos. 35-009[a-d])	7-61
7-10	Phase I Sampling Summary for OU 1129 SWMU Aggregate G (SWMU Nos. 35-010[a,b, and c])	7-69
7-11	Phase I Sampling Summary for OU 1129 SWMU Aggregate H (SWMU Nos. 35-014[a and b])	7-75
7-12	Phase I Sampling Summary for OU 1129 SWMU Aggregate I (SWMU Nos. 35-003[j and k] and 35-015[b])	7-81
7-13	Phase I Sampling Summary for OU 1129 SWMU Aggregate J (SWMU Nos. 35-001[a,b, and c], 42-002[a and b], and 42-003)	7-89
7-14	Total Discharge of Airborne Radioactivity at TA-48 for 1967 Through 1970	7-101
7-15	Air Emissions of Radionuclides at TA-48 for 1971	7-101
7-16	Phase I Sampling Summary for OU 1129 SWMU Aggregate K (SWMU No. 48-001)	7-107
7-17	Phase I Sampling Summary for OU 1129 SWMU Aggregate L (SWMU Nos. 48-002[a and b])	7-112
7-18	Phase I Sampling Summary for OU 1129 SWMU Aggregate M (SWMU No. 48-003)	7-117
7-19	Phase I Sampling Summary for OU 1129 SWMU Aggregate N (SWMU No. 48-005)	7-124
7-20	Phase I Sampling Summary for OU 1129 SWMU Aggregate O (SWMU Nos. 52-002[a] and 52-003[a])	7-130
7-21	Phase I Sampling Summary for OU 1129 SWMU Aggregate P (SWMU No. 63-002[a])	7-137

LIST OF TABLES (concluded)

I-1	Projected Budget for OU 1129 Corrective Action Process	I-4
I-2	Cost Estimate for OU 1129 Phase I Sampling Effort	I-6
A-1	Summary of Archival Release Information for SWMUs Requiring Sampling	A-1
B-1	Environmental Restoration Standard Operating Procedures (SOPs) Applicable to the OU 1129 Sampling and Analysis Program	B-1
B-2	Locations of SWMU or SWMU Aggregate SAPs in the OU 1129 RFI Work Plan	B-2
B-3	Summary of Level III Sample Handling Requirements for OU 1129	B-9
B-4	Summary of Field QC Sample Requirements	B-20

ACRONYMS AND ABBREVIATIONS

AA	atomic absorption
ACAP	as low as practicable
ACGHI	American Congress of Governmental Industrial Hygienists
AIHA	American Industrial Hygiene Association
AIRDOS	computer code
AJ	amber jug
AL	DOE-Albuquerque Operations Office
ALAP	as low as practicable
ALARA	as low as reasonably achievable
AOC	area of concern
AP	administrative procedure
APR	air-purifying respirator
AR	administrative requirement
ARAR	applicable or relevant and appropriate requirement
asl	above sea level
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
ATAC	Advanced Technology Assessment Center
BRET	Biological Resource Evaluation Team
C	Celsius
CAR	Corrective Action Requirement
CEARP	Comprehensive Environmental Assessment and Response Program
CEC	cation exchange capacity
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CGI	combustible gas indicator
CHI	chemical hazards index
CI	confidence interval
CLS Division	the Chemical and Laser Sciences Division
c/m/g	counts per minute per gram
CMI	corrective measures implementation
CMS	corrective measures study
COC	contaminant of concern
COC/RFA	chain of custody/request for analysis
COE	US Corps of Engineers
CPR	cardiopulmonary resuscitation
CRP	Community Relations Plan
CRZ	contamination reduction zone
CWM	clear wide mouth
D&D	decontamination and decommissioning
dB	decibels
DL	detection limit
d/m/l	disintegrations per minute per liter
DNAPL	dense nonaqueous phase liquid
DOE	Department of Energy
DoD	Department of Defense
DQO	data quality objective
EID	(New Mexico) Environmental Improvement Division

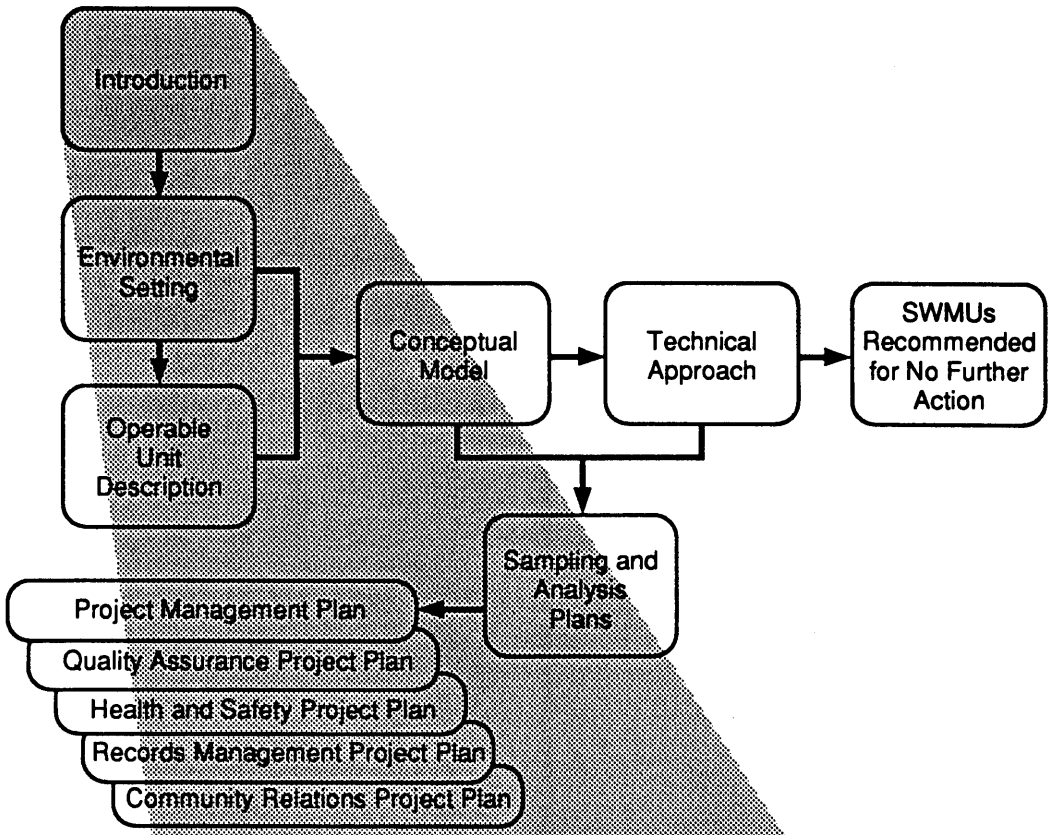
EM	Office of Environmental Restoration and Waste Management or Environmental Management
EM-8	the Environmental Protection Group
EM-9	the Health and Environmental Chemistry Group
EM-13	the Environmental Restoration Group
ENG-5	the Field Operations Group
EP	extraction or engineering procedure
EPA	US Environmental Protection Agency
ER	Environmental Restoration
ERIA	ER Program (Program) Interim Action
ERPG	Emergency Response Planning Guideline
ESG	Environmental Surveillance Group
ES&H	environment, safety, and health
F	Fahrenheit
FID	flame ionization detector
FIDLER	
FIMAD	Facility for Information Management, Analysis, and Display
FR	Federal Register
FTL	Field Task Leader
FY	fiscal year
GC	gas chromatography
G.C.	Garratt-Callahan
GeLi	germanium lithium
GFCI	ground fault circuit interrupter
CGI	combustible gas indicator
gpd	gallons per day
gph	gallons per hour
gpm	gallons per minute
GVV	glass voa vial
HE	high explosive
HEPA	high-efficiency particulate air
HF	hydrofluoric acid
HM-3	Micro R meter
H&S	health and safety
HS Division	the Health and Safety Division
HS-1	the Radiation Protection Group
HS-2	the Occupational Medicine Group
HS-3	the Safety and Risk Assessment Group
HS-5	the Industrial Hygiene Group
HSE Division	the Health, Safety, and Environment Division
HSE-1	the Radiation Protection Group
HSE-3	the Safety & Risk Assessment Group
HSE-5	the Industrial Hygiene Group
HSE-7	the Waste Management Group
HSE-8	the Environmental Protection Group
HSE-9	the Health & Environmental Chemistry Group
HSP	Health and Safety Plan
H&S PL	Health and Safety Project Leader
HSWA	Hazardous and Solid Waste Amendments
ICAP	inductively coupled plasma atomic emission spectroscopy
ICPES	inductively coupled plasma emission spectroscopy
ICPMS	inductively coupled plasma mass spectroscopy

IDLH	Immediately Dangerous to Life and Health
INC Division	the Isotope and Nuclear Chemistry Division
INC-7	the Isotope Geochemistry Group
INC-11	the Nuclear and Radiochemistry Group
IP	ionization potential
IWP	Installation Work Plan
J-11	the Radiochemistry Group
JCI	Johnson Controls World Services Inc.
K_D	distribution coefficient
KrF	krypton fluoride
LA	Laboratory of Anthropology
LAAO	Los Alamos Area Office
Laboratory	Los Alamos National Laboratory
LAMPF	Clinton P. Anderson Meson Physics Facility
LANL	Los Alamos National Laboratory
LAPRE	Los Alamos Power Reactor Experiment
LAMPRE	Los Alamos Molten Plutonium Reactor Experiment
LASCP	Los Alamos Site Characterization Program
LASL	Los Alamos Scientific Laboratory (LANL before 1979)
LASSP	Los Alamos Summer Student Program
LEL	lower exposure limit
LET	linear energy transfer
LNAPL	light nonaqueous phase liquid
MDA	Material Disposal Area
MDL	method detection limit
MEGAS	Multiple Energy Gamma Assay Spectrometer
MEK	methyl ethyl ketone
MFP	mixed fission products
MIBK	methyl isobutyl ketone
mph	miles per hour
MOS	mixed oxide semiconductor
mR	milliroentgens
mrem	millirems
MSDS	Material Safety Data Sheet
MSHA	Mine Safety and Health Administration
MST Division	the Materials Science and Technology Division
N Division	the Nuclear Technology and Engineering Division
NaK	sodium potassium eutectic
NC	nuclear chemistry
NCRP	National Committee on Radiation Protection
NCSC	Nuclear Criticality Safety Committee
NEPA	National Environmental Policy Act
NESHAP	National Emission Standards for Hazardous Pollutants
NFA	no further action
NIOSH	National Institute for Occupational Safety and Health
NMED	New Mexico Environment Department
NMEID	New Mexico Environmental Improvement Division
NOD	Notice of Deficiency
NPDES	National Pollutant Discharge Elimination System
NQA	Nuclear Quality Assurance

NRC	Nuclear Regulatory Commission or National Research Council
OSHA	Occupational Safety and Health Administration
OU	Operable Unit
OU PL	Operable Unit Project Leader
OVA	organic vapor analyzer
PCGEMS	Personal Computer Graphical Exposure Modeling System
P Division	the Physics Division
PAC-7	air proportional probe
PARCC	precision, accuracy, representativeness, completeness, and comparability
PA/SI	preliminary assessment/site investigation
PCB	polychlorinated biphenyl
PEL	permissible (or published) exposure limit
PHREEQE	computer code
PID	photoionization detector
PL	Project Leader
PM	Project Manager
PMP	Project Management Plan
ppb	parts per billion
PPE	personal protection equipment
ppm	parts per million
PQL	practical quantitation limit
PVC	polyvinyl chloride
Q Division	the Energy Division
Q-6	the Safety Assessment Group
QA	quality assurance
QAMS	Quality Assurance Management Staff
QAP	Quality Assurance Plan
QAPjP	Quality Assurance Project Plan
QA/QC	quality assurance/quality control
QC	quality control
QP	quality procedure
QPP	Quality Program Plan
QPPL	Quality Program Project Leader
R	retardation factor
RCRA	Resource Conservation and Recovery Act
REL	recommended exposure limit
RfD	reference dose
RFI	RCRA Facility Investigation
RI/FS	remedial investigation/feasibility study
RLW	radioactive liquid waste
RMP	Records Management Plan
RPF	Records Processing Facility
SAP	Sampling and Analysis Plan
SCBA	self-contained breathing apparatus
SCEP	Site Characterization Enhancement Program
SCF	Sample Control Facility
SESOIL-84	unsaturated zone model
SHPO	State Historic Preservation Officer

SMF	Sample Management Facility
SOP	standard operating procedure
SOW	statement of work
SOSG	Standard Operating Safety Guide
SS	special source or nuclear bomb (materials)
STEL	short-term exposure limit
SURFER	computer code
SVOC	semivolatile organic compound
SWISH	Sanitary Wastewater System Consolidation
SWMU	solid waste management unit
TA	Technical Area
TB	technical bulletin
TBD	To be determined
TCLP	toxicity characteristics leaching procedure
TES	EM-8 habitat requirements data base
3-D	three-dimensional
TLD	thermoluminescent dosimeter
TLV	threshold limit value
TNT	trinitrotoluene
TOC	total organic carbon
TPH	total petroleum hydrocarbons
TRU	transuranic waste
TSCA	Toxic Substance Control Act
TTL	Technical Team Leader
TWA	time-weighted average
UC	University of California
UHTREX	Ultra-High-Temperature Reactor Experiment
UL	Underwriters Laboratory
US	United States
USATHAMA	US Army Toxic and Hazardous Materials Agency
USCG	US Coast Guard
USCS	Unified Soil Classified Service
USGS	US Geological Survey
UST	underground storage tank
VCA/IA	voluntary corrective action/interim action
VOC	volatile organic compound
WIPP	Waste Isolation Pilot Project
X Division	the Applied Theoretical Physics Division
Y	
Z	

CHAPTER 1



Introduction

- Overview
- HSWA Requirements
- Operable Unit Description
- Document Organization

1.0 INTRODUCTION

This document is a Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) Work Plan for characterizing the nature and extent of potential contamination associated with hazardous and radioactive waste sites within Operable Unit (OU) 1129 at Los Alamos National Laboratory (the Laboratory). This Work Plan partially satisfies the regulatory requirements of the Hazardous and Solid Waste Amendments (HSWA) Module VIII of the Laboratory's RCRA operating permit. The State of New Mexico issued the Laboratory's RCRA Hazardous Waste Facility Permit (NM0890010515), which became effective February 19, 1990 (NME10 1989, 0595). The US Environmental Protection Agency (EPA) then issued HSWA Module VIII, which became effective May 23, 1990 (EPA 1990, 0306). The University of California (UC) and the US Department of Energy (DOE) Los Alamos Area Office are submitting this Work Plan to EPA in partial fulfillment of the Laboratory's RCRA Hazardous Waste Facility Permit and HSWA Module VIII.

1.1 Overview of the Environmental Restoration Program

DOE created the Office of Environmental Restoration and Waste Management (EM) to implement its policy of ensuring that past, present, and future DOE operations do not threaten human or environmental health and safety. The Environmental Restoration (ER) Program within EM is responsible for assessing, cleaning up, decontaminating, and decommissioning sites at former and present DOE facilities. The Laboratory is operated for DOE by UC and is subject to the DOE ER Program.

The Laboratory's RCRA operating permit set forth requirements that the ER Program at the Laboratory implements. Chapter 3 of the Installation Work Plan (IWP) for Environmental Restoration describes the ER Program at the Laboratory (LANL 1991, 0553). The Laboratory's ER Program is patterned after the RCRA corrective action guidance published by EPA (EPA 1988, 0594) and is guided by specific corrective action requirements prescribed in the HSWA Module. The ER Program is also designed to integrate other requirements from acts and organizations that may be considered technically appropriate, including the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), the Toxic Substance Control Act, the National Environmental Policy Act (NEPA), the State of New Mexico Environment Department (NMED), and statutes and DOE orders as detailed in the (IWP).

The HSWA Module requires the Laboratory to prepare a work plan to describe the Laboratory-wide procedures for accomplishing RFI/corrective measures study work. The Laboratory satisfied this requirement by submitting an IWP to EPA on November 19, 1990 (LANL 1990, 0144). The IWP, which is updated annually, was prepared in accordance with HSWA Module VIII and with EPA Proposed Subpart S of Title 40, Code of Federal Regulations, Part 264 (EPA 1990, 0432). Proposed Subpart S, dated July 1990, will, when promulgated, implement the cleanup program mandated in Section 3004(u) of RCRA. The IWP, a blueprint for conduct of the ER Program at the Laboratory, lists all of the solid waste management units (SWMUs) identified at the Laboratory as of November 1990 and aggregates them into 23 OUs. The IWP also presents a facilities description and a comprehensive description of the Laboratory's ER Program, as well as a site-wide Project Management Plan, Quality Project Plan, Health and Safety Program Plan, Records Management Program Plan, and Community Relations Program Plan. In addition, a proposal to integrate RCRA

closure and corrective action and a strategy for the conduct of interim remedial measures are included in the IWP. General information about the Laboratory and its ER Program and information common to each OU are also provided in the IWP. Therefore, individual OU work plans may reference this material, which eliminates redundancy and streamlines the documents.

1.2 Hazardous and Solid Waste Amendments Requirements

The Laboratory's HSWA Module requires that the Laboratory submit RFI Work Plans to EPA and NMED by May 22, 1992. The RFI for OU 1129 contains 10% (63 of 603) of the SWMUs listed in Table A of the HSWA Module. Twenty-three of the OU 1129 Table A SWMUs are also identified in Table B of the HSWA permit as being priority SWMUs. The tables in the HSWA Module are based on the SWMU report prepared by the Laboratory in 1988 (International Technology Corporation 1988, 0329). Sampling and analysis plans (Chapter 7.0) have been developed for all Table A SWMUs that are not identified as candidates for no further action (NFA) (Table I-2 and Chapter 6.0).

After Laboratory personnel further researched and investigated the TAs, their effort culminated in a revised SWMU report submitted to EPA in November 1990 (LANL 1990, 0145). In that report, some SWMUs were added, combined, or renumbered. The 1990 SWMU report lists 190 SWMUs for OU 1129, including 176 SWMU subunits and 14 areas of concern (AOCs). In the context of this Work Plan, the general use of the term SWMU will refer to SWMUs and their subunits, as defined in the Laboratory's 1990 SWMU report (LANL 1990, 0145). The general use of the term AOC will refer to areas of environmental concern that do not meet the definition of a SWMU. The term AOC is explained to avoid confusing the term AOC as used in this Work Plan with the CERCLA term for area of contamination. The technical approach used in investigating both SWMUs or AOCs will be the same. Table 1-1 presents a list of SWMUs included in the 1988 SWMU report, SWMUs included in Tables A and B of Module VIII, new SWMU numbers (as of 1990), SWMUs and AOCs added to the 1990 SWMU report, a complete list of 1990 SWMUs and AOCs, and a brief description of each SWMU.

Section 3.5 of the IWP states that each OU work plan may propose a HSWA Module Class III permit modification to adjust the SWMUs listed in Table A of the HSWA Module. Such adjustments may be made to remove SWMUs determined to need no further investigation and to add new SWMUs to the revised SWMU report. A list of recommended changes to the 1990 SWMU list for OU 1129 are given in Table 1-2. SWMUs recommended for NFA are described further in Chapter 6.0.

1.3 Description of OU 1129 and Its SWMUs

OU 1129 is comprised of nine Technical Areas (TAs) at the Laboratory: former TA-4; TA-5; TA-35; former TA-42; TA-48; TA-52; TA-55; TA-63; and TA-66. This OU is located in Los Alamos County in north-central New Mexico (Figures 1-1). The entire OU is within the boundaries of the Laboratory, and all OU 1129 land is under DOE control. DOE previously used or currently uses all TAs in OU 1129 for Laboratory operations. A variety of SWMU types is found in OU 1129, including firing sites, disposal areas, aboveground and underground storage tanks, septic systems, outfalls, waste lines, lagoons, oil spills, container storage areas, waste oil and wastewater treatment facilities, and radioactive liquid waste spills. Detailed

TABLE 1-1

CURRENT LISTING OF OPERABLE UNIT 1129 SWMUs AND AOCs AS OF 1990

SWMUs Listed in 1988 SWMU Report[a]	SWMUs Listed in Tables A and B of HSWA Module[b]	Renumbered SWMUs (as of 1990)[c]	Additional SWMUs or Areas of Concern[c] (as of 1990)	Current Listing of SWMUs and Areas of Concern[c] (as of 1990)	SWMU Description
Technical Area 4					
4-001	4-001	—	—	4-001	Firing Site
4-002	4-002	—	—	4-002	Surface Disposal Site
—	—	—	4-003(a-b)	4-003(a-b)	Drains and Outfalls
—	—	—	4-004	4-004	Soil Contamination Beneath Former Building
—	—	—	C-4-001	C-4-001	Potential Soil Contamination Associated with Former Structures
Technical Area 5					
5-001(a-b)	5-001(a-b)	—	—	5-001(a-b)	Firing Sites
–	–	—	5-001(c)	5-001(c)	Firing Site
5-002	5-002	—	—	5-002	Canyonside Disposal
5-003	5-003	—	—	5-003	Calibration Chamber
5-004	5-004	—	—	5-004	Septic System
5-005	5-005*	5-005(a)	—	5-005(a)	French Drain
—	—	—	5-005(b)	5-005(b)	Outfall
—	—	—	5-006(a-h)	5-006(a-h)	Soil Contamination Beneath Former Buildings
—	—	—	C-5-001	C-5-001	Potential Soil Contamination Associated with Former Structures
Technical Area 35					
35-001	—	—	—	35-001	Material Disposal Area W
35-002	35-002	—	—	35-002	Material Disposal Area X
35-003(a-q)	35-003(a-q)*	—	35-003(r, misc.)	35-003(a-r, misc.)	Wastewater Treatment Plant and Receiving Canyon
35-004(a-j)	35-004(e)	—	35-004(k-o)	35-004(a-o)	Active/Inactive Container Storage Areas
35-005	—	—	—	35-005(a-b)	Inactive Surface Impoundments
35-006	35-006*	—	—	35-006	Decommissioned Surface Impoundments
35-007	—	—	—	35-007	Waste-Oil Treatment
35-008	35-008	—	—	35-008	Surface Disposal/Landfill
35-009(a-c)	35-009(a-c)	35-009(a)	—	35-009(a)	Septic System
35-009(d-e)	35-009(d-e)	35-009(b)	—	35-009(b)	Septic System
35-009(f)	35-009(f)	35-009(c)	—	35-009(c)	Septic System
35-009(g)	35-009(g)	35-009(d)	—	35-009(d)	Septic System
35-009(h	35-009(h)	35-009(c)	—	35-009(c)	Septic System Distribution Box
—	—	—	35-009(e)	35-009(e)	Septic System
35-010(a-d)	35-010(a-d)*	—	35-010(misc. =e)	35-010(a-e)	Sanitary Lagoon and Sand Filters
35-011(a-b)	—	—	35-011(c-d)	35-011(a-d)	Active Underground Tanks (USTs)
35-012	—	35-012(a)	35-012(b)	35-012(a-b)	Underground Storage Tanks
35-013(a-d)	—	—	—	35-013(a-d)	Sumps
35-014	35-014	35-014(a-b)	—	35-014(a-b)	Operational Releases

TABLE 1-1 (continued)

CURRENT LISTING OF OPERABLE UNIT 1129 SWMUs AND AOCs AS OF 1990

SWMUs Listed in 1988 SWMU Report[a]	SWMUs Listed in Tables A and B of HSWA Module[b]	Renumbered SWMUs (as of 1990)[c]	Additional SWMUs or Areas of Concern[c] (as of 1990)	Current Listing of SWMUs and Areas of Concern[c] (as of 1990)	SWMU Description
—	—	—	35-014(c-g)	35-014(c-g)	Operational Releases
35-015(a-b)	35-015(b)	—	-	35-015(a-b)	Decommissioned Waste-Oil Treatment
—	—	—	35-016(a-q)	35-016(a-q)	Drains and Outfalls
—	—	—	35-017	35-017	Soil Contamination from Reactor Operations
—	—	—	35-018(a-b)	35-018(a-b)	Leaking PCB Transformers
—	—	—	C-35-001	C-35-001	Former UST Location
—	—	—	C-35-002	C-35-002	Former UST Location
—	—	—	C-35-003	C-35-003	Former UST Location
—	—	—	C-35-004	C-35-004	Oil Spill
—	—	—	C-35-005	C-35-005	Oil Spill
—	—	—	C-35-006	C-35-006	Organic Waste Spill
—	—	—	C-35-007	C-35-007	Unknown Spilled Material
—	—	—	C-35-008	C-35-008	Leaking PCB Transformer
Technical Area 42					
42-001	—	—	—	42-001(a-c)	Incinerator Complex
42-002	—	42-002(a)	42-002(b)	42-002(a-b)	Decontamination Facility
42-003	—	—	—	42-003	Septic System
42-004	—	—	—	42-004	Canyon Disposal
—	—	—	C-42-001	C-42-001	Canyonside Disposal Area
Technical Area 48					
48-001	—	—	—	48-001	Air Exhaust System
48-002(a)	48-002(a)	—	—	48-002(a)	Container Storage Area
48-002(b)	48-002(b)	48-002(c)	—	48-002(c)	Container Storage Area
—	—	—	48-002(b,d-e)	48-002(b,d-e)	Container Storage Areas
48-003(a-b)	48-003(a-b)	48-003	—	48-003	Inactive Septic System
48-004(a-d)	—	—	—	48-004(a-d)	Sumps and Tanks
48-005	48-005	—	—	48-005	Waste Lines
48-006	—	—	—	48-006	Active Septic System
—	—	—	48-007(a-f)	48-007(a-f)	Drains and Outfalls
—	—	—	48-008	48-008	Leakage from PCB Transformers
—	—	—	48-009	48-009	Soil Contamination from Air-Compressor Operations
—	—	—	48-010	48-010	Surface Impoundment
Technical Area 52					
52-001(a-d)	52-001(a-d)	—	—	52-001(a-d)	UHTREX Equipment
52-002(a-b)	52-002(a-b)	52-002(a)	—	52-002(a)	Active Septic System
52-002(c,h,i)	52-002(c,h,i)	52-002(b)	—	52-002(b)	Active Septic System
52-002(d)	52-002(d)	52-002(c)	—	52-002(c)	Active Septic System
52-002(e)	52-002(e)	52-002(d)	—	52-002(d)	Active Septic System
52-002(f-g)	52-002(f-g)	52-002(e)	—	52-002(e)	Active Septic System
52-002(j)	52-002(j)	52-002(f)	—	52-002(f)	Active Septic System

TABLE 1-1 (concluded)

CURRENT LISTING OF OPERABLE UNIT 1129 SWMUs AND AOCs AS OF 1990

SWMUs Listed in 1988 SWMU Report[a]	SWMUs Listed in Tables A and B of HSWA Module[b]	Renumbered SWMUs (as of 1990)[c]	Additional SWMUs or Areas of Concern[c] (as of 1990)	Current Listing of SWMUs and Areas of Concern[c] (as of 1990)	SWMU Description
52-002(k)	52-002(k)	63-001(b)	—	63-001(b)	Active Septic System
—	—	—	52-002(g)	52-002(g)	Active Septic System
52-003	—	—	—	52-003	Waste Treatment Facility
52-004	—	—	—	52-004	Inactive Outfall
—	—	—	C-52-001	C-52-001	Potential Release Site
—	—	—	C-52-002	C-52-002	Potential Release Site
Technical Area 55					
55-001	—	—	—	55-001	Cement Plant
55-002	—	55-002(a)	—	55-002(a)	Radioactive Waste Container Storage Area
—	—	—	55-002(b)	55-002(b)	Radioactive Waste Container Storage Area
55-003	—	—	—	55-003	Containment Area
55-004	—	—	—	55-004	Evaporator
55-005	—	—	—	55-005	Filtration Unit
55-006	—	—	—	55-006	Glass Breaker
55-007	—	—	—	55-007	Thermal Treatment Units
55-008	—	—	—	55-008	Sumps and Tanks
55-009**	—	—	—	—	2 USTs (Delisted in 1989)
55-010	—	55-009	—	55-009	Monitoring Sump
55-xxx	—	55-010	—	55-010	Solvent Spills
—	—	—	55-011(a-e)	55-011(a-e)	Drains and Outfalls
—	—	—	55-012	55-012	Inactive Hazardous Waste Container Storage Area
—	—	—	55-013(a-b)	55-013(a-b)	Active Hazardous Waste Container Storage Areas
—	—	—	C-55-001	C-55-001	MEK/Solvent Spill
Technical Area 63					
52-002(k)	—	63-001(b)	63-001(a)	63-001(a-b)	Septic Systems

Note: The — symbol means that the column heading is not applicable.

[a]International Technology Corporation (1988, 0329).
[b]HSWA Module VIII of the Laboratory's Hazardous Waste Permit (NM0890010515) (EPA 1990, 0306).
[c]Areas of Concern are listed in Appendix C of LANL (1990, 0145).

*Table B priority SWMUs from HSWA Module VIII of the Laboratory's Hazardous Waste Permit (NM0890010515) (EPA 1990, 0306).
**SWMU delisted in 1989; USTs were used for product storage.

TABLE 1-2

RECOMMENDED CHANGES TO 1990 SWMU LIST FOR OU 1129

Proposed New SWMUs	SWMUs Recommended for No Further Action
48-011	5-003
55-002(c)	35-001
63-002	35-002
	35-003(i)
	35-004(c-f, k-l, n)
	35-005(a-b)
	35-006
	35-007
	35-011(a-d)
	35-012(a-b)
	35-013(a-d)
	35-014(e_3)*
	C-35-005
	C-35-006
	C-35-008
	42-004
	C-42-001
	48-004(a-d)
Proposed Changes to SWMU Numbers	48-006
	48-008
52-003 to 52-003 (a-b)	52-001(a-d)
35-014 (e) to 35-014 (e_1,e_2,e_3)*	52-002(b-g)
35-014(g) to 35-014 (g_1,g_2,g_3)*	52-003(b)
	52-004
	55-001
	55-002(a-b)
	55-003
	55-004
	55-005
	55-006
	55-007
	55-008
	55-009
	55-012
	55-013(a-b)
	C-55-001

*See Chapter 3.0 for subscript explanation.

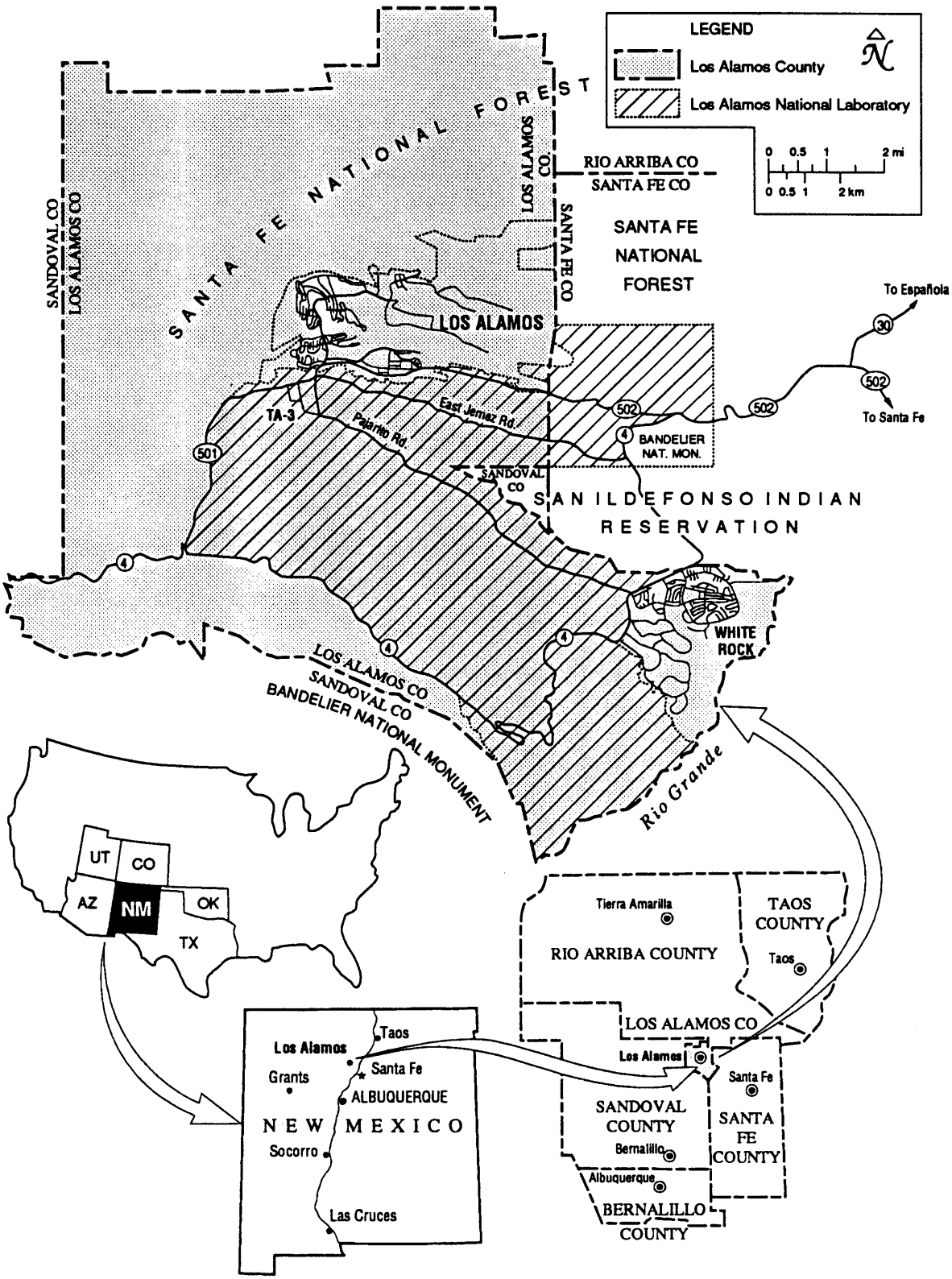


Figure 1-1. Location map of Los Alamos National Laboratory.

descriptions of past and present waste management activities at these SWMUs are provided in Chapter 3.0.

Figure 1-2 shows the location of the current and former TAs that comprise OU 1129. Some general information on the location and background of these TAs is as follows:

- Former TA-4, which is located within the current boundaries of TA-52 and TA-63, was used as a firing site. The site was abandoned in the late 1940s and decontaminated and decommissioned in 1985.

- TA-5, which is located east of former TA-4, was used as a firing site. The site was abandoned in 1959 and decontaminated and decommissioned in 1985.

- TA-35, which is also known as Ten Site and located on a finger mesa between Mortandad and Ten Site canyons, is currently used for safeguard studies, laser research and development, and other experimental research. During the 1950s and 1960s, operations at Ten Site included source preparation, radionuclide experimentation, and nuclear fission reactor development.

- Former TA-42, which is located within the current boundary of TA-55, contained an incinerator for volume reduction of low-level waste. All structures were decontaminated, decommissioned, and removed from TA-42 in 1978.

- TA-48, which is also known as the Radiochemistry Site and located west of TA-55, is currently used for chemical and radiochemical analyses, radioactive waste disposal research, and radioisotope production for nuclear medicine.

- TA-52, which is located within the central portion of former TA-4, is used by the Safety Assessment, Safety Code Development, and Reactor Design and Analysis Groups. The Ultra-High-Temperature Reactor Experiment was operated at TA-52 from 1965 until 1968. It was decontaminated, decommissioned, and removed in 1990.

- TA-55, which was established in 1973 and is located on Pecos Drive just north of Pajarito Road and west of TA-35, is primarily used for the fabrication of plutonium metal components, plutonium processing, and transuranic materials research.

- TA-63, which is located west of TA-52, consists of office buildings and trailers used by the Laboratory's Engineering Field Operations Group, ENG-5, and by Johnson Controls World Services Inc., the maintenance contractor for the Laboratory.

- TA-66, which was established in 1989 and is located southeast of Pajarito Road and TA-63, houses the Advanced Technology Assessment Center for the Department of Defense.

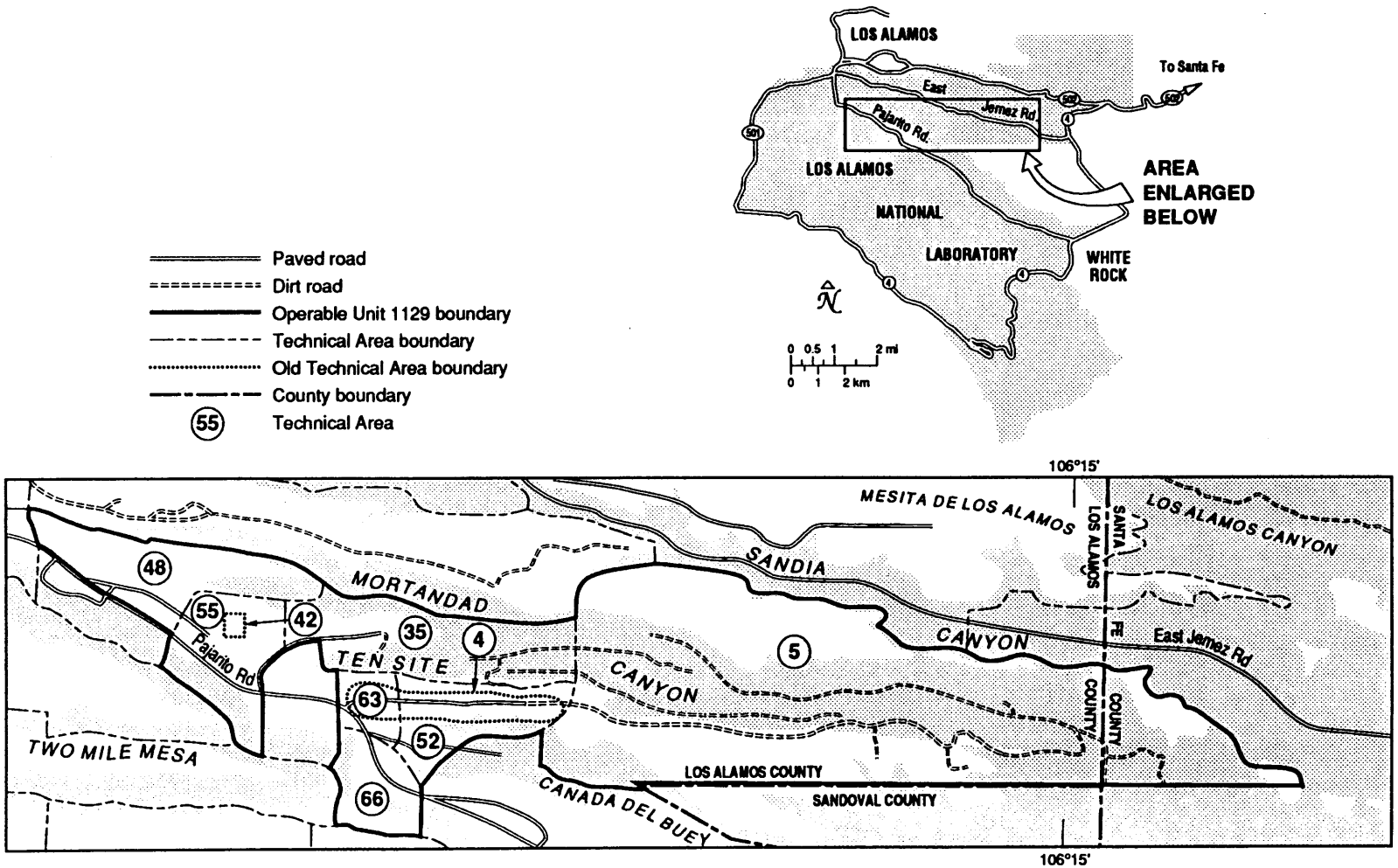


Figure 1-2. Location of OU 1129.

Each of these TAs is described in greater detail in Chapter 3.0, which includes physical descriptions, historical overviews, waste management activities, and a summary of regulatory activities.

1.4 Organization of this Work Plan

The HSWA Module established the general scope for the installation-wide and OU-specific RFI work plans. The HSWA Module outlines five summary tasks to be addressed in the OU-specific RFI work plan. Table 1-3 summarizes these five tasks and lists the ER Program equivalents for each task. The following text discusses the tasks applicable to this Work Plan and identifies the chapters of this Work Plan that correspond to the tasks:

RFI Task I, Description of Current Conditions. This task consists of a presentation of facility background information and a discussion of the nature and extent of contamination.

Chapter 2.0 presents information on the environmental setting of OU 1129 and includes discussions of topography, climatology, geology, hydrology, and biological resources.

Chapter 3.0 provides a description of each of the TAs in the OU, including site location and physical description, historical overview and description of SWMUs and waste management activities, and a summary of regulatory activities for the TAs.

Chapter 4.0 discusses the potential for contamination to the environment at OU 1129, migration pathways and transport mechanisms, and potential public health and environmental impacts.

RFI Task II, RFI Work Plan. This task requires plans for data collection quality assurance, data management, health and safety, and community relations. These plans, along with a project management plan, are presented in Annexes I through V of this Work Plan.

Chapter 5.0 includes a discussion on the overall technical approach, data quality objectives, and the decision process to be implemented during the OU 1129 field investigation. Chapter 5.0 also provides field and analytical data quality requirements.

RFI Task III, Facility Investigation. The requirements of this task include further characterization of the environmental setting, characterization of sources and contaminants, and identification of potential receptors. Chapter 4.0 presents existing information on potential receptors.

Chapter 6.0 presents the rationale for the recommendation of NFA for SWMUs listed in Table 1-2. Documentation is presented to form the basis for the NFA decision.

TABLE 1-3

RFI GUIDANCE FROM HSWA MODULE VIII OF THE LABORATORY'S RCRA OPERATING PERMIT

Scope of the RFI	ER Program Equivalent	OU 1129 Work Plan Equivalent
The RCRA Facility investigation consists of five tasks:	LANL Installation RI/FS Work Plan	LANL Task/Site RI/FS
Task I: Description of Current Conditions A. Facility Background B. Nature and Extent of Contamination	I. LANL Installation RI/FS Work Plan A. Installation Background B. Tabular Summary of Contamination by Site	I. Quality Assurance Project Plan A. Task/Site Background B. Nature and Extent of Contamination
Task II: RFI Work Plan A. Data Collection Quality Assurance Plan B. Data Management Plan C. Health and Safety Plan D. Community Relations Plan E. Project Management Plan	II. LANL Installation RI/FS Work Plan A. General Standard Operating Procedures for Sampling, Analysis, and Quality Assurance B. Technical Data Management Program C. Health and Safety Program D. Community Relations Program E. Project Managment Plan	II. LANL Task/Site RI/FS Documents A. Quality Assurance Project Plan and Field Sampling Plan B. Records Management Project Plan C. Health and Safety Project Plan D. Community Relations Project Plan E. Project Management Plan
Task III: Facility Investigation A. Environmental Setting B. Source Characterization C. Contamination Characterization D. Potential Receptor Identification	III.	III. Task/Site Investigation A. Environmental Setting B. Source Characterization C. Contamination Characterization D. Potential Receptor Identification
Task IV: Investigative Analysis A. Data Analysis B. Protection Standards	IV.	IV. LANL Task/Site Investigative Analysis A. Data Analysis B. Protection Standards
Task V: Reports A. Preliminary and Work Plan B. Progress C. Draft and Final	V. Reports A. LANL Installation RI/FS Work Plan B. Annual Update of LANL Installation RI/FS Work Plan C. Draft and Final	V. LANL Task/Site Reports A. Quality Assurance Project Plan, Field Sampling Plan, Records Management Project Plan, Health and Safety Project Plan, Community Relations Project Plan B. LANL Task/Site RI/FS Documents and LANL Monthly Management Status Report C. Draft and Final

Chapter 7.0 presents sampling and analysis plans (SAPs) for SWMUs listed on the HSWA Module that are recommended for further investigation. Table 7-1 summarizes the SWMU aggregates. The SAPs address the facility investigation requirements and are the general field plans by which all field investigations are implemented.

RFI Task IV, Investigative Analysis. This task contains subtasks of data analysis and protection standards; the IWP addresses these considerations.

RFI Task V, Reports. Task V requirements include preliminary, work plan, progress, draft, and final reports. Work plans are provided on an installation-wide (the IWP) and OU-specific basis, as well as for specific ER Program activities. Monthly progress reports for the entire ER Program will be submitted as described in the IWP, as will draft and final RFI reports.

A proposed and an alternative work plan outline are presented in Tables 3-2 and 3-3, respectively, in the IWP (LANL 1991, 0553). Although the OU 1129 Work Plan does not adhere strictly to that outline, it does include all required work plan elements. The HSWA Module requires that the IWP presents an OU RFI outline for approval by the Administrative Authority; however, the IWP reserved the option to modify the outline as necessary for individual activities. This Work Plan exercises that option to consolidate common elements and improve the organization.

REFERENCES

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)

EPA (US Environmental Protection Agency), June 1988. "RCRA Corrective Action Interim Measures Guidance," Interim Final, EPA/530-SW-88-029, Office of Solid Waste and Emergency Response, Washington, D.C. (EPA 1988, 0594)

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)

International Technology Corporation, December 1988. "Solid Waste Management Units Report, Los Alamos National Laboratory, Los Alamos, New Mexico," prepared by International Technology Corporation, Project No. 301215.02.01, Los Alamos, New Mexico. (International Technology Corporation 1988, 0329)

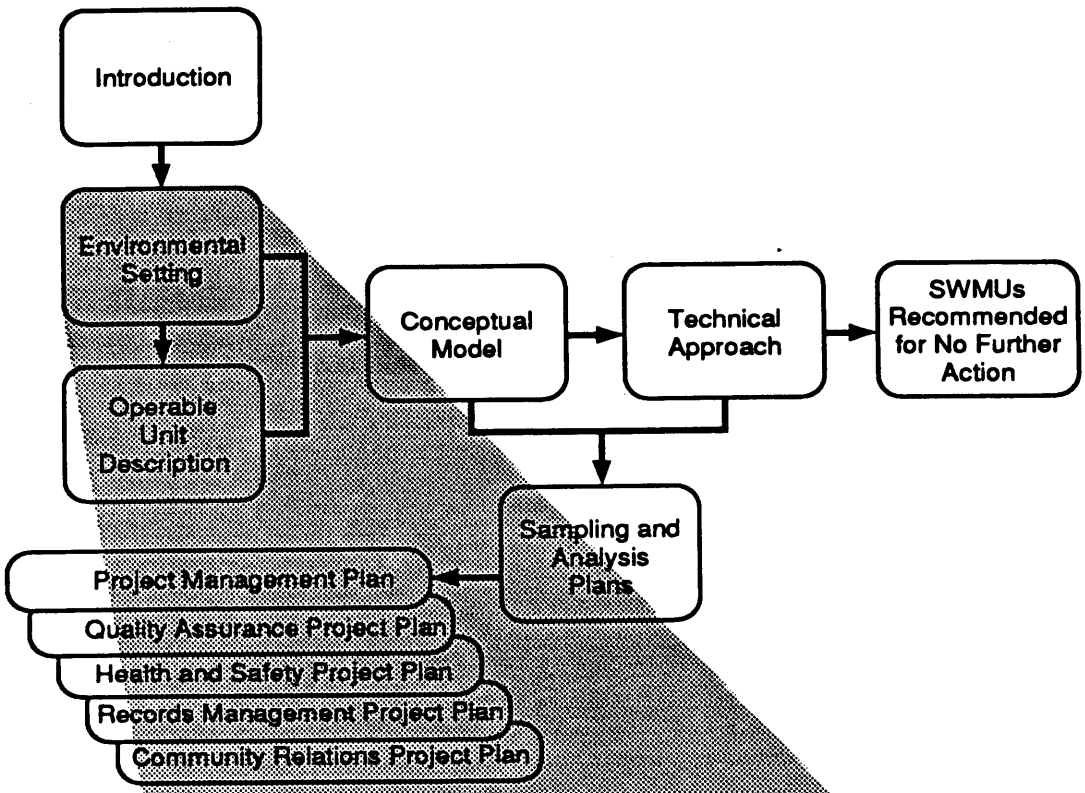
LANL (Los Alamos National Laboratory), November 1990. "Installation Work Plan for Environmental Restoration," Los Alamos National Laboratory Report No. LA-UR-90-3825, Los Alamos, New Mexico. (LANL 1990, 0144)

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 International Technology 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)

NMEID (New Mexico Environmental Improvement Division) November 8, 1989. "Hazardous Waste Facility Permit," Permit No. NM0890010515-1 issued to Los Alamos National Laboratory, Los Alamos, New Mexico, effective February 19, 1990, Santa Fe, New Mexico. (NMEID 1989, 0595)

CHAPTER 2



Environmental Setting

- Environmental Overview
- Geology, Geochemistry and Geophysics
- Hydrology
- Biological Resources
- Cultural Resources

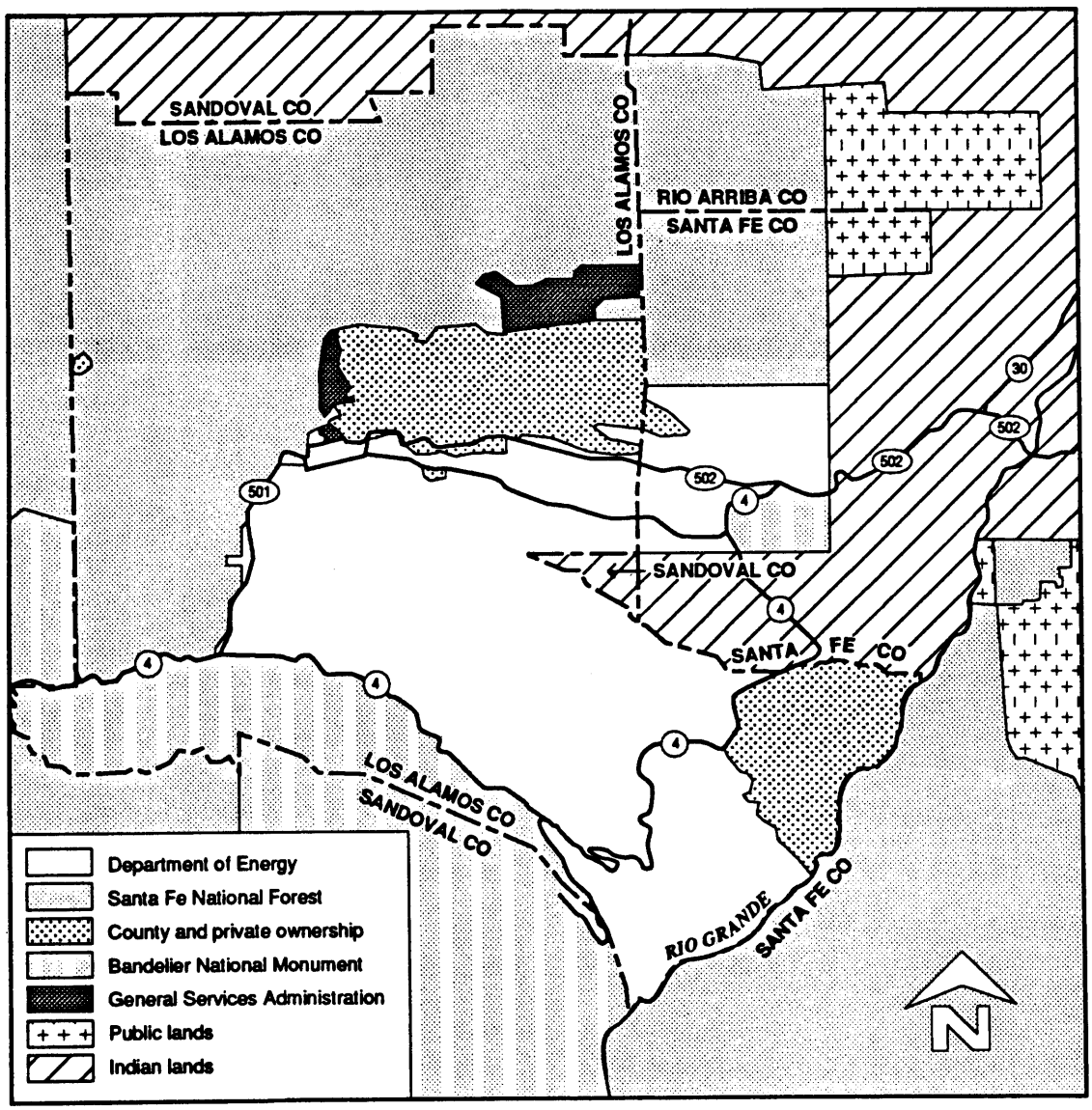


Figure 2-2. Land ownership in the Los Alamos area.

averages 18 in., of which approximately 40% occurs in July and August during summer thundershowers (Figure 2-3). Winter snow accumulations average about 51 in. Summer temperatures range from 50° Fahrenheit (F) to 90°F, while those of winter range from 15°F to 50°F.

The complex surface terrain in the area contributes to wind conditions that vary with time of day and location. Predominant winds are southerly to northwesterly over much of the OU (Figure 2-4). No tornadoes have been reported, but strong dust devils (up to 75 miles per hour [mph]) and spring wind gusts (exceeding 60 mph) occur. The irregular terrain promotes strong daytime dispersion, but nighttime clear skies and light winds result in strong, shallow surface inversions that retard dispersion.

2.2 Geology, Geochemistry, and Geophysics

The effects of regional and local geology, geochemistry, and geophysics on the site conditions at OU 1129 are the focus of this subsection. OU 1129 is located on the Pajarito Plateau along the eastern flanks of the Jemez Mountains. The upper portions of the plateau are composed of Bandelier Tuff volcanic rocks that erupted from the Jemez volcanic field (Smith and Bailey 1966, 0377).

2.2.1 Geology

2.2.1.1 Tectonic Setting

The Rio Grande rift, extending from central Colorado to southern New Mexico, dominates the tectonic setting of the Los Alamos area. The Española basin is one of several Late Tertiary basins associated with the rift (Chapin 1979, 0597) (Figure 2-1). The rift first evolved approximately 25 to 30 million years ago. It is characterized by crustal extension as displayed in most normal fault geometry. In northern New Mexico, the rift is bounded on the west by the Sierra Nacimientos and on the east by the Sangre de Cristo range of the southern Rocky Mountains (Figure 2-1). Manley (1979, 0349) considers the Pajarito Plateau and its underlying rocks as a geologic feature of the Española basin segment of the Rio Grande rift.

The Española basin is separated from the San Luis basin to the north by the Embudo fault zone and from the Albuquerque-Belen basin to the south by the La Bajada fault zone. The Jemez lineament is an alignment of Miocene to Quaternary volcanic centers stretching from western Arizona to southeastern Colorado through the Española basin (Mayo 1958, 0603). The Jemez volcanic field, including the Valles caldera, is the largest volcanic center along this lineament. Aldrich (1986, 0554) describes the Jemez lineament as being controlled by the various fault zones trending across the basin. The Cerros del Rio volcanic field, just east of the Pajarito Plateau, is a peripheral part of the Jemez field (Smith et al. 1970, 0606) (Figure 2-1).

2.2.1.2 Volcanism

Volcanism began in the Pajarito Plateau region about 16.5 to 14 million years ago as small volume basaltic extrusions. These earlier basaltic volcanics are interbedded and interfingered with the sedimentary rocks of the Española basin (Dethier and

2.0 ENVIRONMENTAL SETTING

2.1 Environmental Overview

2.1.1 Topography

Los Alamos National Laboratory (the Laboratory) and the associated residential areas of Los Alamos and White Rock are located in Los Alamos County, north-central New Mexico, approximately 60 mi north-northeast of Albuquerque and 25 mi northwest of Santa Fe (Figure 1-1). The Laboratory and adjacent communities occupy 43 mi^2 on the Pajarito Plateau, which is a series of finger-like mesas separated by deep east-west oriented canyons (Figure 2-1). Mesa tops range in elevation from about 7,800 ft on the western flank of the Jemez Mountains to about 6,200 ft at their eastern termination above the Rio Grande Valley.

Operable Unit (OU) 1129 is situated along Pajarito Road near the center of the northern half of the Laboratory (Figure 1-2). OU 1129 consists of nine Technical Areas (TAs), TAs-5, -35, -48, -52, -55, -63, and -66, and two former TAs, TAs-4 and -42. Attachment I is a fold-out map that shows the location of the OU 1129 TAs and associated HSWA Modole solid waste management units (SWMUs) (EPA 1990,0306). OU 1129 is located on Mortandad Mesa, which is bounded by Mortandad Canyon on the north and Two Mile and Pajarito canyons on the south. The total land area of OU 1129 is 2.1 mi^2. Mesa top elevations range from 7,360 ft at the western boundary of OU 1129 to 6,800 ft at the eastern edge of the mesa. Canyon bottom elevations within OU 1129 range from 7,200 ft to 6,800 ft.

2.1.2 Land Use and Demographics

The land the Laboratory bounds is managed by the Santa Fe National Forest, Bandelier National Monument, the General Services Administration, and Los Alamos, Sandoval, and Santa Fe Counties, as well as by land owned by the San Ildefonso Pueblo and private owners (Figure 2-2). The Department of Energy (DOE) owns all of the land that OU 1129 is on, and the future land use of OU 1129 is anticipated to be for Laboratory operations.

Laboratory land in OU 1129 is used for building sites, experimental areas, waste disposal locations, roads, and utility rights-of-way. Access to TAs -48, -55, and -66 is controlled by a manned guard gate, while TAs-4, -5, -42, and -63 are accessible to the public. Some buildings within TAs -35 and -52 are fenced and gated; however, the major portions of these TAs are accessible to the public.

Los Alamos County has an estimated population of approximately 19,300 people in the two residential and related commercial areas of Los Alamos and White Rock. Population estimates for 1989 placed about 208,000 people within a 50-mi radius of Los Alamos (Environmental Protection Group 1990, 0497).

2.1.3 Climate

Los Alamos has a semiarid, temperate mountain climate. Bowen (1990, 0033) has compiled and interpreted climatological data for the area. Annual precipitation

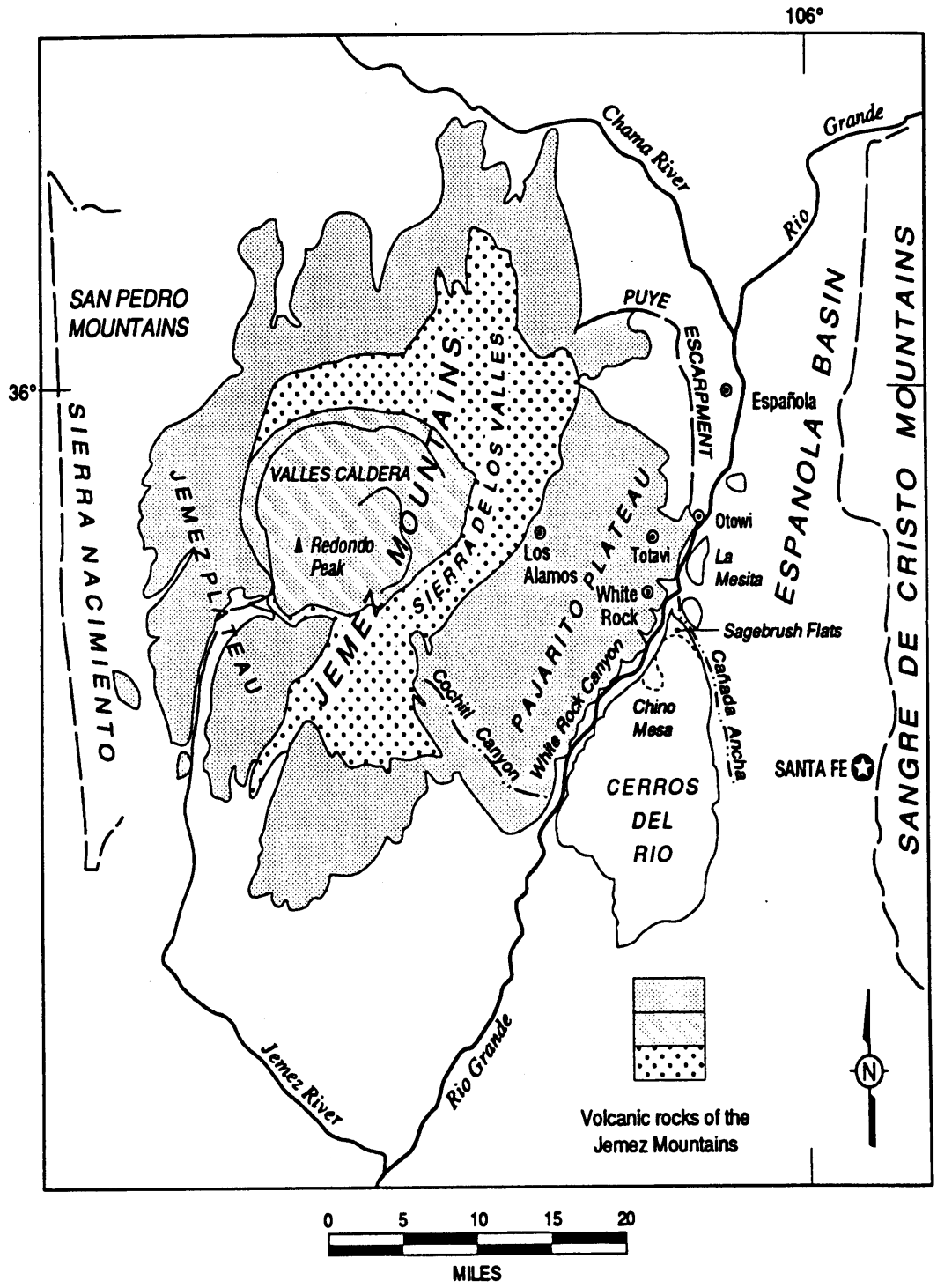


Figure 2-1. General geographic location and topographic features in the vicinity of Los Alamos.

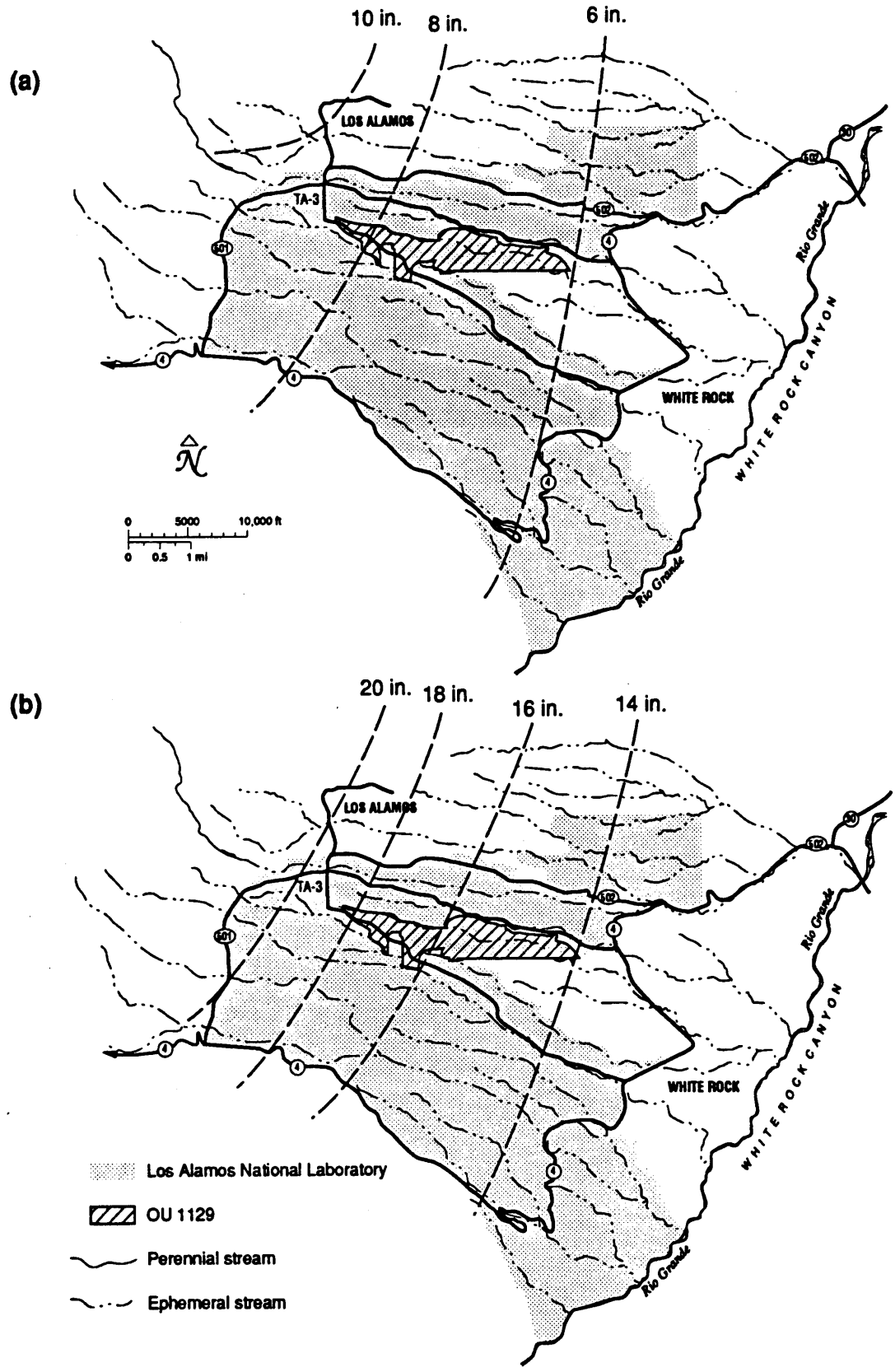


Figure 2-3. (a) Summer (June–August) mean precipitation at Los Alamos; (b) annual mean precipitation at Los Alamos.

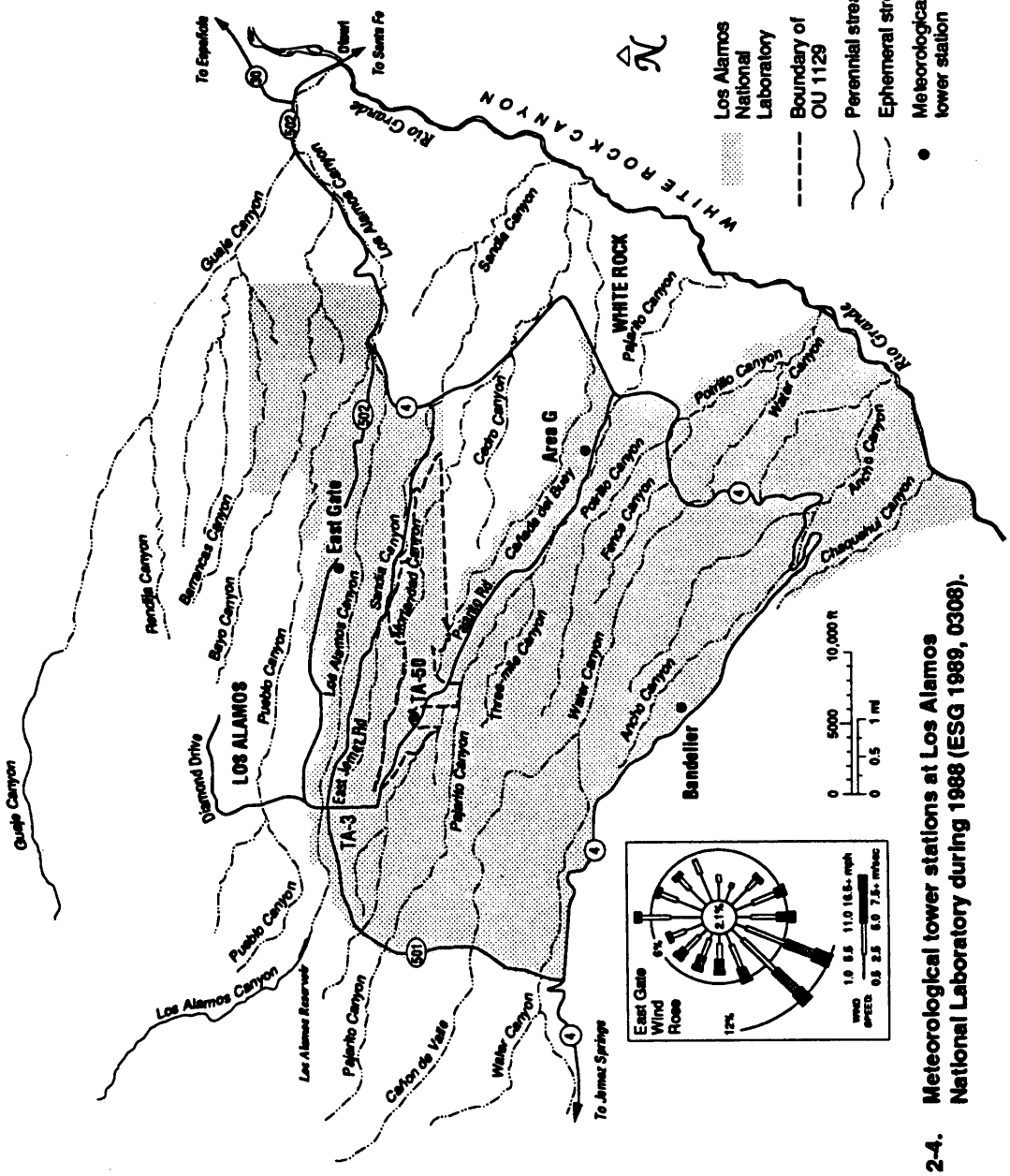


Figure 2-4. Meteorological tower stations at Los Alamos National Laboratory during 1988 (ESG 1989, 0308).

Manley 1985, 0249; Gardner et al. 1986, 0310; New Mexico Bureau of Mines and Mineral Resources 1990, 0557). The major volcanic feature, the Jemez volcanic field, originated with eruptions of mostly andesitic domes and flows that occurred about 10 to 7 million years ago. These flows were followed by predominantly dacitic extrusions, about 6 to 2.5 million years ago, which compose the Sierra de los Valles immediately west of Los Alamos (Figure 2-5). The andesitic and dacitic extrusions, which compose 360 mi^3, are the source of the volcaniclastic aprons of the Cochiti and Puye formations, which spread eastward into the Española basin. The Cerros del Rio basaltic lava flows and scoria cones, which erupted 4 to 2 million years ago, interfinger with the volcaniclastic deposits and fluvial and basin-fill sediments, all underlying the Pajarito Plateau.

With the formation of the Toledo and Valles calderas 1.5 and 1.13 million years ago, respectively, about 144 mi^3 of rhyolitic ash flow tuff (Bandelier Tuff) was deposited within and on the flanks of the Jemez Mountains (Smith and Bailey 1968, 0605; Doell et al. 1968, 0599; Spell et al. 1990, 0607). These ash flows represent the largest eruptive events in northern New Mexico. Because the Pajarito Plateau is composed primarily of Bandelier Tuff deposits from 260 to 1,050 ft thick, this is the dominant rock unit at OU 1129. The most recent volcanism, which occurred approximately 1.05 to 0.13 million years ago, includes intracaldera eruptions of rhyolitic pumice, lava domes, and flows.

2.2.1.3 Pajarito Plateau Stratigraphy

The Bandelier Tuff of Pleistocene age immediately underlies the mesa surfaces within OU 1129. The tuff is exposed in a few places on the mesa surface and is almost completely exposed along the canyon walls. Beneath the Bandelier Tuff, a sequence of interstratified sedimentary and volcanic rocks of Miocene to Pleistocene age occurs. This sequence, which has been penetrated by water supply wells, also crops out on the margins of the Pajarito Plateau. Along the canyon walls within OU 1129 and below the Bandelier Tuff are outcrops of Pliocene to Pleistocene andesite and latite volcanic rocks of the Tschicoma Formation, basaltic rocks of the Cerros del Rio volcanic field, and sedimentary rocks of the Puye Formation, as well as Pliocene sedimentary rocks of the Totavi Formation (Figure 2-5). The four youngest lithologic units are discussed briefly in the following text. A more extensive discussion of all of the geologic units can be found in the IWP (LANL 1991, 0553).

2.2.1.3.1 Bandelier Tuff

The Bandelier Tuff is the primary stratigraphic unit of OU 1129. It is subdivided into lower and upper units, the lower Otowi Member (1.5 million years old) and the upper Tshirege Member (1.13 million years old). These subunits have distinctive, 3- to 36-ft-thick basal pumice and ash falls called the Guaje and Tsankawi pumice beds, respectively (Bailey et al. 1969, 0019; Self et al. 1986, 0375). The Otowi Member is a crystal-rich rhyolite tuff. It is generally nonwelded and vitric throughout, and bears more lithic fragments than does the Tshirege Member. The Tshirege Member is a crystal-rich, nonwelded to moderately welded rhyolite tuff containing phenocrysts of sanidine and quartz. Lithic fragments are subordinate (~2%). Under Sigma Mesa, approximately 1 mi west of OU 1129, the Otowi Member is 430 ft thick and the Tshirege Member is 269 ft thick. The actual thicknesses of these two members beneath OU 1129 has not been determined. Vaniman and Wohletz (1990, 0541) developed a stratigraphy for the Tshirege Member (Figure 2-6) on the basis of the physical characteristics of this high-silica, crystal-rich tuff after observing that it is

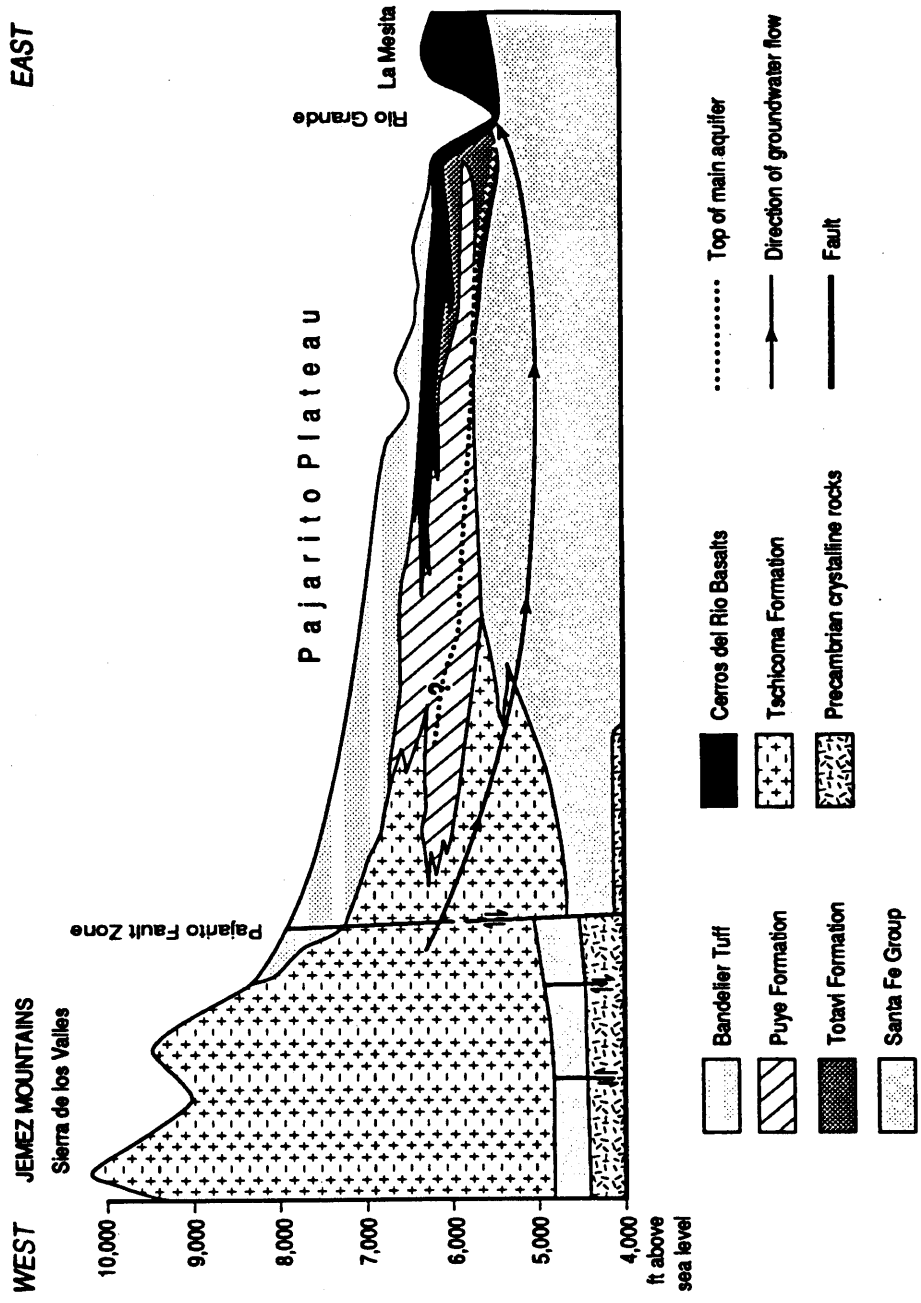


Figure 2-5. Generalized cross section showing stratigraphy and structure of the Pajarito Plateau from the Sierra de los Valles to the Rio Grande (modified from Purtymun 1984, 0196).

chemically and mineralogically homogeneous in the vicinity of OU 1129. This stratigraphy includes four principal units from bottom to top: (1) white, pink, and gray nonwelded vitric tuff, approximately 55 to 160 ft thick, which is easily eroded; (2) nonwelded to densely welded brown- and salmon-colored tuff, approximately 100 to 180 ft thick, which is resistant to erosion; (3) nonwelded brown to moderately welded white tuff, approximately 65 to 180 ft thick, which has variable erodibility with vapor-phase alteration; and (4) strongly indurated nonwelded to moderately welded white tuff, less than 100 ft thick, which shows vapor-phase alteration (Baltz et al. 1963, 0024; Crowe et al. 1978, 0041).

2.2.1.3.2 Puye Formation

The underlying Puye Formation is a volcanogenic alluvial fan that spreads eastward from the Tschicoma volcanic center of the Polvadera Group. Smith et al. (1970, 0606) mapped and Turbeville et al. (1989, 0221) studied the formation, which was deposited between 3.5 and 1.9 million years ago. The formations areal extent covers an area of 77 mi^2, the formation is 600 ft thick beneath Sigma Mesa and is intersected by all deep water wells in the northern Pajarito Plateau area (Dransfield and Gardner 1985, 0082). The Puye Formation consists predominantly of conglomerates in a volcanic sand matrix and subordinate finer grained sediments. It is interbedded with Tschicoma dacite/andesite flows and Cerros del Rio basalt flows.

2.2.1.3.3 Totavi Formation

The Totavi Formation (formerly the Totavi Lentil) is a coarse, poorly consolidated conglomerate defined as the basal unit of the Puye Formation (Griggs and Hem 1964, 0313). The lithology of the Totavi Formation (cobbles within an arkosic matrix), however, suggests that it is more closely related to the Chamita Formation described in the following text. The Totavi Formation is 65 ft thick beneath Sigma Mesa and, although its exact age is unknown, it was probably deposited between 3.5 to 2.5 million years ago (Turbeville et al. 1989, 0221).

2.2.1.3.4 Santa Fe Group

In the vicinity of the Pajarito Plateau, the Santa Fe Group consists of the Tesuque and overlying Chamita Formations (Galusha and Blick 1971, 0108; Manley 1979, 0349; Cavazza 1989, 0242). The rocks of the Santa Fe Group are predominantly arkosic, fluvial sandstone, siltstone, and conglomerate with subordinate aeolian, ash, and lacustrine beds. The Tesuque Formation, which is about 21 to 7 million years old, is made up primarily of Miocene and early Pliocene terrestrial conglomerates, sandstones, mudstone volcanic tuffs, and intercalated basalts. The Chamita Formation, which is 4.5 to 6 million years old, is similar to the Tesuque Formation in composition and is interfingered with it (MacFadden 1977, 0690). Basaltic flows and flow breccias are commonly interfingered with Santa Fe Group deposits, especially on the east side of the Pajarito Plateau. Dacitic to andesitic flows of the Polvadera Group are interbedded on the west side of the plateau.

2.2.1.4 Pajarito Plateau Structure

The Pajarito Plateau dips gently several degrees to the east and northeast. Most of the stratigraphic units that compose the plateau reflect this gentle regional dip. The

plateau is cut by six fault zones of the Pajarito fault system, which includes the Pajarito, Guaje, and Rendija canyon faults. The six fault zones show Quaternary movement (Dransfield and Gardner 1985, 0082; Wachs et al. 1988, 0502). Gardner and House (1987, 0110) compiled and Krier (1990, 04-0235) reinterpreted the structural contours for the Pajarito Plateau. The revised structural contours reveal three major lithologies interfingering beneath the Laboratory. The interfingering lithologies are cut by a series of down-to-the-west faults.

Numerous microstructures characterize the Bandelier Tuff (Vaniman and Wohletz 1990, 0541). These include micrograbens up to 25 ft across and 75 ft long with vertical displacements up to 10 ft. Joint sets in the tuff sometimes form zigzag fracture patterns along which greater erosion is evident. Fractures are a conspicuous feature of the Bandelier Tuff, trending in northwest and northeast sets with nearly vertical individual fractures, 5 to 10 ft apart. Earlier studies by Baltz et al. (1963, 0024) and Dames & Moore (1972, 0044) called these fractures "joints" because no appreciable movement is noted along them. These fractures are typical features of welded tuff and are generally attributed to contraction of the tuff upon cooling.

In a later study made in the vicinity of OU 1129, Vaniman and Wohletz (1990, 0541) reported that the linear density and average width of these fractures increase in the immediate vicinity of the Rendija Canyon and Guaje Mountain fault splays of the Pajarito fault system. Average fracture openings are about 1.0 cm, and observed vertical displacements along these fractures are also about 1.0 cm, which is evidence of fault movement. Cumulative surface deformation calculated over the Rendija Canyon fault zone along Pajarito Road is about 8.2 ft horizontal and 8.6 ft vertical, dispersed over 900 horizontal ft. Surface deformation on the Guaje Mountain fault zone along East Jemez Road is calculated to be 5.8 ft horizontal and 6.1 ft vertical, spread out over 1,600 horizontal ft. This would indicate that tectonic movement has caused 6 to 9 ft of vertical displacement of the fractures over distances of 900 and 1,600 ft across the Rendija Canyon and Guaje Mountain faults, respectively. Inflections in mesa-top and canyon-bottom topographic gradients support the fracture measurements (Figure 2-7).

2.2.2 Geochemistry

The Otowi Member ranges in SiO_2 content from 75.8 to 77.9 wt %, while the Tshirege Member ranges from 72 to 77 wt %. Crowe et al. (1978, 0041) and Kuentz (1986, 0602) presented trace element data that show uranium concentrations ranging from 4 to 18 parts per million (ppm), lead concentrations ranging from 6 to 49 ppm, and mercury concentrations at less than 5 ppm. The Tshirege Member of the Bandelier Tuff is the primary subunit of concern at OU 1129. Mineral content of this member increases stratigraphically upward from 5% to 35% of the volume (Smith and Bailey 1966, 0377). Xenoliths occupy a volume of up to 25% in some parts of this subunit, while the remaining volume is mostly unaltered glass. No data exist for the volume contribution by microcrystalline alteration (e.g., clays, zeolites, and vapor-phase minerals) for the Tshirege Member.

2.2.3 Geophysics

Geophysical characterization of the Pajarito Plateau includes some rock characterization and seismic studies. Although systematic bulk densities of the Bandelier Tuff have not been performed, nonwelded rocks range in density from 1.0 to 1.7 gm/cm^3 (Heiken 1979, 0600) and up to 2.4 gm/cm^3 for densely welded tuff. Gardner and

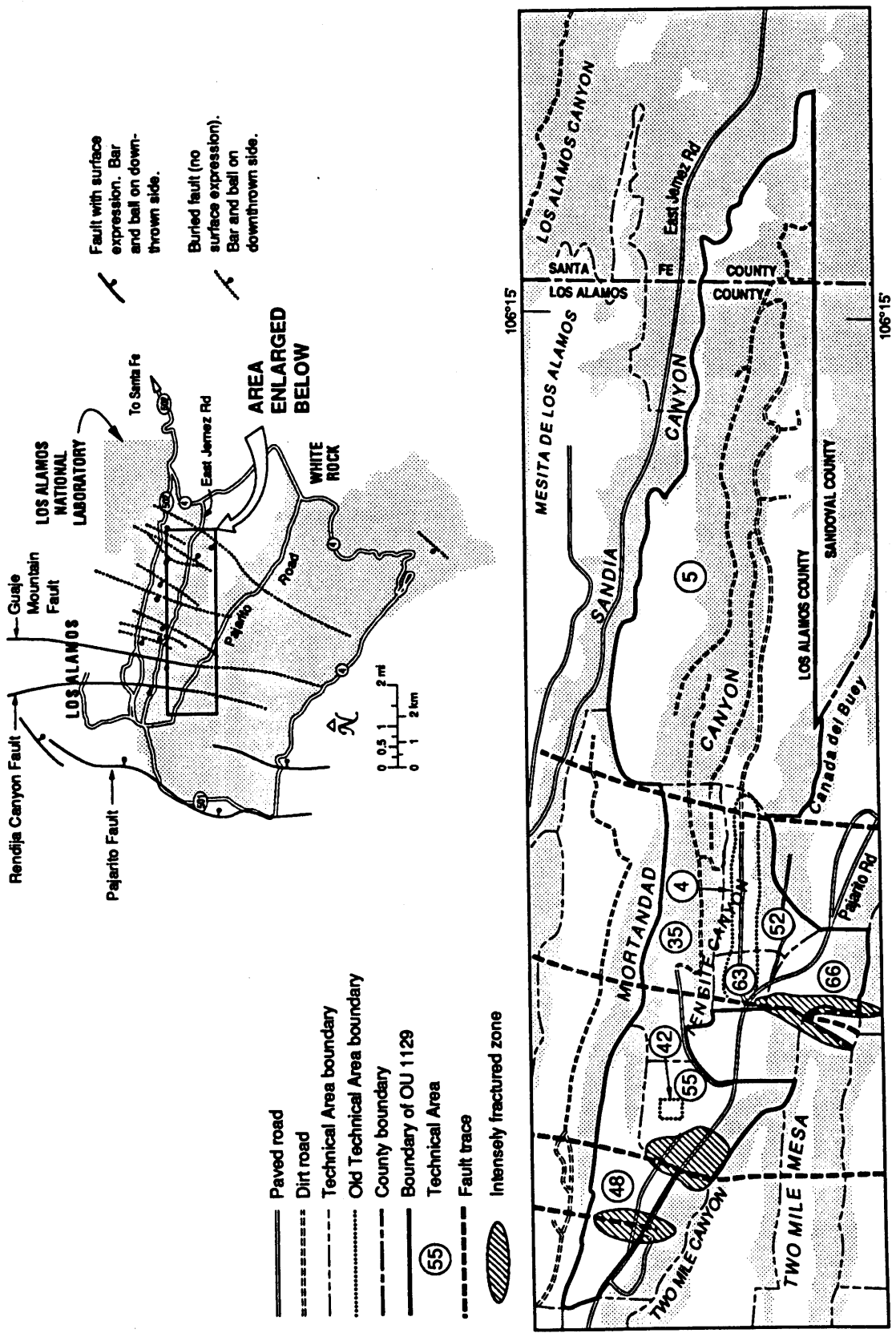


Figure 2-7. Locations of fault traces and intensely fractured zones along Pajarito Road near TAs -48, -55, and -35 (modified from Vaniman and Wohletz 1990, 0541).

House (1987, 0110) determined seismic P-wave velocities ranging from 2,500 ft per second for vapor-phase-altered tuff of the Tshirege Member to 15,000 ft per second for some densely welded Bandelier Tuff. Gravity surveys (Budding 1978, 0596; Williams 1979, 0608; Cordell 1978, 0598; Cordell 1979, 0604) show a prominent gravity low in the Pajarito Plateau area with inflection points in gravity profiles near projected faults. Seismic reflection surveys (Bridwell et al. 1979, 0646) through Mortandad Canyon did not show consistent shallow reflectors that might represent the base of the Bandelier Tuff; however, the data did indicate bedrock offset that suggests that the Rendija Canyon and Guaje Mountain faults extend through OU 1129.

2.2.4 Soils

Soils on the Pajarito Plateau, as mapped and described by Nyhan et al. (1978, 0161), are derived from the Bandelier Tuff and are poorly developed under a semiarid climate. Mesa top soils in the vicinity of OU 1129 are mainly shallow, well-drained sandy loams of the Hackroy series. The surface layer is a brown sandy loam, or loam about 4 in. thick, while the subsoil is a reddish-brown clay, gravelly clay, or clay loam about 8 in. thick. These soils are classified as Alfisols and have an effective rooting depth of about 8 to 20 in. Intermixed with the Hackroy soils on mesa tops are small areas of deeper loams of the Nyjack series, which are texturally similar to Hackroy soils but are distinguished by thicknesses of 20 to 40 in. and by the common presence of pumice fragments in the lower zones. Other soils of the Pajarito Plateau and pertinent to OU 1129 are the Tocal series soils and the Cuervo series soils. The Tocal series soils range in thickness from 0 to 14 in. The composition of these soils ranges from a fine sandy loam to a clay at depth. The Cuervo series soils are gravelly or coarse sandy soils ranging in thickness from 0 to 28 in. (Nyhan et al. 1978, 0161). Soil thicknesses may be reduced in TAs that have undergone scarification or landscaping for construction or decommissioning purposes.

Hackroy series soils are typically present at TAs-4, -35, and -52. Nyjack series soils are common throughout the grounds of TAs -5, -63, and -66. Tocal series soils are predominant at TA-42, and Cuervo series soils and present at TAs-48 and -55 (Nyhan et al. 1978, 0161).

The slopes between mesa tops and canyon bottoms are mostly mapped as steep rock outcrops consisting of about 90% bedrock and patches of shallow, undeveloped soils. The south-facing canyon walls are steep and have little or no soil material or vegetation. North-facing walls have areas of very shallow, dark soils.

2.3 Hydrology

2.3.1 Surface Water Hydrology

Surface water drains across the Pajarito Plateau and OU 1129 eastward from the Jemez Mountains to the Rio Grande, and continues south to the Cochiti Reservoir through the Rio Grande Valley. Los Alamos area surface water occurs primarily as intermittent streams in all the major canyons that border or transect OU 1129 (i.e., Mortandad, Pajarito, Two Mile, and Ten Site canyons, and Cañada del Buey) (Figure 2-8). Springs on the flanks of the Jemez Mountains supply base flow into the upper reaches of some canyons, but the amount is insufficient to maintain surface flow. Run-off from heavy thunderstorms and spring snowmelt is the sole source of surface

water within the boundaries of OU 1129. Effluent from an industrial waste treatment plant and cooling-tower water are released to Mortandad Canyon, just north of OU 1129, at rates sufficient to maintain flow for about 1 mi downstream from the point of discharge (Environmental Protection Group 1990, 0497). Stream loss caused from infiltration into underlying alluvium and evapotranspiration typically prevents surface flow in these canyons from discharging across the eastern boundary of OU 1129. During periods of excessive storm run-off or snowmelt, surface flow may reach the Rio Grande (Abeele et al. 1981, 0009). Some drainages within or surrounding OU 1129 either contain solid waste management units (SWMUs) or may receive surface run-off from SWMUs located within the OU.

2.3.2 Hydrology of the Vadose Zone

OU 1129 overlies approximately 950 ft of unsaturated volcanic tuff, sediments, and basalt of the Bandelier Tuff, the Puye Formation, and the Cerros del Rio basalt. Numerous investigations characterizing the hydrology of the upper 100 ft of Bandelier Tuff have been conducted in the Los Alamos area since the 1950s (e.g., 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 vadose zone below about 100 ft has not been adequately characterized.

Modeling water and contaminant movement in the vadose zone at OU 1129 requires a detailed understanding of the physical, hydrogeologic, and hydrogeochemical properties of the transport medium (the Bandelier Tuff). However, no vadose studies have been undertaken within OU 1129 that can provide adequate parameters for modeling. As a result, hydrogeologic characterizations of the Bandelier Tuff in adjacent areas (TA-50 and TA-54) should be considered sufficiently representative of OU 1129 to be discussed here. Aspects of interest include the following:

- **Physical characteristics of the Bandelier Tuff**—degree of welding and variability within and between pyroclastic flow units; influence of welding on physical and hydrogeologic properties; orientation, frequency, and filling of joints and fractures; interconnectedness of fractures; flow barriers or pathways at pyroclastic flow unit contacts or paleosurfaces;
- **Hydrogeologic properties of the Bandelier Tuff**—particle size distribution, porosity, moisture content, moisture-tension relationship, hysteresis, hydraulic conductivity, intrinsic permeability; and
- **Hydrogeochemical properties of the Bandelier Tuff**—retardation factor, distribution coefficient, and cation-exchange capacity for specific inorganic and organic contaminants.

For water and contaminant modeling that will be done for OU 1129, detailed information on the physical and hydrogeologic properties of the Bandelier Tuff are discussed in the following sections.

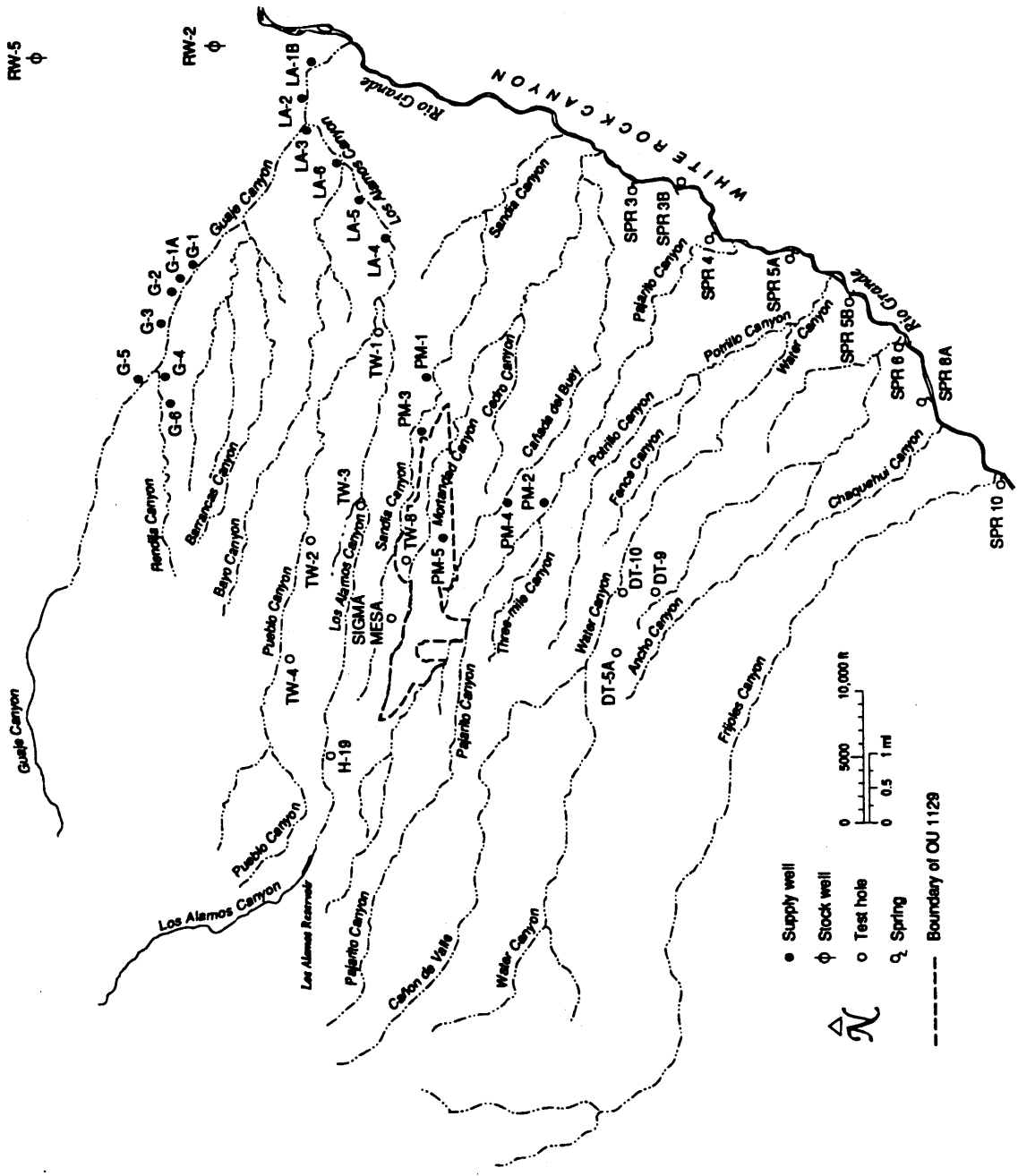


Figure 2-8. Location of major surface water drainages, springs, test holes, and stock and supply wells in the Los Alamos area (modified from Purtymun 1984, 0196).

2.3.2.1 Physical Characteristics of the Bandelier Tuff

A series of ash flows and ash falls described as nonwelded, moderately welded, and welded tuffs formed the Bandelier Tuff. The units are gradational, both vertically and horizontally. Individual ash flows, or a series of flows that have cooled as a single unit, may show a greater degree of welding near the center than near the upper and lower contacts. Horizontal variation in welding occurs with the greatest degree of welding westward toward the ash source (Purtymun 1975, 0194).

The US Geological Survey and the University of California performed injection tests to determine the hydrologic characteristics of the unsaturated Bandelier Tuff at TA-50 (TA-50 is surrounded by OU 1129). The test results, described in Section 2.6.3.3.2, Injection Well Studies, of the IWP (LANL 1991, 0553), led the authors to conclude that the hydrologic characteristics of the unsaturated tuff can cause retention or arrest the movement of water-soluble contaminants.

Physical characteristics of the tuff that affect fluid flow result primarily from the degree of welding and jointing. The degree of welding, which varies markedly within and between tuff units, influences the nature and variability of hydrologic characteristics. Welding results in increased density, decreased porosity, and decreased hydraulic conductivity (Purtymun and Koopman 1965, 0201). Joints, formed by the cooling of the ash flows, typically divide the tuff into irregular blocks. The major joint sets are vertical or near-vertical with dips greater than 70 degrees, and joint frequency increases with degree of welding. Joint apertures range from closed to several centimeters open. The joints are commonly filled with caliche near the surface and grading downward to clay, and the joints may be open at depths greater than 30 ft (Purtymun et al. 1978, 0207; Abeele et al. 1981, 0009). Filled fractures strongly inhibit moisture movement. Open fractures are effective barriers to liquid-phase unsaturated flow but provide preferential flow paths for vapor transport under unsaturated conditions or for rapid water movement under saturated or near-saturated conditions (Abeele et al. 1981, 0009). Roots have been found in joints to depths of at least 30 ft (Abeele et al. 1981, 0009), which suggests that joints may be important infiltration pathways.

2.3.2.2 Hydrogeologic Properties and Conditions of the Bandelier Tuff

Most investigations of the hydrogeologic properties of the Bandelier Tuff have been conducted on crushed or disturbed tuff samples, and applying these values to *in situ* tuff is uncertain.

Particle Size Distribution. Size of the particles in the tuff has a direct effect on the movement of water because particle arrangement and packing determine porosity and pore size.

Porosity. Porosity measurements by Abrahams (1963, 0011) range from 20% to 60% by volume, generally decreasing with increasing degree of welding. Measurements by Hurley et al. (1985, 0601) yielded slightly higher values, from approximately 39% to 74%. Extreme changes in porosity over a short vertical distance have been observed (Abrahams 1963, 0011).

Moisture Content. A number of hydraulic properties of the vadose zone vary with changing moisture content. A very low volumetric moisture content typically

characterizes the tuff. Vadose zone characterization studies at TA-54, located just east of OU 1129, indicated that typical volumetric moisture contents were 2% to 4%, with localized intervals ranging from 10% to 28% (International Technology Corporation 1987, 0327). Studies by Abrahams (1963, 0011) showed that moisture content varied between disturbed and undisturbed soils and that, generally, moisture content decreased with depth. Tuff samples taken from just below the surface had volumetric moisture contents ranging from less than 1% in samples from undisturbed areas, to about 26% in samples from disturbed areas. At sites with high near-surface moisture contents, the volumetric moisture content decreased rapidly with depth to less than 5% (Abrahams 1963, 0011). The TA-54 studies also indicated varying depths of water infiltration and relatively high moisture contents associated with certain fractures and with a moderately welded zone in the lower portion of the Tshirege Member.

Moisture Characteristic Curves. The relationship between moisture content and soil-water potential has been obtained from rock cores at TA-54 by Hurley et al. (1985, 0601). These data indicate extremely high residual moisture contents ranging up to 80%, and a low air-entry pressure head. Purtymun and Stoker (1987, 0204) indicated that, at TA-49, specific retention (residual moisture content) ranged from 11% to 27%.

Hysteresis. The relationships between capillary pressure and moisture content, and capillary pressure and hydraulic conductivity are hysteretic; that is, the relationship depends on whether the soils are wetting or drying. Abrahams (1963, 0011) presented moisture-tension data that show significant hysteretic effects. This indicates that a temporal history of wetting and drying will be required to predict pressure heads and hydraulic conductivities from moisture content values for the Bandelier Tuff.

Unsaturated Hydraulic Conductivity. Hydraulic conductivity is the parameter that describes the rate of flow of a fluid through a porous medium. Laboratory measurements of unsaturated hydraulic conductivities on rock-core samples of Bandelier Tuff from TA-54, Material Disposal Areas (MDAs) G and L, ranged from $3x10^{-9}$ to $1.6x10^{-7}$ cm/s at 25% to 61% volumetric water content (International Technology Corporation 1987, 0327). When calculated from moisture retention data, unsaturated conductivity was approximately 10^{-8} cm/s, determined at 20% to 40% moisture content. In many parts of OU 1129, field moisture conditions and unsaturated hydraulic conductivity may be even lower than these values.

Intrinsic Permeability. Intrinsic permeability is the parameter that describes the conductive properties of a porous medium, independent of the fluid moving through it. This parameter is required to estimate the magnitude of fluid movement through the tuff. On the basis of air permeability tests conducted at TA-54, MDAs-G and -L, International Technology Corporation (1987, 0327) reported average values on the order of 10^{-8} cm^2. The test results also indicated an order-of-magnitude decrease in intrinsic permeability with depth in the Tshirege Member of the Bandelier Tuff. This permeability range is consistent with typical permeability values for an unconsolidated silty sand.

Sorption. The ion-exchange capacity of alluvium and tuff allows for significant retention of radionuclides. Polzer and Essington (1984, 0178) reported an ion-exchange capacity for strontium, cesium, and cobalt of 3.3 µeq/g (0.33 meq/100 g). Christenson and Thomas (1962, 0039) reported that ion-exchange capacities for

plutonium range from 0.5 to 3 meq/100 g for the Tshirege Member of the Bandelier Tuff. Purtymun and Stoker (1987, 0204) reported values of 0.7 to 2.8 meq/100 g; however, actinide sorption may be decreased by complexation with citrates and fluorides.

2.3.3 Hydrology of the Saturated Zone

Groundwater occurs under saturated conditions in three water-bearing zones in the Los Alamos area: (1) shallow stream-connected alluvium in canyons; (2) perched water underlying the alluvium; and (3) the main aquifer of the Los Alamos area. Discussions of the alluvial, perched, and main aquifers in the Los Alamos area are presented in Sections 2.6.4, Geohydrology of Canyon Surface Waters and Alluvial Aquifers; 2.6.5, Perched Water; and 2.6.6, Hydrology of the Main Aquifer; respectively, of the IWP (LANL 1991, 0553).

Alluvial aquifers are found only in the canyons that dissect the Pajarito Plateau and will be addressed in more detail in the RFI Work Plan for OU 1049. Perched water occurs in limited areas beneath the Pajarito Plateau in the midreach of Pueblo Canyon and near the confluence of Pueblo and Los Alamos canyons. Perched water is not known to exist beneath OU 1129. The main aquifer is approximately 950 ft below the surface of OU 1129 and no known hydrologic connection between the main aquifer and OU 1129 exists. Figure 2-9 shows the generalized potentiometric surface and direction of groundwater flow for the main aquifer.

2.3.4 Characteristics of Mortandad Mesa

OU 1129 is located on Mortandad Mesa. The characteristics of this mesa are similar to those of Mesita del Buey, just east of OU 1129. Approximately 700 ft of Bandelier Tuff covered by a clay-like soil underlies Mortandad Mesa. The main aquifer is at a depth of nearly 950 ft. During drilling of two supply wells along Pajarito Road near OU 1129, perched water was not encountered in either borehole (Devaurs and Purtymun 1985, 0049).

On Mesita del Buey, 5 horizontal boreholes, ranging from 239 to 302 ft in length, were drilled beneath the waste pits at TA-54. The boreholes were installed at a depth of about 39 to 46 ft below the mesa top. Abundant joints were encountered during drilling. These joints may allow infiltration of surface water (Baltz et al. 1963, 0024). Major joints were either vertical or dipping at angles greater than 70 degrees. The joints were filled or coated with calcite; a few were open with light weathering of the joint face. Joints open at depth were filled with clay from beneath the thin soil on the mesa top; 19% were open with slight weathering, 72% were filled or plated with brown clay, and 9% were filled or plated with caliche. Within the horizontal cores, joint frequencies ranged from 1.2 to 3.3 per meter.

2.4 Biological Resources

During 1991, field surveys were conducted by the Biological Resource Evaluations Team (BRET)of the Environmental Protection Group (EM-8) for OU 1129, TAs -4, -5, -35, -42, -48, -52, -55, -63, and -66 site characterization. Site characterization during the OU 1129 RFI requires surface and subsurface sampling within the TA(s). This section briefly summarizes the results of the biological field surveys for OU 1129. Further information concerning these surveys is contained in the report,

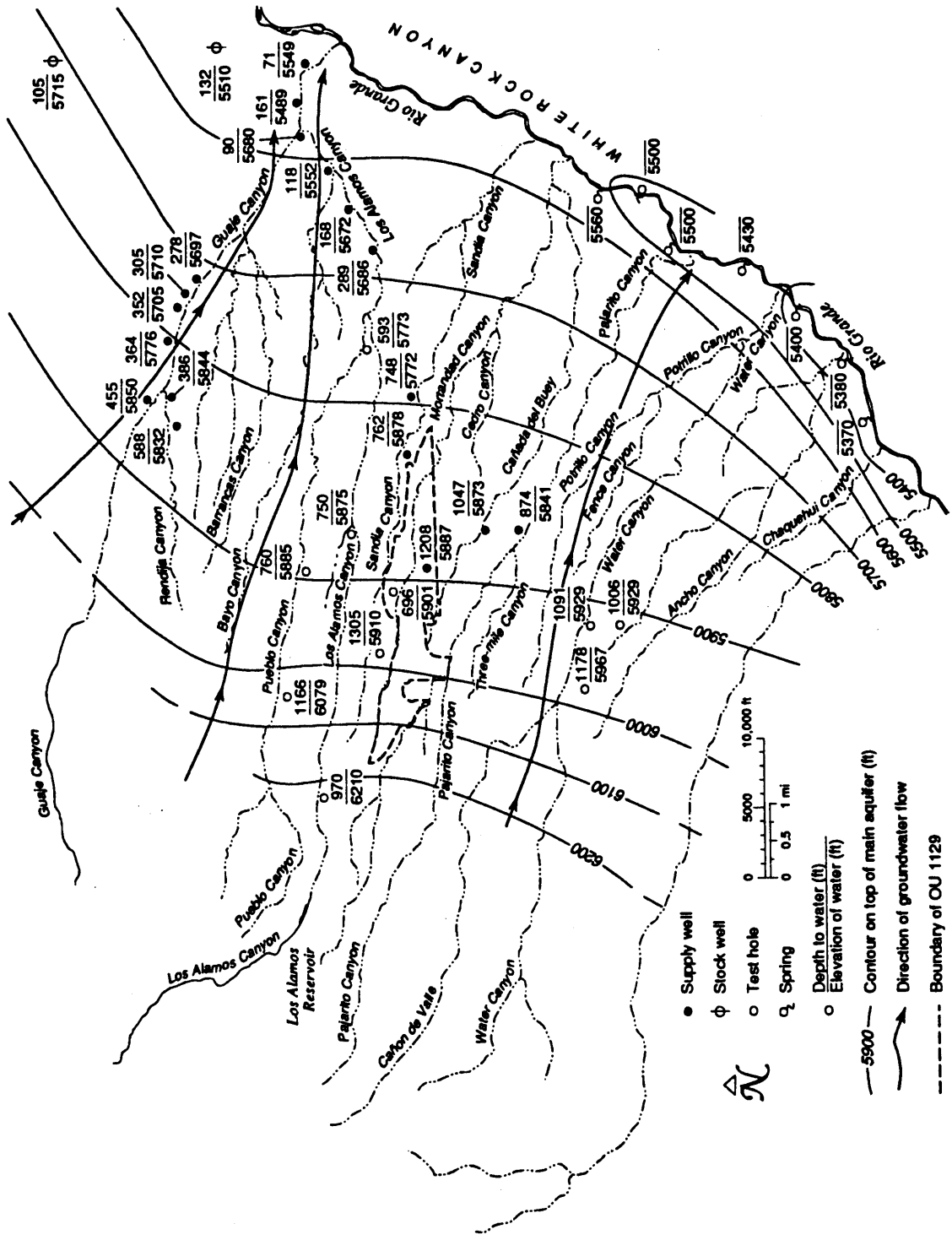


Figure 2-9. Generalized potentiometric surface and groundwater flow map for the main aquifer (modified from Purtymun 1984, 0196).

"Biological Assessment for Environmental Restoration Program, Operable Unit 1129 (Durham 1992, 04-0247)." The biological assessment report contains specific information on survey methodology, results and mitigation measures, and information that may aid in defining ecological pathways and vegetation restoration.

2.4.1 Laws

Biological field surveys were conducted for compliance with the Federal Endangered Species Act of 1973; New Mexico's Wildlife Conservation Act; New Mexico Endangered Plant Species Act; Executive Order 11990, "Protection of Wetlands;" Executive Order 11988, "Floodplain Management;" 10 Code of Federal Regulations 1022, "Compliance with Floodplan/Wetlands Environmental Review Requirements;" and DOE Order 5400.1, "General Environmental Protection Program."

2.4.2 Methodology

The purpose of the field surveys was three-fold. The first was to determine the presence or absence of any critical habitat within the OU boundaries. A critical habitat refers to a habitat required by any state or federal sensitive, threatened, or endangered plant or animal species.

Second, the surveys were to identify the presence or absence of any sensitive areas. Sensitive areas include flood plains and wetlands that may be present within locations to be sampled. Field teams noted their extent and general characteristics during the surveys.

The third purpose was to provide additional plant and wildlife data about the habitat types within the OU. This information provides further base-line information about the site's biological components and presampling conditions, which are needed for site characterization. NEPA documentation and determination of a categorical exclusion for the sampling plan for site characterizaiton also require base-line data.

Group EM-8 maintains a habitat requirements data base, called TES. This data base is for all state and federally listed sensitive, threatened, or endangered plant and animal species known to occur within the Laboratory's boundaries and surrounding areas.

The BRET conducted habitat evaluation surveys (Level 2). The field crews used transect and Daubenmire plots to collect data for these Level 2 surveys. The techniques (designed to collect percent cover, density, and frequency data) assessed the understory and overstory components of the plant community.

BRET compared the field survey results to the habitat requirements for the species of concern, which were identified in a data base search. If habitat types did not meet the habitat requirements, then the team considered the site cleared for impact on state and federally listed species. If habitat types met the habitat requirements, then a team conducted specific (Level 3) surveys for the species of concern. These are species-specific surveys done by pre-established survey protocols (standard operating procedures). These protocols often require certain meteorological or seasonal conditions.

The report, "Biological Assessment for Environmental Restoration Program, Operable Unit 1129," summarizes data bases containing historical information and

biological reports of any previous surveys within the area to provide background information about the site (Dunham 1992, 04-0247). The summary provides inventory information that may be used in future ecological risk assessments and pathway analysis.

The relatively undisturbed areas of OU 1129 contain historic and prehistoric fields and archeological sites. The terrain in OU 1129 is varied with predominantly mesa tops and steep canyon slopes in Mortandad and Ten Site canyons. BRET did Level 2 surveys within the OU on the mesa top in three different locations within the pinon-juniper woodland. Within Ten Site Canyon, the team did habitat evaluations of the north canyon rim, north canyon wall, and the canyon bottom.

Major disturbances are mostly confined to the west end of OU 1129. These disturbances include buildings, roads, and surface and subsurface utilities. Mortandad Canyon receives Laboratory effluent discharges.

2.4.3 Species Identified

The mesa top portions of the OU are within a pinon-juniper woodland with an understory of blue grama. A mixed conifer forest characterizes the north-facing slopes with an open Ponderosa pine forest in the canyon bottom. Data base searches indicated that the species of concern for OU 1129 are:

- Peregrine falcon (*Falco Peregrinus*-federally endangered);
- Bald eagle (*Haliaeetus leuccephalus*-federally endangered);
- Common black hawk (*Buteogallus anthracinus*-state endangered);
- Mississippi kite (*Ictinia mississippiensis*-state endangered);
- Broad-billed hummingbird (*Cynanthus latirostris*-state endangered);
- Willow flycatcher (*Empidonax trailii*-state endangered and federal candidate);
- Spotted bat (*Euderma maculatum*-state endangered);
- Meadow jumping mouse (*Zapus hudsonius*-state endangered and federal candidate);
- Say's pond snail (*Lymnaea captera*-state endangered);
- Wright's fishhook cactus (*Mammillaria wrightii*-state endangered);
- Santa Fe cholla (*Opuntia viridiflora*-state endangered); and
- Grama grass cactus (*Pediocactus papyracanthus*-state endangered and federal candidate);

- Sessile-flowered false carrot (*Aletes sessiliflorus*- state sensitive);
- Threadleaf horsebrush (*Tetradymia filifolia*-state sensitive);
- Plank's catchfly (*Silene plankii*-state endangered and federal candidate);
- Santa Fe milkvetch (*Astragalus feensis*-state sensitive);
- Mathew's wooly milkvetch (*Astragalus mollissimus*- state sensitive);
- Cyanic milk-vetch (*Astragalus cyaneus*-state sensitive);
- Tufted sand verbena (*Arbroma bigelovii*-state sensitive and federal candidate);
- Pagosa phlox (Phlox *caryophylla*-state sensitive).

2.4.4 Results and Mitigation

2.4.4.1 Threatened and Endangered Species

The results of the field habitat evaluation suggests that the habitat elements needed for sensitive and endangered species are not present. Therefore, the species listed in Section 2.4.3, Species Identified, are not likely to appear in the project area. Surface sampling of OU 1129 will not cause any adverse impacts to any known critical habitat or sensitive species.

2.4.4.2 Wetlands/Floodplains

In OU 1129, teams verified all wetlands and floodplains within the survey area. National Wetland Inventory Maps were field checked, and wetlands, floodplains, and riparian area characteristics were noted using criteria outlined in the Federal Manual for Delineating Jurisdictional Wetlands (Federal Interagency Committee for Wetland Delineation 1989, 0631). BRET did not delineate wetland boundaries during these surveys. These boundaries are valid for only two years and are best determines by teams just before sampling. This ensures that the work will not occur within areas meeting wetland criteria. Additionally, field surveys suggested that no floodplain or wetland concerns exist within OU 1129 that must be addressed during sampling. Surface sampling of OU 1129 will not cause any adverse impacts to any known critical habitat or sensitive areas.

2.4.5 Best Management Practices

Impacts to nonsensitive plant species should be avoided when possible. Off-road driving is especially harmful to plants and soil crust. Vehicular travel should be restricted to existing roads whenever possible. If off-road travel is required, Group EM-8 must be contacted to monitor the activity. Revegetation may be required at some sites. A list of native plants suitable for revegetation for OU 1129 is contained

in the report "Biological Assessment for Environmental Restoration Program, Operable Unit 1129" (Dunham 1992, 04-0247).

2.5 Cultural Resources

As required by the National Historic Preservation Act of 1966 (as amended), a cultural resource survey is being conducted at OU 1129. The methods and techniques used for this survey conform to those specified in the Secretary of the Interior's Standards and Guidelines for Archeology and Historic Preservation.

At present, one archaeological site in OU 1129 is known to be eligible for inclusion on the National Register of Historic Places under Criterion D. This is referenced as the Laboratory of Anthropology (LA) site number LA-4601.

Because of suspected contamination of LA 4601, environmental restoration (ER) sampling within this site is requested. The attributes of this site that make it eligible for inclusion on the National Register will not be affected by any ER sampling activities proposed at OU 1129. However, these samples will be limited to shovel dug augers or 8-in. drill-core samples. An archaeologist will monitor sample collection. A report, "Environmental Restoration Program, Operable Unit 1129, Cultural Resource Survey Report," which will document the survey area, methods, results, and monitoring recommendations, if any, will be transmitted to the New Mexico State Historic Preservation Officer (SHPO) for a concurrence in a "Determination of No Effect." The SHPO has informally concurred that the sampling of LA 4601 will not adversely affect the site.

As specified in 36 Code of Federal Regulation 800.5(b) and following the intent of the American Indian Religious Freedom Act, a copy of the cultural resource survey report will also be sent to the Governor of San Ildefonso Pueblo, which is adjacent to DOE land, for comment on any possible impacts to sacred and traditional places.

All monitoring and avoidance recommendations contained in the cultural resource survey report must be followed by all personnel involved in ER sampling activities.

REFERENCES

Abeele, M. V., M. L. Wheeler, and B. W. Burton, October 1981. "Geohydrology of Bandelier Tuff," Los Alamos National Laboratory Report LA-8962-MS, Los Alamos, New Mexico. (Abeele et al. 1981, 0009)

Abrahams, J. H., Jr., J. E. Weir, Jr., and W. D. Purtymun, 1961. "Distribution of Moisture in Soil and Near Surface Tuff on the Pajarito Plateau, Los Alamos County, New Mexico," Article No. 339 in Geological Survey Research 1961, Washington, DC. (Abrahams et al. 1961, 0015)

Abrahams, J. H., Jr., January 1963. "Physical Properties of and Movement of Water in the Bandelier Tuff, Los Alamos and Santa Fe Counties, New Mexico," US Geological Survey Administrative Release, Albuquerque, New Mexico. (Abrahams 1963, 0011)

Aldrich, M. J., Jr., February 10, 1986. "Tectonics of the Jemez Lineament in the Jemez Mountains and Rio Grande Rift," in *Journal of Geophysical Research*, Vol. 91., No. B2, pp. 1753-1762. (Aldrich 1986, 0554)

Bailey, R. A., R. L. Smith, and C. S. Ross, 1969. "Stratigraphic Nomenclature of Volcanic Rocks in the Jemez Mountains, New Mexico," in *Contributions to Stratigraphy*, US Geological Survey Bulletin 1274-P, Washington, DC, p. 1. (Bailey et al. 1969, 0019)

Baltz, E. H., J. H. Abrahams, Jr., and W. D. Purtymun, March 1963. "Preliminary Report on the Geology and Hydrology of Mortandad Canyon near Los Alamos, New Mexico, with Reference to Disposal of Liquid Low-Level Radioactive Waste," US Geological Survey Open File Report, Albuquerque, New Mexico. (Baltz et al. 1963, 0024)

Bowen, B. M., May 1990. "Los Alamos Climatology," Los Alamos National Laboratory Report LA-11735-MS, Los Alamos, New Mexico. (Bowen 1990, 0033)

Bridwell, R. J., E. F. Homuth, and C. Ptozick, July 1979. "Preliminary Predictions of Cenozoic, Mesozoic, and Paleozoic Stratigraphy of EGH-LA-1" (draft), US Department of Energy, Washington, D.C. (Bridwell et al. 1976, 0646)

Budding, A. J., 1978. "Gravity Survey of the Pajarito Plateau, Los Alamos and Santa Fe Counties, New Mexico," Los Alamos Scientific Laboratory Report LA-7419-MS, Los Alamos, New Mexico. (Budding 1978, 0596)

Cavazza, W., 1989. "Sedimentation Pattern of a Rift-Filling Unit, Tesuque Formation (Miocene), Española Basin, Rio Grande Rift, New Mexico," *Journal of Sedimentary Petrology*, Vol. 59, No. 2, pp. 287-296. (Cavazza 1989, 0242)

Chapin, C. E., 1979. "Evolution of the Rio Grande Rift—A Summary," in Rio Grande Rift: Tectonics and Magmatism (R. Riecker, Ed.), American Geophysical Union, Washington, D.C. (Chapin 1979, 0597)

Christenson, C.W., and R. G. Thomas, March 1962. "Movement of Plutonium Through Los Alamos Tuff," in *Ground Disposal of Radioactive Wastes, Second Conference Proceedings*, No. TID-7628, prepared by The John Hopkins University, Baltimore, Maryland, pp. 248-281. (Christenson and Thomas 1962, 0039)

Cordell, L., 1978. "Regional Geophysical Setting of the Rio Grande Rift," *Geological Society of America Bulletin*, Vol. 89, pp. 1073-1090. (Cordell 1978, 0598)

Cordell, L., 1979. "Gravimetric Expression of Graben Faulting in Santa Fe County and the Española Basin, New Mexico," New Mexico Geological Society Guidebook, 30th Field Conference, Santa Fe, New Mexico, pp. 59-64. (Cordell 1979, 0604)

Crowe, B. M., G. W. Linn, G. Heiken, and M. L. Bevier, April 1978. "Stratigraphy of the Bandelier Tuff in the Pajarito Plateau, Applications to Waste Management," Los Alamos Scientific Laboratory Report LA-7225-MS, Los Alamos, New Mexico. (Crowe et al. 1978, 0041)

Dames & Moore, November 1972. "Report of Geologic, Foundation, Hydrologic and Seismic Investigation, Plutonium-Processing Facility, Los Alamos Scientific Laboratory," for the US Atomic Energy Commission, Job No. 0651-120-02, Los Angeles, California. (Dames & Moore 1972, 0044)

Dethier, D. P., and K. Manley, 1985. "Geologic Map of the Chili Quadrangle, Rio Arriba County, New Mexico," US Geological Survey Miscellaneous Field Studies Map, MF-1814,1:24,000 scale. (Dethier and Manley 1985, 0249)

Devaurs, M., and W. D. Purtymun, 1985. "Hydrologic Characteristics of the Alluvial Aquifers in Mortandad, Cañada del Buey, and Pajarito Canyons," Los Alamos National Laboratory Report LA-UR-85-4002, Los Alamos, New Mexico. (Devaurs and Purtymun 1985, 0049)

Doell, R. R., G. B. Dalrymple, R. L.Smith, and R. A. Bailey, 1968. "Paleomagnetism, Potassium-Argon Ages, and Geology of Rhyolites and Associated Rocks of the Valles Caldera, New Mexico," in Studies in Volcanology, Memoir 116, Geological Society of America, Inc., Boulder Colorado. (Doell et al. 1968, 0599)

Dransfield, B. J., and J. N. Gardner, May 1985. "Subsurface Geology of the Pajarito Plateau, Española Basin, New Mexico," Los Alamos National Laboratory Report LA-10455-MS, Los Alamos, New Mexico. (Dransfield and Gardner 1985, 0082)

Dunham, D. A., March 31, 1992. "Biological Assessment for Environmental Restoration Program, Operable Unit 1129, TA-4, 5, 35, 42, 48, 52, 55, 63, 66, Operable Unit 1147, TA-50," Environmental Protection Group (EM-8), Los Alamos National Laboratory, Los Alamos, New Mexico. (Dunham 1992, 04-0297)

Environmental Protection Group, December 1990. "Environmental Surveillance at Los Alamos During 1989," Los Alamos National Laboratory Report LA-12000-ENV, Los Alamos, New Mexico. (Environmental Protection Group 1990, 0497)

ESG (Environmental Surveillance Group), June 1989. "Environmental Surveillance at Los Alamos During 1988," Los Alamos National Laboratory Report LA-11628-ENV, Los Alamos, New Mexico. (ESG 1989, 0308)

Federal Interagency Committee for Wetland Delineation, January 1989. "Federal Manual for Identifying and Delineating US Jurisdictional Wetlands," Army Corps of Engineers, US Environmental Protection Agency, US Fish and Wildlife Service, and US Soil Conservation Service, cooperative technical publication, Washington, D.C. (Federal Interagency Committee for Wetland Delineation 1989, 0631)

EPA (US Environmental Protection Agency), April 10, 1990. Module VIII of RCRA Permit No. NM 0890010515, 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)

Galusha, T., and J. C. Blick, April 1971. "Stratigraphy of the Santa Fe Group, New Mexico," *Bulletin of the American Museum of Natural History*, Vol. 144, Article 1, Lund Humphries, Great Britian, pp. 1-128. (Galusha and Blick 1971, 0108)

Gardner, J. N., F. Goff, S. Garcia, and R. C. Hagan, February 10, 1986. "Stratigraphic Relations and Lithologic Variations in the Jemez Volcanic Field, New Mexico," in *Journal of Geophysical Research*, Vol. 91, No. B2, pp. 1763-1778. (Gardner et al. 1986, 0310)

Gardner, J. N., and L. House, October 1987. "Seismic Hazards Investigations at Los Alamos National Laboratory, 1984 to 1985," Los Alamos National Laboratory Report No. LA-11072-MS, Los Alamos, New Mexico. (Gardner and House 1987, 0110)

Griggs, R. L., and J. D. Hem, 1964. "Geology and Ground-Water Resources of the Los Alamos Area, New Mexico," U. S. Geological Survey Water Supply Paper 1753, United States Government Printing Office, Washington, D.C. (Griggs and Hem 1964, 0313)

Heiken, G., 1979. "Pyroclastic Flow Deposits," *American Scientist*, Vol. 67, pp. 564-571. (Heiken 1979, 0600)

Hurley, C., P. Hale, G. Orton, December 1985. "Laboratory Analysis of Rock Core Bandelier Formation," Terra Tek Research Report TR 86-49, submitted to Bendix Field Engineering Corporation, Department of Energy, Grand Junction, Colorado. (Hurley et al. 1985, 0601)

International Technology Corporation 1987. "Geologic Assessment of Technical Area 54 Areas G and L, Los Alamos National Laboratory," Project No. 30l017.02, Los Alamos, New Mexico. (International Technology Corporation 1987, 0327)

Kearl, P. M., J. J. Dexter, and M. Kautsky, March 1986. "Vadose Zone Characterization of Technical Area 54, Waste Disposal Areas G and L, Los Alamos National Laboratory, New Mexico, Report 3: Preliminary Assessment of the Hydrogeologic System," Report GJ-44, Bendix Field Engineering Corporation, Grand Junction, Colorado. (Kearl et al. 1986, 0135)

Krier, D., October 5, 1990. "TA-55 Seismic Hazards Study: Geologic Cross Sections," Los Alamos National Laboratory Memorandum EES1-SH90-15 to Jamie Gardner (EES-1) from Don Krier (EES-1), Los Alamos, New Mexico, 6 pp (including figures). (Krier 1990, 04-0235)

Kuentz, D. C., December 1986. "The Otowi Member of the Bandelier Tuff: A Study of the Petrology, Petrography, and Geochemistry of an Explosive Silicic Eruption, Jemez Mountains, New Mexico," Master of Science in Geology thesis, University of Texas, Arlington, Texas. (Kuentz 1986, 0602)

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)

MacFadden, B. J., 1977. "Magnetic Polarity Stratigraphy of the Chamita Formation Stratotype (Mio-Pliocene) of North-Central New Mexico," *American Journal of Science*, Vol. 277, pp. 769-800. (MacFadden 1977, 0690)

Manley, K., 1979. "Stratigraphy and Structure of the Española Basin, Rio Grande Rift, New Mexico," in Rio Grande Rift: Tectonics and Magmatism, R. Riecker (Ed.), American Geophysical Union, Washington, DC, pp. 71-86. (Manley 1979, 0349)

Mayo, E. B., November 1958. "Lineament Tectonics and Some Ore Districts of the Southwest," *Mining Engineering*, Vol. 10, pp. 1169-1175. (Mayo 1958, 0603)

New Mexico Bureau of Mines & Mineral Resources 1990. "Geology of St. Peter's Dome Area, Jemez Mountains, New Mexico," Geologic Map 69, New Mexico Institute of Mining & Technology, Socorro, New Mexico. (New Mexico Bureau of Mines & Mineral Resources 1990, 0557)

Nyhan, J. W., L. W. Hacker, T. E. Calhoun, and D. L. Young, June 1978. "Soil Survey of Los Alamos County, New Mexico," Los Alamos Scientific Laboratory Report LA-6779-MS, Los Alamos, New Mexico. (Nyhan et al. 1978, 0161)

Polzer, W. L., and E. H. Essington, 1984. "A Modified Freundlich Adsorption Equation for Modeling of Ion-Exchange Rections in Soils," Los Alamos National Laboratory Report LA-UR-84-2512, Los Alamos, New Mexico. (Polzer and Essington 1984, 0178)

Purtymun, W. D., 1975. "Geohydrology of the Pajarito Plateau with Reference to Quality of Water, 1949-1972," Los Alamos Scientific Laboratory Informal Report LA-5744, Los Alamos, New Mexico. (Purtymun 1975, 0194)

Purtymun, W. D., and W. R. Kennedy, May 1971. "Geology and Hydrology of Mesita del Buey," Los Alamos Scientific Laboratory Report LA-4660, Los Alamos, New Mexico. (Purtymun and Kennedy 1971, 0200)

Purtymun, W. D., and F. C. Koopman, 1965. "Physical Characteristics of the Tshirege Member of the Bandelier Tuff with Reference to Use as a Building and Ornamental Stone," prepared for the Community Action Program, Santa Clara Indian Pueblo, in cooperation with the US Atomic Energy Commission and the University of California, US Geological Survey, Albuquerque, New Mexico. (Purtymun and Koopman 1965, 0201)

Purtymun, W. D., M. L. Wheeler, and M. A. Rogers, May 1978. "Geologic Description of Cores from Holes P-3 MH-1 Through P-3 MH-5, Area G, Technical Area 54," Los Alamos Scientific Laboratory Report LA-7308-MS, Los Alamos, New Mexico. (Purtymun et al. 1978, 0207)

Purtymun, W. D., January 1984. "Hydrologic Characteristics of the Main Aquifer in the Los Alamos Area: Development of Ground Water Supplies," Los Alamos National Laboratory Report LA-9957-MS, Los Alamos, New Mexico. (Purtymun 1984, 0196)

Purtymun, W. D., and A. K. Stoker, November 1987. "Environmental Status of Technical Area 49, Los Alamos, New Mexico," Los Alamos National Laboratory Report LA-11135-MS, Los Alamos, New Mexico. (Purtymun and Stoker 1987, 0204)

Purtymun, W. D., E. A. Enyart, and S. G. McLin, August 1989. "Hydrologic Characteristics of the Bandelier Tuff as Determined Through an Injection Well System," Los Alamos National Laboratory Report LA-11511-MS, Los Alamos, New Mexico. (Purtymun et al. 1989, 0214)

Self, S., F. Goff, J. N. Gardner, J. V. Wright, and W. M. Kite, 1986. "Explosive Rhyolitic Volcanism in the Jemez Mountains: Vent Locations, Caldera Development, and Relation to Regional Structure," *Journal of Geophysical Research*, Vol. 91, pp. 1779-1798. (Self et al. 1986, 0375)

Smith, R, L., and R. A. Bailey, 1966. "The Bandelier Tuff: A Study of Ash-Flow Eruption Cycles from Zoned Magma Chambers," *Bulletin Volcanologique*, Vol. 29, pp. 83-104. (Smith and Bailey 1966, 0377)

Smith, R. L., and R. A. Bailey, 1968. "Resurgent Cauldrons," in Studies of Volcanology, Memoir 116, Geological Society of America, Inc., Boulder, Colorado. (Smith and Bailey 1968, 0605)

Smith, R. L., R. A. Bailey, and C. S. Ross, 1970. "Geologic Map of the Jemez Mountains, New Mexico," US Geological Survey, Miscellaneous Geologic Investigations Map I-571, 1 sheet, (color, 1:125,000 scale). (Smith et al. 1970, 0606)

Spell, T. L., T. M. Harrison, and J. A. Wolf, January 18,1990. "$^{40}Ar/^{39}Ar$ Dating of the Bandelier Tuff and San Diego Canyon Ignimbrites, Jemez Mountains, New Mexico: Temporal Constraints on Magmatic Evolution," *Journal of Volcanology and Geothermal Research*, Vol. 43., pp. 175-193. (Spell et al. 1990, 0607)

Turbeville, B. N., D. B. Waresback, and S. Self, February 1989. "Lava-Dome Growth and Explosive Volcanism in the Jemez Mountains, New Mexico: Evidence from the Plio-Pleistocene Puye Alluvial Fans," *Journal of Volcanology and Geothermal Research*, Vol. 36, pp. 267-291. (Turbeville et al. 1989, 0221)

Vaniman, D., and K. Wohletz, November 14,1990. "Results of Geological Mapping/ Fracture Studies: TA-55 Area," Los Alamos National Laboratory Memorandum EES1-SH90-17, submitted to J. Gardner (EES-1) from D. Vaniman and K. Wohletz, Los Alamos New Mexico. (Vaniman and Wohletz 1990, 0541)

Wachs, D., C. D. Harrington, J. N. Gardner, and L. W. Maassen, February 1988. "Evidence of Young Fault Movements on the Pajarito Fault System in the Area of Los Alamos, New Mexico," Los Alamos National Laboratory Report LA-1156-MS, Los Alamos, New Mexico. (Wachs et al. 1988, 0502)

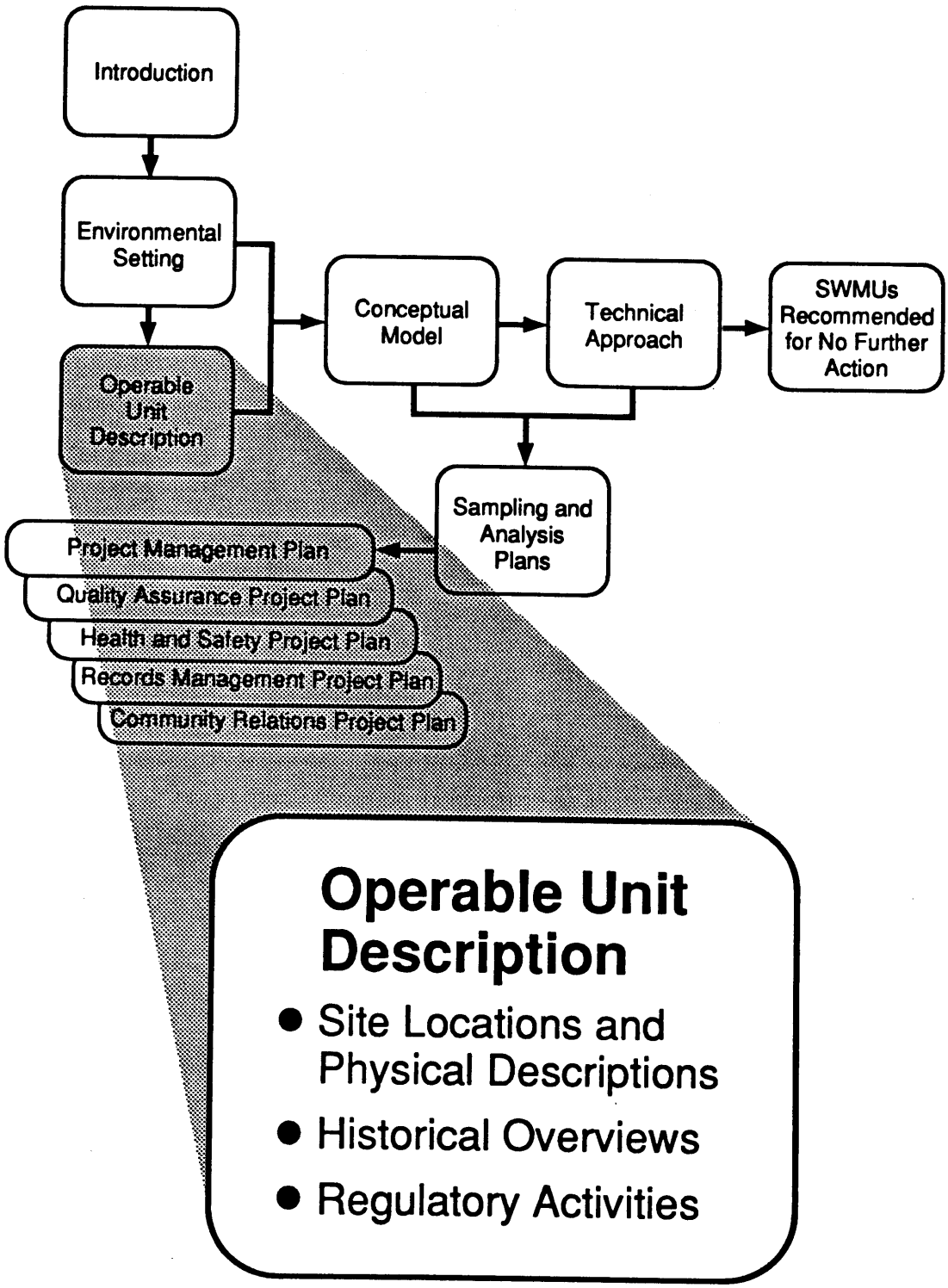
Weir, J. E., Jr., and W. D. Purtymun, 1962. "Geology and Hydrology of Technical Area 49, Frijoles Mesa, Los Alamos County, New Mexico," US Geological Survey Administrative Release, Albuquerque, New Mexico. (Weir and Purtymun 1962, 0228)

Williams, L. M., November 1979. "Gravity Study of the Los Alamos Area, New Mexico," Los Alamos Scientific Laboratory Report LA-8154-MS, Los Alamos, New Mexico. (Williams 1979, 0608)

ATTACHMENT I

Map of OU 1129 TAs and SWMUs

CHAPTER 3


Introduction
Environmental Setting
Operable Unit Description
Conceptual Model
Technical Approach
SWMUs Recommended for No Further Action
Sampling and Analysis Plans
Project Management Plan
Quality Assurance Project Plan
Health and Safety Project Plan
Records Management Project Plan
Community Relations Project Plan
Operable Unit Description
• Site Locations and Physical Descriptions
• Historical Overviews
• Regulatory Activities

3.0 OPERABLE UNIT DESCRIPTION

Operable Unit (OU) 1129, which is comprised of Technical Areas (TAs)-4, -5, -35, -42, -48, -52, -55, -63, and -66, is situated on the Pajarito Plateau. OU 1129 is bounded by Mortandad Canyon to the north; Two Mile Canyon and Pajarito Canyon to the south; TA-3 to the west; and the Santa Fe County line to the east. OU 1129 solid waste management units (SWMUs) are generally located on a finger mesa formed between a branch of Mortandad Canyon on the north and Two Mile Canyon and a branch of Pajarito Canyon on the south. TAs-48, -52, -63, and -66 are located on Mesita del Buey, which is bounded on the north by Ten Site Canyon, a tributary of Mortandad Canyon, and on south by Cañada del Buey. The elevation of technical areas in OU 1129 ranges from approximately 6,600 ft to 7,300 ft.

OU 1129 contains within its boundaries 190 SWMUs and areas of concern (AOCs) as listed in the 1990 Solid Waste Management Units Report (LANL 1990, 0145). All of the SWMUs in OU 1129 are located on Department of Energy (DOE) property in the north-central portion of the Los Alamos National Laboratory (the Laboratory) in Los Alamos, New Mexico.

Two former TAs in OU 1129 (i.e., TA-4 and -42) are within current TA boundaries. Former TA-4 represents the Alpha firing site, which was officially abandoned in 1946 and is located within the current boundaries of TA-52 and TA-63. TA-42, which is located within the current boundaries of the Plutonium Processing Facility at TA-55, was an incinerator facility that was shut down in 1952 because of operational problems. Operational history for each TA in OU 1129 will be discussed in more detail in this section.

Laboratory operations in OU 1129 began as early as 1944 and, except for former TAs-4 and -42, are currently ongoing. Historical and current waste management operations at OU 1129 have involved surface impoundments and disposal areas, experimental nuclear fission reactors, container storage areas, wastewater treatment and septic systems, aboveground and underground storage tanks, sanitary- and industrial-waste effluent lines, polychlorinated biphenyls (PCB) transformers, firing sites, incineration, and chemical processing and machining of radioactive materials. Most of the SWMUs at OU 1129 have resulted from one or more of the above operations.

Potential waste materials present at OU 1129, as derived from known historical operations at the Laboratory, include radioactive materials, heavy metals, photoprocessing chemicals, water-treatment chemicals, solvents, high explosives, miscellaneous solid waste, waste oil, diesel fuel, PCBs, and other unspecified chemicals. Some SWMUs at OU 1129 have been decontaminated and decommissioned (e.g., abandoned, relocated, removed to designated disposal areas, or cleaned up to DOE residual radioactivity guidelines); most SWMUs have not yet undergone decontamination or cleanup activities. Decontamination and decommissioning (D&D) activities conducted before 1989 generally focused on the removal of radioactivity only. Site characterizations for nonradiological contamination have been conducted at only a few sites. Archival release information about each TA is discussed in the following text and summarized in Appendix A.

The following subsections provide a discussion of site location and physical description, historical overview and description of waste management activities, and a summary of regulatory activities for each of the TAs at OU 1129.

3.1 Description of Former TA-4, Alpha Site

3.1.1 Site Location and Physical Description

Alpha Site, a firing site, was located at the former site of TA-4, which was abandoned in the late 1940s. Former TA-4 lies within the current boundaries of TA-63 and TA-52; however, all the SWMUs designated for TA-4 are located within the boundaries of TA-52. The following subsections provide a detailed description of the site.

3.1.1.1 Geographic Location and Local Area Description

Former TA-4 is located on Puye Drive at an approximate latitude and longitude of 35°51'37" N and 106° 17'15" W. The site is situated on a small finger mesa that extends eastward from the main Pajarito Mesa. The mesa is bounded on the north by Ten Site Canyon, which is a tributary of Mortandad Canyon, and on the south by Pajarito Canyon. The elevation at TA-4 ranges from approximately 7,150 ft to 7,200 ft. TA-4 lies within the present boundaries of the Laboratory in Los Alamos County (Roy F. Weston 1989, 0487; DOE 1988, 0491; LANL 1990, 0144).

3.1.1.2 Physical Site Description

In 1944, Alpha Site was established as a test firing site for use by the Manhattan Project personnel (Ahlquist 1983, 04-0011; Montoya 1985, 04-0159; LASL 1945, 04-0134; LASL 1947, 0460; DOE 1988, 0491). Construction at Alpha Site was initiated in May 1945 (LASL no date, 0402). By the end of the summer in 1945, structures in the technical area included: a double magazine (TA-4-1); two magazines (TA-4-2 and TA-4-8); a laboratory control building (TA-4-3); a battery building (TA-4-4); a storage building (TA-4-5); a process and trimming building (TA-4-6); a guard building (TA-4-9); a water tank (TA-4-10); a fire tool house (TA-4-11); a siren tower (TA-4-12); a hutment (TA-4-13); three road blocks (TA-4-14, TA-4-15, and TA-4-16); a latrine (TA-4-17); and a firing pit (TA-4-18) (LASL no date, 0402; LASL 1945, 04-0134; LASL 1947, 0460). The darkroom and photography laboratory building (TA-4-7) was relocated from TA-20 in March 1948 (LASL no date, 0402). The contaminated pit (TA-4-19), now known as Material Disposal Area (MDA)C, which was located adjacent to the TA-4 road turnoff, was listed briefly as an Alpha Site structure but was later redesignated as TA-0-900 (LASL 1949, 04-0139; DOE 1988, 0491). MDA-C is now part of TA-50, which is included under OU 1147. The approximate former locations of these structures are shown in Figure 3-1. Table 3-1 contains detailed descriptions of these Alpha Site structures.

3.1.1.3 Ownership Profile and Land Uses

DOE currently owns the property on which the former Alpha Site was located (Montoya 1985, 04-0159). Alpha Site is currently a depository for clean fill material and is also a jogging area for Laboratory employees (DOE 1988, 0491).

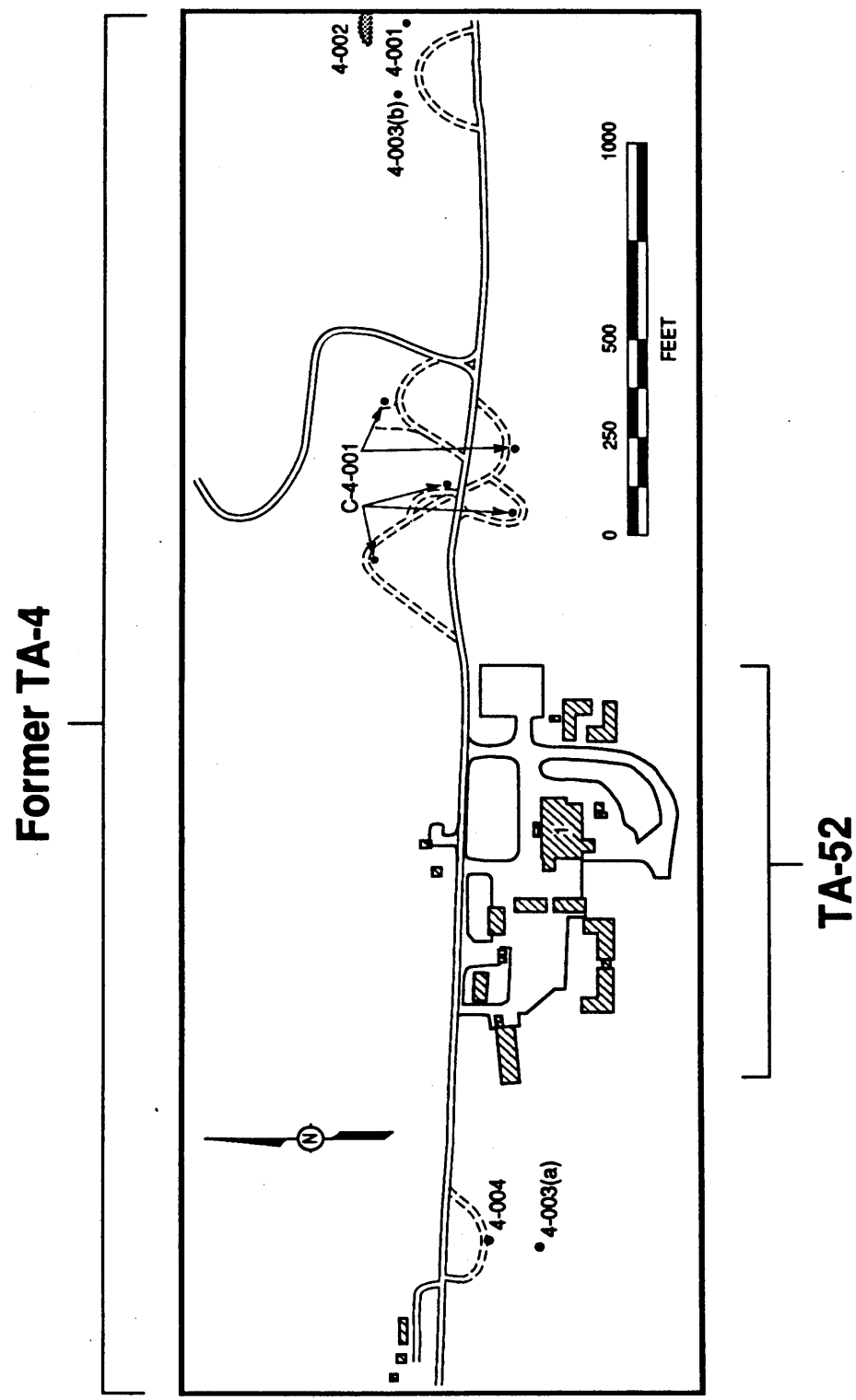


Figure 3-1. Locations of structures and SWMUs at former TA-4.

TABLE 3-1

DESCRIPTION OF STRUCTURES AT TA-4

- **TA-4-1, Double magazine.** Construction completed in June 1945 and demolished in mid-July 1985 (LASL no date, 0402; Scholl 1989, 0485).
- **TA-4-2, Magazine.** Construction completed in July 1945 and removed by The Zia Company as salvage in December 1956 (LASL no date, 0402).
- **TA-4-3, Laboratory control building.** Constructed in July 1945 and removed by The Zia Company as salvage in December 1956 (LASL no date, 0402). The outfall from this building is SWMU No. 4-003(b).
- **TA-4-4, Battery building.** Constructed circa July 1945 and removed by The Zia Company as salvage in December 1956 (LASL no date, 0402).
- **TA-4-5, Storage building.** Constructed circa July 1945 and removed by The Zia Company as salvage in December 1956 (LASL no date, 0402; LASL 1945, 04-0134).
- **TA-4-6, Process and trimming building.** Constructed in July 1945 and removed by The Zia Company as salvage in December 1956 (LASL no date, 0402).
- **TA-4-7, Darkroom and photography laboratory building.** Relocated to TA-4 from TA-20 circa March 1948 and removed as salvage by The Zia Company in December 1956 (LASL no date, 0402). The outfall from this building is SWMU No. 4-003(a). Potential soil contamination at this site is SWMU No. 4-004.
- **TA-4-8, Magazine.** Constructed circa July 1945 and removed as salvage by The Zia Company in December 1956 (LASL no date, 0402).
- **TA-4-9, Guard building.** Constructed circa June 1945 and relocated to TA-16 in February or March 1952 (LASL no date, 0402).
- **TA-4-10, Water tank.** Constructed circa July 1945 and removed as salvage by The Zia Company in December 1956 (LASL no date, 0402).
- **TA-4-11, Fire tool housing.** Constructed circa 1945, transferred as salvage to The Zia Company in November 1956 and sold as scrap lumber in September 1966 (LASL no date, 0402).
- **TA-4-12, Siren tower.** Installed circa July 1945 and removed as salvage by The Zia Company in December 1956 (LASL no date, 0402).
- **TA-4-13, Hutment.** Constructed circa July 1945 and removed by The Zia Company as salvage in December 1956 (LASL no date, 0402).
- **TA-4-14, Road block.** Constructed circa July 1945 and removed to Bayo Canyon and renumbered as TA-10-57 in December 1956 (LASL no date, 0402).
- **TA-4-15, Road block.** Constructed circa July 1945 and removed as salvage by The Zia Company in December 1956 (LASL no date, 0402).
- **TA-4-16, Road block.** Constructed circa July 1945, redesignated as TA-0-3, ULR-3, in January 1950, and removed circa March 1952 (LASL no date, 0402).
- **TA-4-17, Latrine.**
- **TA-4-18, Firing pit.** Constructed circa July 1945 (LASL no date, 0402; LASL 1945, 04-0134). The former site of this structure is SWMU No. 4-001.
- **TA-4-19, Contaminated pit.** Located "adjacent to the TA-4 road take-off" and redesignated as TA-0-900 (LASL 1949, 04-0139). Now designated as MDA-C.

3.1.2 Historical Overview

Alpha Site was established in 1944 to provide a test firing site for small charges (LASL 1947, 0460). Alpha Site was used as a firing site for implosion studies using the "electric" method of detonation wave determination (LASL 1947, 0461; Ahlquist et al. 1985, 04-0019; DOE 1988, 0491; Scholl 1989, 0485). The maximum charges fired were 200 lb (LASL 1947, 0460). Other documented studies at Alpha Site include smaller tests of the "pin shot" and "magnetic" methods of studying implosions and "equation of state" experiments (Ahlquist et al. 1985, 04-0020; Ahlquist et al. 1985, 04-0019). Groups G-3 and M-4 conducted these tests before their move to R Site (LASL 1947, 0461; Ahlquist et al. 1985, 04-0019).

Alpha Site was abandoned in 1946 (DOE 1988, 0491; Scholl 1989, 0485). The guard building (TA-4-9) was relocated to TA-16 in February or March 1952. The TA-4-16 road block was redesignated as TA-0, ULR-3, in January 1950, and removed in March 1952 (LASL no date, 0402). In 1955, TA-4 structures were surveyed for radioactivity, and all but the darkroom and laboratory (TA-4-7) were found to be free of detectable radioactive contamination. The contaminated floor in TA-4-7 was removed and the building subsequently released along with the other buildings for removal "in the near future" (H-Division 1955,0625). The Zia Company removed all Alpha Site structures except TA-4-1 in December 1956 (LASL no date, 0402). TA-4-1 was the only building intact before the start of the 1985 Los Alamos Site Characterization Program (LASCP) (Scholl 1989, 0485). TA-4-1 was demolished in July 1985, and the site was leveled and contoured to the existing terrain (Montoya 1985, 04-0159). In 1988, the only evidence of TA-4 structures was traces of wire and other surface debris, including two projectiles and pieces of shrapnel found in the firing pit area (TA-4-18) (Shafer circa 1989, 04-0187).

3.1.2.1 Waste Management Activities

The use of high explosives and radioactive materials (i.e., natural and depleted uranium) in firing tests at Alpha Site has been documented (Scholl 1989, 0485). High explosives used included "Composition B," 2,4,6-trinitrotoluene (TNT), sucretol, and primacord (DOE 1988, 0491). Terbium, a rare earth element, and terbium oxide were used in "equation of state" experiments (DOE 1988, 0491). Other materials that may have been used at the site include beryllium, photo-processing chemicals, lead and other heavy metals, and unspecified laboratory chemicals (Ahlquist 1983, 04-0011; LASL 1946, 04-0136; Hansen 1984, 04-0091; LANL 1990, 0145; ESG 1984,0622; Ahlquist et al. 1985, 04-0019; LANL 1988, 04-0125; DOE 1988, 0491; Roy F. Weston, Inc. 1989, 0487).

The SWMUs in Table 3-2 were identified at TA-4 in the 1990 SWMU report (LANL 1990, 0145).

SWMU No. 4-001, Firing Site: The firing site, or firing pit (TA-4-18), SWMU No. 4-001, was constructed in 1945 and abandoned in 1946. The pit was located approximately 2,000 ft east of the current location of the Ultra-High-Temperature Reactor Experiment Facility (UHTREX), TA-52-1. The pit measured 10 ft by 10 ft and contained associated conduit and firing lines (LASL 1945, 04-0134). High explosives were the energy source of the firing experiments. Shot sizes ranged from 0.5 lb to 200 lb of high explosives (LASL 1947, 0460). Potential contaminants from firing site operations include high explosives, natural and depleted uranium, lead,

TABLE 3-2

TA-4 SWMUs

SWMU No.	Description
SWMU No. 4-001*	Firing Site
SWMU No. 4-002*	Canyonside Disposal Site
SWMU No. 4-003(a-b)	Drains and Outfall
SWMU No. 4-004	Soil Contamination Beneath Former Building

* SWMU Nos. 4-001 and 4-002 were listed in the HSWA Module VIII (EPA 1990, 0306). In addition to these SWMUs, one AOC, C-4-001, has been designated at TA-4.

and beryllium (LANL 1990, 0145; DOE 1988, 0491). Debris in the vicinity of the firing pit included wire and shrapnel. Shot debris was periodically bulldozed to the north edge of the mesa bordering Mortandad Canyon. The debris bulldozed off the mesa composes SWMU No. 4-002, discussed in a following paragraph. Fill material used to level the area when the craters got too deep may have covered some debris at the firing site (Ahlquist 1983, 04-0011; Montoya 1985, 04-0159; Ahlquist et al. 1985, 04-0019).

In August of 1985, during the LASCP cleanup effort, the pit was cleaned of all debris, backfilled, and contoured. No radioactive subsurface or surface soil contamination was detected during this cleanup operation (Montoya 1985, 04-0158). The LASCP did not address nonradioactive contamination (Scholl 1989, 0485).

During an ER Program radiation survey on April 25, 1988, beta-gamma activity at the pit area was found to be 354 cpm (background is 109 cpm) using a Geiger-Mueller No. 44-9 probe. Two projectiles (each 6 in. in diameter) and a piece of shrapnel (2 in. by 6 in.) were found in the firing pit (Shafer circa 1989, 04-0187). Contamination surveys of the projectiles and shrapnel detected beta-gamma contamination of 586 cpm and 1,318 cpm, respectively (LANL 1988, 04-0126; LANL 1988, 04-0127). Whether these materials were removed or left at the site is unknown.

In early 1991, one surface soil sample was collected at the TA-4 firing pit. The sample was screened for HE residues and analyzed for toxicity characteristic leaching procedure (TCLP) metals, total beryllium, total uranium, and RCRA target semivolatile organic compounds (SVOCs). Gross-alpha, -beta, and -gamma activity were at background levels. All metals were below EPA guidelines. Total beryllium and uranium were determined to be at background levels. No HE or SVOCs were detected (Fresquez 1991, 04-0232).

SWMU No. 4-002, Canyonside Disposal Site: A canyonside disposal site, SWMU No. 4-002, at which test debris was bulldozed off the mesa top, consists of the north-facing slope of Mortandad Canyon immediately north of SWMU No. 4-001 (LANL 1990, 0145) (Figure 3-1). The area of debris is small, approximately 20 ft wide. The shot debris consisted of cables, wires, and possibly small amounts of uranium, beryllium, lead, aluminum, and HEs. Because the material was not covered at the

end of its active life, a possibility of natural mobilization exists (Ahlquist 1983, 04-0011; Montoya 1985, 04-0159; Ahlquist et al. 1985, 04-0019; LANL 1990, 0145). This site was not addressed during the 1985 LASCP (Scholl 1989, 0485).

SWMU No. 4-003(a-b), Drains and Outfall: A photo-processing outfall, SWMU No. 4-003(a), discharged on the south side of the darkroom and photography laboratory building (TA-4-7). In 1955, beta activity to a level of 2 mR/hr was detected in the darkroom, and portions of the floor were removed in an attempt to remediate radioactive contamination (H-Division 1955, 0625; Roy F. Weston, Inc. 1989, 0689). The outfall was not removed when the building was dismantled in 1956. The exact location of this outfall is unknown, but the former location of TA-4-7 is just east of the TA-52 western fence (Roy F. Weston, Inc. 1989, 0689). A 1988 survey located a possible outfall in the drainage area next to the west edge of the TA-52 fence (Shafer circa 1989, 04-0187). An approximate location is indicated in Figure 3-1. Potential contaminants that may have been discharged from TA-4-7 to the outfall include photo-processing chemicals possibly contaminated with uranium (Roy F. Weston, Inc. 1989, 0689).

A drain outfall, SWMU No. 4-003(b), which was connected to the laboratory control building (TA-4-3), discharged to the north of TA-4-3 (Roy F. Weston, Inc. 1989, 0689). A 6-in.-diameter vitrified clay pipe, placed in the tuff, directed the waste to an outfall in Mortandad Canyon 20 ft north of TA-4-3 (Scholl 1989, 0485)(Figure 3-1). The outfall became inactive when TA-4-3 was abandoned in 1946. No radioactivity was detected in a 1953 survey (LANL 1990, 0145). The building was demolished and partially removed in 1956 (Roy F. Weston, Inc. 1989, 0689). The concrete storm drain, electrical conduit, wood and other surface debris, and the drainpipe were removed during the 1985 LASCP cleanup effort. A portable instrument was used to monitor for radioactive soil and surface contamination. No radioactive contamination was observed at that time (Montoya 1985, 04-0159). Potential contaminants that may have been discharged from TA-4-3 to the outfall are unknown. The site has not been investigated for nonradioactive contamination.

SWMU No. 4-004, Soil Contamination Beneath Former Building: The darkroom and laboratory building (TA-4-7) was used to develop film of firing tests performed at TA-4 (Ahlquist et al. 1985, 04-0020). Photo-processing chemicals may have been disposed of by pouring them through drainpipes in the darkroom or on the ground outside the building (DOE 1987, 0264). Other laboratory processes conducted at TA-4-7 or chemicals handled at the facility are unknown (Roy F. Weston, Inc. 1989, 0689). A 1953 radiation survey detected contamination on part of the darkroom floor. The contaminated portions of the floor were removed before the building was demolished in 1956 (H-Division 1955, 0625; LASL no date, 0402). Building debris was cleaned up during 1985 LASCP activities and no radioactive contamination was detected at that time (Scholl 1989, 0485). Potential contaminants associated with this SWMU include photo-processing chemicals, radioactive materials, and possibly other unspecified chemicals (LANL 1990, 0145). SWMU No. 4-004 lies within the current boundaries of TA-52, just inside the TA-52 western fence (Figure 3-1).

C-4-001, Potential Release Sites: Potential soil contamination may be associated with several former structures TA-4-1, TA-4-2, TA-4-3, TA-4-4, TA-4-5, TA-4-6, TA-4-8, and TA-4-13, which underwent D&D in 1985 (LANL 1990, 0145). These sites have been characterized for the presence of nonradioactive contaminants. The former locations of these structures are shown in Figure 3-1.

3.1.2.2 Summary of Potential Waste Materials

Available information suggests that waste materials potentially handled at TA-4 included the following:

- Terbium and terbium oxide
- Natural and depleted uranium
- Beryllium
- Aluminum
- Lead
- High explosives (e.g., TNT, sucretol, and primacord)
- Photo-processing chemicals
- Unspecified laboratory chemicals
- Uranium-contaminated aluminum and/or steel

3.1.2.3 Past Waste Spills, Releases, and Incidents

No documentation of accidental spills or releases at TA-4 has been found. A 1955 survey, however, detected beta contamination on the floor of the darkroom and laboratory building (TA-4-7) to a level of 2 mR/hr. After the contaminated portion of the floor was removed, the building was listed as being free of radioactive contamination (H-Division 1955, 0625).

3.1.2.4 Environmental Surveys and D&D Activities

In 1955, TA-4 structures were surveyed for radioactive contamination to determine whether they were suitable for release and subsequent transfer to other sites. Contamination was detected only in TA-4-7. After the contaminated portion of the darkroom floor was removed, the building was then listed as being free of radioactive contamination (H-Division 1955, 0625; H-Division 1955, 0467). The Zia Company removed all structures at TA-4, with the exception of the double magazine (TA-4-1), by the end of 1956.

In 1956, six soil samples were taken from Alpha Site and analyzed for uranium. All samples were measured at background (< 1-mg U/g of soil) (H-Division 1956, 0468). The locations at which samples were taken are unknown.

D&D of TA-4 was conducted as part of the LASCP from July 31 to August 9, 1985. Actual D&D work included radiological monitoring, site cleanup (e.g., picking up debris), demolishing buildings, removing structures, exhuming underground utilities, and contouring the areas. D&D was conducted for radioactive constituents only, and no radioactive contamination greater than background was detected during the LASCP at TA-4. No monitoring or sampling for any chemical contamination was conducted (Scholl 1989, 0485).

TABLE 3-3

TA-4 STRUCTURES ADDRESSED DURING LASCP

Structure Designation	Structure Description
TA-4-1	Double magazine
TA-4-2	Magazine
TA-4-3	Laboratory control building
TA-4-4	Battery building
TA-4-6	Trimming building
TA-4-8	Magazine
TA-4-13	Hutment
TA-4-18	Firing pit

TA-4 areas addressed during the LASCP D&D project are listed in Table 3-3. D&D (for radioactive contamination only) of the other TA-4 structures had previously been done during the removal of buildings in 1956 and the construction of TA-52 facilities.

Because no radioactive contamination greater than background was encountered, the bulk of the D&D activity at Alpha Site included the excavation of structures and general site cleanup. The TA-4 area was monitored before and during the work using an HM-3 Micro R Meter (HM-3), a Pac-7 air proportional probe (Pac-7), and a Harshaw Model 301 phoswich. Because radioactive materials were reported to have been used at this TA, a majority of the waste was disposed of at TA-54 as contaminated waste. Cleanup was undertaken only in the eastern one third of this site because the western portion had been addressed in the mid-1960s during the construction of TA-52 (Montoya 1985, 04-0164; Scholl 1989, 0485).

The double magazine, TA-4-1, was the only building intact at TA-4 before the start of LASCP. This structure was demolished in mid-July before the cleanup program started (Ahlquist 1985, 04-0015; Scholl 1989, 0485). This area was then contoured to existing terrain (Montoya 1985, 04-0159; DOE 1988, 0491). No radioactive contamination was detected (DOE 1988, 0491).

The firing pit (TA-4-18), SWMU No. 4-001, required the most extensive D&D effort at TA-4. During the initial field survey, this pit appeared to be a bermed area that would need only to be leveled. While removing surface debris from the pit, workers uncovered electrical utility lines encased in steel pipe. Upon further excavation, workers also uncovered two large pieces of steel encased in concrete. The lines and concrete pieces were removed. Additional excavation of the area led workers to uncover debris (i.e., wire, shrapnel, etc.) suspected to have been buried from past site activities. This and other surface debris was taken to TA-54 for disposal (Montoya 1985, 04-0159; DOE 1988, 0491; Scholl 1989, 0485; Montoya 1985, 04-0158).

A 12-in.-diameter concrete storm drain, a 6-in.-diameter vitrified clay pipe, abandoned electrical conduit, and surface debris were removed from the site of the laboratory control building, TA-4-3. The clay pipe emerged north of the building

location at an outfall (SWMU No. 4-003 [b]) on the edge of Mortandad Canyon and was believed to have serviced the laboratory building. The laboratory building and drainage areas were monitored for surface and soil contamination using the Pac-7, HM-3, and phoswich. No radioactive contamination was detected (Montoya 1985, 04-0159).

Surface debris was removed from the magazine areas TA-4-2 and TA-4-8, battery building TA-4-4, trimming building TA-4-6, and hutment TA-4-13. No radioactive surface or subsurface contamination was detected at any of these areas. Soil samples were collected from the site of TA-4-8 and analyzed for radioactivity, but no activity greater than background was detected. (Montoya 1985, 04-0159; DOE 1988, 0491; Scholl 1989, 0485).

In April 1988, Roy F. Weston, Inc. reported the results of a radiation survey it had conducted. (LANL 1988, 04-0126; LANL 1988, 04-0127; Shafer circa 1989, 04-0187) (Table 3-4). Field notes taken during the 1988 survey indicated that no trace of TA-4-1, TA-4-2, or TA-4-8 could be found; surface debris was visible in the vicinity of TA-4-5 and TA-4-6; and the former site of the latrine (TA-4-17) could not be located. A survey of the firing pit (SWMU No. 4-001) yielded two projectiles and a piece of shrapnel (beta-gamma activity on these objects exceeded background [refer to Table 3-4]). A possible location of the outfall from TA-4-7 (SWMU No. 4-003[a]) was also identified in the drainage area near the western TA-52 fence (Shafer circa 1989, 04-0187).

TABLE 3-4

TA-4 RADIOACTIVE CONTAMINATION SURVEY MEASUREMENTS

APRIL 1988

Location ID[a]	Beta-Gamma (cpm)[b]	Gamma Exposure (μR/hr)[c]	
		surface	3ft
4-1	172	14	15
4-2	160	16	15
4-3	215	15	16
4-3 (outfall)	224	24	21
4-4	274	16	16
4-5	180	14	15
4-6	218	18	16
4-7	240	18	16
4-8	192	16	15
4-13	268	18	16
4-17	172	15	16
4-18	354	19	18
4-18 (projectiles)	586	30	40
4-18 (shrapnel)	1318	–	–

Sources: LANL (1988, 04-0126); LANL (1988, 04-0127); Shafer (circa 1989, 04-0187).
[a]Locations of former structures.
[b]Background: 109 cpm.
[c]Background: 14 μR/hr.

3.1.3 Regulatory Activities

3.1.3.1 Permits

No previous or existing permits are associated with TA-4.

3.1.3.2 Interim Corrective Measures

The 1988 Inventory of Federal Hazardous Waste Activities forms completed for TA-4 indicate that Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) preliminary assessment/site investigation (PA/SI) corrective actions were completed in October 1987 as part of the CEARP Phase I investigation (LANL 1988, 04-0125). No additional documentation on corrective actions has been located.

3.2 Description of TA-5, Beta Site

3.2.1 Site Location and Physical Description

The present TA-5 includes the site of former TA-5, a firing site called Beta Site. Beta Site is no longer in operation and was decontaminated and decommissioned in 1985. The following is a detailed description of the site.

3.2.1.1 Geographic Location and Local Area Description

TA-5 is located on Puye Drive at an approximate latitude and longitude of 35°51'30" N and 106°16'0" W. The site is situated on a small finger mesa that extends eastward from the main Pajarito Mesa. TA-5 includes parts of a branch of Mortandad Canyon north of the mesa, a portion of Cañada del Buey south of the mesa, the eastern end of Sigma Mesa, and the south wall of Sandia Canyon. The elevation at TA-5 ranges from approximately 6,600 ft to 7,150 ft. The mesa on which Beta Site was formerly situated lies within the boundaries of the Laboratory in Los Alamos County. Current TA-5 boundaries extend to the Santa Fe County boundary (Scholl 1989, 0485; LANL 1990, 0145).

3.2.1.2 Physical Site Description

In 1944, Beta Site was established as an adjunct test firing site to Alpha Site (former TA-4) for Manhattan Project personnel (LANL 1990, 0145; LASL 1947, 0460; LASL 1947, 0461; Ahlquist 1983, 04-0011; Scholl 1989, 0485; Scholl Fritz 1985, 04-0082). By the end of 1945, structures present in the TA included a control building (TA-5-4), two day magazines (TA-5-2 and TA-5-3), a shop and darkroom (TA-5-5), a laboratory building (TA-5-6), two steel barricades at Firing Pits No. 1 and No. 2 (TA-5-7 and TA-5-15), a storage building (TA-5-8), an X-unit chamber (TA-5-9), and a latrine (TA-5-10) (LASL no date, 0402; LASL 1945, 04-0134). In addition, the following structures were constructed or relocated to Beta Site over succeeding years: a laboratory building (TA-5-1), an underground water tank (TA-5-11), an underground pump house (TA-5-12), a septic tank (TA-5-13), log and/or earthen

barricades (TA-5-14 and TA-5-16); an experimental concrete wall (TA-5-17), platforms (TA-5-18 and TA-5-19), a calibration facility (TA-5-20), a maintenance building (TA-5-21), and a transformer station (TA-5-22) (LASL no date, 0402). The approximate locations of these structures are shown in Figure 3-2. Table 3-5 provides detailed descriptions of Beta Site structures.

Storage building TA-5-8 was removed in April 1950, and barricade TA-5-14 was removed in July 1952 (LASL circa 1967, 04-0144; LASL no date, 0402). In September 1952, the water tank, pump house, and septic tank (TA-5-11, TA-5-12, and TA-5-13, respectively) were returned to ENG-3 for disposition (Vogt 1952, 04-0196). Platform TA-5-18 was relocated near TA-15-44 in July 1957 (LASL 1967, 04-0144; LASL no date, 0402). The transformer station, TA-5-22, was renumbered TA-53-99 in January 1971. The remaining TA-5 structures were abandoned in place in 1959 (LASL no date, 0402). The following structures were destroyed by fire in March 1960: two day magazines (TA-5-2, TA-5-3); control building (TA-5-4); shop and darkroom (TA-5-5); laboratory building (TA-5-6), and latrine (TA-5-10) (LASL no date, 0402 ; LANL 1989, 04-0129). Structures TA-5-1, TA-5-2, TA-5-3, TA-5-4, TA-5-5, TA-5-7, TA-5-9, TA-5-11, TA-5-12, TA-5-14, TA-5-15, and TA-5-17 were addressed during 1985 LASCP D&D activities.

3.2.1.3 Ownership Profile and Land Uses

DOE currently owns the property on which the former Beta Site was located (DOE 1988, 0491). Within the current boundaries of TA-5 are a well and an electrical substation. TA-5 is currently used as a security buffer zone (LANL 1990, 0145).

3.2.2 Historical Overview

Beta Site was originally established as a test firing site in 1944 and was used as such until 1947 (Ahlquist et al. 1985, 04-0019). In 1944, G-Division began using Beta Site as a firing site for implosion studies using the "pin" or "electric" method of detonation wave determination (Ahlquist et al. 1985, 04-0019). Firing site tests typically involved about 50 lb of high explosives per test. The site was also used to fire larger charges than those tested at Alpha Site (former TA-4) using the "magnetic method." Two large tests involving approximately 2,000 lb of high explosives were conducted at the site for confirmatory measurements in preparation for the Trinity event (DOE 1987, 0264). As at TA-4, a shop and darkroom were used to process photographs of implosion activities conducted at the site.

After firing activities at TA-5 were halted, several Laboratory groups used the site for a variety of experiments. In 1952, J-Division temporarily used the shop and darkroom (TA-5-5) for calibration of high-range meters (Vogt 1952, 04-0196). Beta Site was used in the summer of 1953 for experiments conducted to study hydrogen fires. Also in 1953, Beta Site was used to conduct studies on the effects of radiation on E. coli and cell surface adsorption of radioactive compounds (H-Division 1953, 0466). A 1955 report indicates that Group H-4 conducted animal radiation experiments using 30 Ci of ^{60}Co (H-Division 1955, 0467). A 1957 report describes an experiment the US Air Force requested to determine if a burning plane carrying significant amounts of beryllium would cause hazardous air or ground contamination. A piece of beryllium was suspended above a large amount of jet engine fuel that was ignited. The metal reached a temperature of 950°Celsius (C) and, although air sampling was performed in the smoke cloud and at various distances downwind, no air or soil contamination was detected (H-Division 1957, 0489).

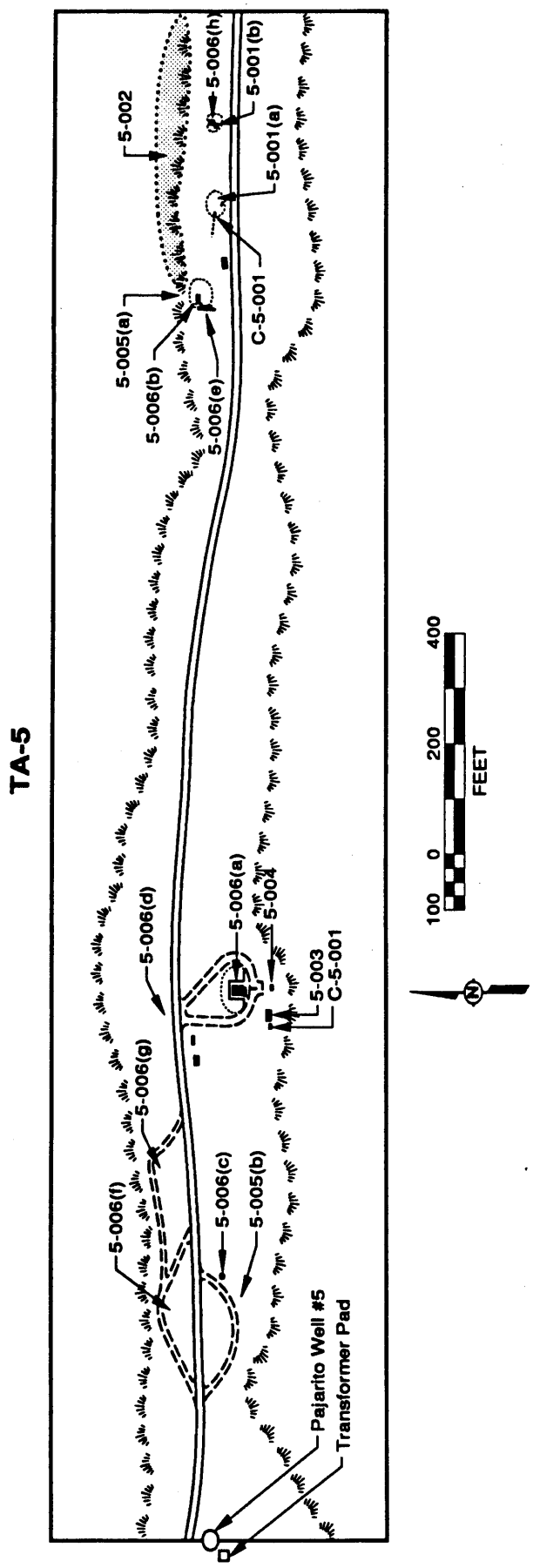


Figure 3-2. Locations of structures and SWMUs at TA-5 (LASL 1961, 04-0248).

TABLE 3-5

DESCRIPTION OF STRUCTURES AT TA-5

- **TA-5-1, Laboratory building.** Relocated to TA-5 from TA-18 in May or June 1948 and abandoned in place in December 1959 (LASL 1947, 0460; LASL 1947, 0461; LASL no date, 0402).
- **TA-5-2, Magazine.** Construction completed in June 1945, abandoned in place in December 1959, and destroyed by burning in March 1960 (LANL 1989, 04-0129).
- **TA-5-3, Magazine.** Construction completed in July 1945, abandoned in place in December 1959, and destroyed by burning in March 1960 (LANL 1989, 04-0129).
- **TA-5-4, Control building.** Construction completed circa June 1945, abandoned in place in December 1959, and destroyed by burning in March 1960 (LANL 1989, 04-0129).
- **TA-5-5, Shop and darkroom.** Construction completed circa March 1944, abandoned in place in December 1959, and destroyed by burning in March 1960 (LANL 1989, 04-0129).
- **TA-5-6, Laboratory building.** Construction completed in March 1944, abandoned in place in December 1959, and destroyed by burning in March 1960 (LANL 1989, 04-0129).
- **TA-5-7, Steel barricade firing pit no. 1.** Construction completed circa July 1944, abandoned in place in December 1959 (LANL 1989, 04-0129).
- **TA-5-8, Storage building.** Construction completed circa March 1944, removed in April 1950 (LANL 1989, 04-0129).
- **TA-5-9, X-unit chamber, firing point no. 2.** Construction completed in February 1944 and abandoned in place in December 1959 (LANL 1989, 04-0129).
- **TA-5-10, Latrine.** Construction completed circa February 1944, abandoned in place in December 1959, and destroyed by burning in March 1960 (LANL 1989, 04-0129).
- **TA-5-11, Underground water tank.** Installation completed in May 1948, and abandoned in place in December 1959 (LANL 1898, 04-0129).
- **TA-5-12, Underground pump house.** Construction completed in May 1948, abandoned in place in December 1959 (LASL no date, 0402).
- **TA-5-13, Septic tank.** Construction completed in May 1948, abandoned in place in December 1959 (LASL no date, 0402).
- **TA-5-14, Log barricade.** Construction completed in July 1948, removed circa July 1952. (LASL no date, 0402).
- **TA-5-15, Steel barricade firing pit no. 2.** Construction completed circa May 1945, abandoned in place in December 1959 (LASL no date, 0402).
- **TA-5-16, Barricade.** Construction completed in May 1948, abandoned in place in December 1959. (LASL no date, 0402).
- **TA-5-17, Experimental concrete wall.** Construction completed in October 1954, abandoned in place in December 1959 (LASL no date, 0402).
- **TA-5-18, Platform.** Construction completed circa November 1953, relocated near TA-15-44 in July 1957 (LANL 1989, 04-0129; LASL no date, 0402).
- **TA-5-19, Platform.** Construction completed circa November 1953, abandoned in place in 1959. The 6-ft by 6-ft wooden platform was mounted 26 ft above the ground on two 45-ft-tall wooden poles (Blackwell 1976, 04-0028; LASL no date, 0402).
- **TA-5-20, Calibration Facility.** Construction completed circa January 1960, abandoned in place in 1974 (Bacastow 1974, 04-0022). A 1.83-m-diameter, 10.67-m-deep shaft is the only remaining original Beta Site structure remaining at TA-5 (LASL no date, 0402).
- **TA-5-21, Maintenance building.** Construction completed circa January 1960, abandoned in place in 1959 (LASL no date, 0402).
- **TA-5-22, Transformer station.** Installed in December 1959 and removed and installed on Zia Pole No. 1281 and renumbered transformer station MPF-99, TA-53-99, in January 1971 (LANL 1989, 04-0129). Consisted of three 10 Kv, single phase, 13,200-100/240 volt transformers mounted on a 35 ft high pole (Zia No. 1280) (LASL no date, 0402).

In October 1959, the Nuclear Criticality Safety Committee (NCSC) approved Group J-12 to operate an experimental reactor, "Little Eva," at Beta Site (Reider 1959, 04-0174). Field measurements of Little Eva were made at Beta Site in January 1960. Radiation levels taken inside a control trailer located 800 ft from Little Eva were measured at 12 mR/hr using the Hurst proportional counter and at 83 mR/hr using a converted Pee Wee (H-Division 1960, 0481; LASL circa 1960, 04-0141). Because of these findings, the trailer was moved to a distance of 1,612 ft from Little Eva (H-Division 1960, 0481; LASL circa 1960, 04-0141). In November 1959, the NCSC approved Group J-16 to use another experimental reactor, "Godiva," at the Beta Site (Reider 1959, 04-0174). No data are available on possible soil contamination from operation of these reactors.

Beta Site was officially abandoned in 1959 (Scholl Fritz 1985, 04-0082; Russo 1959, 04-0177; Montoya 1976, 04-0163; Montoya 1985, 04-0159) but was used periodically for testing until the 1970s. In the 1960s and early 1970s, tests using radiation calibration sources were conducted (DOE 1987, 0264). A magnetometer was installed at Beta Site in July 1967 to record variations in the geomagnetic field (LASL 1967, 04-0144). Group A-2 conducted an experiment using neutron sources with no environmental contamination in 1972 (Russo 1972, 04-0180; Ahlquist 1985, 04-0014). Group P-10 conducted a "solar experiment" at Beta Site in 1979 (Montoya 1985, 04-0158).

3.2.2.1 Waste Management Activities

Most of the waste materials potentially generated at TA-5 were related to test shots that were exploded at the firing sites. These materials include high explosives, natural and depleted uranium, beryllium, cadmium, and lead. Other contaminants potentially generated at TA-5 include photo-processing chemicals and other unspecified chemicals and acids.

SWMUs identified at TA-5 are listed in Table 3-6 and their approximate locations are shown in Figure 3-2.

TABLE 3-6

TA-5 SWMUs

SWMU No.	Description
5-001(a-c)*	Firing Sites
5-002*	Canyonside Disposal
5-003*	Calibration Chamber
5-004*	Septic System
5-005(a-b)*	Drains and Outfall
5-006(a-h)	Soil Contamination Beneath Former Buildings

* SWMU Nos. 5-001(a-b), 5-002, 5-003, 5-004, and 5-005(a) were listed in the HSWA Module VIII (EPA 1990, 0306). In addition to these SWMUs, one AOC, C-5-001, has been designated at TA-5.

SWMU No. 5-001(a-c), Firing Sites: Steel barricade Firing Pit No. 1 (TA-5-7) has been designated SWMU No. 5-001(a). This site was used for implosion tests from 1944 to 1947. Steel barricade Firing Pit No. 2 (TA-5-15) is designated SWMU No. 5-001(b). This pit was used from 1945 until the late 1940s. Experimental shots were set up at these two sites and fired on open ground. The shots used high explosives as an energy source. The firing pits were approximately 200 ft apart, with overlapping areas of contamination and debris fallout. As debris accumulated, a bulldozer was used to clear the pit area by pushing scrap and debris northward to the edge of Mortandad Canyon (DOE 1987, 0264). The shrapnel zone included the canyon sides, canyon bottom, and approximately 200 ft around the firing pit. Both firing pit structures were removed during the 1985 LASCP. No radioactive contamination was detected on steel barricade Firing Pit No. 1 or beneath it after the structure was removed (Scholl 1989, 0485). However, steel barricade Firing Pit No. 2 contained uranium contamination. Another firing point, SWMU No. 5-001(c), is referenced on maps and memos and was apparently located several hundred feet east of 5-001(b). No information is available about the period of use of this firing point. Two tests involving large amounts (approximately 2,000 lb each) of HEs were conducted at this site in the spring of 1945 as final confirmatory tests before the Trinity test. During 1985 LASCP D&D activities, a cable run to a far firing point was removed, but the location was not mentioned (Scholl 1989, 0485).

Waste materials potentially released in association with test shots at TA-5 include high explosives, natural and depleted uranium, beryllium, lead, cadmium, and uranium-contaminated aluminum or steel (LANL 1990, 0145). The sites have been decontaminated for radioactive constituents, but no characterization or cleanup of nonradioactive constituents has been performed.

SWMU No. 5-002, Canyonside Disposal: A canyonside disposal site, SWMU No. 5-002, was created by bulldozing shot debris from the firing pits over the north-facing slope of Mortandad Canyon. The debris zone extended to the canyon bottom. The site was used intensively for about three years. A radiation survey in 1976 indicated contamination at this disposal site. During 1985 LASCP activities, visible surface shot debris was removed, but the canyonside was not monitored or decontaminated for radioactivity (Scholl 1989, 0485). Waste materials potentially disposed of at this location include shot debris, cables, wire, and trace amounts of uranium, lead, beryllium, cadmium, and uranium-contaminated aluminum or steel (LANL 1990, 0145; DOE 1987, 0264).

SWMU No. 5-003, Calibration Chamber: In January 1960, a calibration facility was constructed over a 35-ft-deep shaft or calibration chamber (SWMU No. 5-003), which was lined with lead brick. A small room off the bottom of the chamber was reportedly used to calibrate thermoluminescent dosimeters with a sealed radium source. Equipment containing uranium was reportedly used in the chamber. The facility was abandoned before February 1974 and backfilled sometime before 1985. The lead bricks were not removed before the shaft was backfilled. The building over the chamber was removed at an unknown date. The concrete shaft, which was not addressed in the 1985 LASCP, is the only original Beta Site structure remaining at TA-5. The location of the calibration chamber is shown in Figure 3-2. Waste materials at the site include the lead bricks that were left in the chamber during backfilling (LANL 1990, 0145).

SWMU No. 5-004, Septic System: SWMU No. 5-004 is a septic tank (TA-5-13) that received industrial waste from TA-5-1 for approximately 10 years. Surveys conducted in 1959 (the year the tank was abandoned) found the tank to be free of radioactive and HE contamination, but the tank was suspected of being contami-

nated with acid. The tank and associated piping were subsequently removed. The 1985 LASCP confirmed removal of the tank and piping by re-excavation. No evidence of radioactively contaminated soil was detected at that time (LANL 1990, 0145). As-built drawings indicate a discharge line running from TA-5-1 near the TA-5-16 barricade to TA-5-13 and then south toward the canyon (LANL 1955, 04-0238). Whether the discharge area was investigated during the removal of the tank is unknown. The septic tank may have handled wastes including unknown toxic chemical constituents (LANL 1990, 0145).

SWMU No. 5-005(a-b), Drains and Outfalls: During 1985 LASCP activities, a French drain, SWMU No. 5-005(a), was discovered running from the control building (TA-5-4) toward the canyon (Figure 3-2). The French drain was presumably constructed in 1945 and abandoned in 1959 along with the control building. The control building was removed in 1960, and the French drain and affected soil were removed in 1985. The types of waste introduced from the control building to the French drain are unknown. An outfall, SWMU No. 5-005(b), associated with TA-5-5, the shop and darkroom, was identified during a 1987 ER Program site reconnaissance. The outfall was presumably operational from 1944 to 1959, when TA-5-5 was used. Waste materials potentially released at this site include radioactive and chemical constituents (LANL 1990, 0145).

SWMU No. 5-006(a-h), Soil Contamination Beneath Former Buildings: In surveys conducted in 1958, 1959, and 1985, several sites were found to be contaminated with HEs and uranium, as summarized in Table 3-7 (LANL 1990, 0145). Although TA-5 is no longer in operation and surface features have been removed, these constituents may remain as soil contamination at the site (LANL 1990, 0145).

C-5-001, Potential Release Sites: Potential soil contamination may be associated with two former structures, the storage building (TA-5-8) and the maintenance building (TA-5-21), which underwent D&D in 1985 (LANL 1990, 0145). The contaminants that may have been released at these sites are unknown.

TABLE 3-7

SOIL CONTAMINATION BENEATH FORMER BUILDINGS (SWMU NO. 5-006)

SWMU No.	Structure No.	Period of Use	Removed	Potential Waste
5-006(a)	TA-5-1	1948-1959	1959	High explosives; unknown other
5-006(b)	TA-5-4	1945-1959	1960	Uranium; unknown other
5-006(c)	TA-5-5	1944-1959	1960	High explosives; possible photo- processing chemicals; unknown other
5-006(d)	TA-5-6	1944-1959	1960	High explosives; unknown other
5-006(e)	TA-5-19	1953-1958	1985	Uranium; unknown other
5-006(f)	TA-5-2	1945-1959	1960	High explosives; unknown other
5-006(g)	TA-5-3	1945-1959	1960	High explosives; unknown other
5-006(h)	TA-5-9	1947-1959	?	Uranium; unknown other

Source: LANL (1990, 0145).

3.2.2.2 Summary of Potential Waste Materials

Available information (H-Division 1955, 0467; H-Division 1957, 0489; Vogt 1952, 04-0196; DOE 1988, 0491; LANL 1990, 0145) suggests that waste materials potentially handled at TA-5 included the following:

- Natural and depleted uranium
- Beryllium
- High explosives (i.e., "Composition B," detonators, and primacord)
- Photo-processing chemicals
- Cadmium
- Lead
- Unspecified laboratory chemicals
- Uranium-contaminated aluminum and steel

3.2.2.3 Past Waste Spills, Releases, and Incidents

No documentation exists that states if accidental spills or releases occurred at TA-5; however, some soil contamination was detected during 1985 LASCP D&D activities, which is discussed in the following section (DOE 1988, 0491).

3.2.2.4 Environmental Surveys and D&D Activities

In 1956, six soil samples were collected at TA-5 and analyzed for uranium. All results were at or below background (<1 mg U/g of soil) (H-Division 1956, 0468). The locations from which these samples were taken are not known.

In 1959, Group H-3 listed structures considered contaminated by HE. These structures included TA-5-2, TA-5-3, TA-5-5, TA-5-7, TA-5-9, and TA-5-15 (Penland 1959, 04-0167). Several other surveys were conducted in 1959 to determine the presence, if any, of radioactive, HE, and toxic contamination at TA-5 (Hyatt 1959, 04-0102; Blackwell 1959, 04-0025; Hyatt 1959, 04-0103; Penland 1959, 04-0168; Schulte 1959, 04-0184; Blackwell 1959, 04-0026; Blackwell 1959, 04-0027; Russo 1959, 04-0178; Russo 1959, 04-0179). All structures surveyed were found to be free of radioactivity (the survey instruments employed are not discussed in the reports), but five structures (TA-5-1, TA-5-2, TA-5-3, TA-5-5, and TA-5-6) had HE contamination. The septic tank (TA-5-13) contained unspecified toxic chemicals.

In 1960, the Laboratory initiated a program for the demolition of abandoned and/or contaminated (e.g., HE, radioactive materials) structures that could not be sold or reused (Wingfield 1960, 04-0203). Buildings at Beta Site that were to be burned included the laboratory buildings (TA-5-1 and TA-5-6), the steel barricade at TA-5-9, the latrine (TA-5-10), and a platform (TA-5-19) (Wingfield 1960, 04-0202). The

following structures were to be abandoned in place: the steel barricades at TA-5-7 and TA-5-15, the underground pump house (TA-5-12), the septic tank (TA-5-13), and the experimental concrete wall (TA-5-17) (Wingfield 1960, 04-0202). Buildings to be demolished included the magazines (TA-5-2 and TA-5-3), a control building (TA-5-4), and the shop and darkroom (TA-5-5) (Wingfield 1960, 04-0202).

TA-5-1, TA-5-16, and TA-5-21 were monitored in 1973 and found to be free of radioactive contamination. Surface soils beneath the barricade (TA-5-16) were also free of contamination (Martin 1973, 04-0151). In June 1976, no detectable radiation was measured in TA-5-1, TA-5-7, TA-5-9, TA-5-15, TA-5-17, TA-5-20, or TA-5-21. TA-5-11 and TA-5-12 were underground structures (a water tank and pump house, respectively) used for city water and could not be monitored, but the structures were assumed to be uncontaminated. The septic tank, TA-5-13, was filled with liquid that was to be sampled. The platform on poles 26 ft aboveground (TA-5-19) was considered too risky to monitor in place and was to be monitored when removed (Blackwell 1976, 04-0028). A large amount of plate steel was scattered about the mesa. Contamination levels to 2,000 cpm alpha and 4.0 mR/hr beta-gamma were detected on the steel plates. The contamination was believed to be from uranium (Blackwell 1976, 04-0028).

LASCP D&D activities at TA-5 were conducted from August 12 to September 23, 1985. Actual D&D work included radiological monitoring, picking up debris, demolishing buildings, removing structures, exhuming underground utilities, and contouring the areas. The LASCP did not address nonradioactive contamination. TA-5 structures that were addressed during the 1985 D&D project are listed in Table 3-8 (Scholl 1989, 0485).

Many of the buildings, such as the laboratories, magazines, and the shop and darkroom, had previously been razed or burned to the ground. Past abandonment activities left mounds of soil with building debris. Some structures such as the storage building (TA-5-8), latrine (TA-5-10), septic tank (TA-5-13), barricade (TA-5-16), and platform (TA-5-18) had previously been removed. Although the septic tank was

TABLE 3-8

TA-5 STRUCTURES ADDRESSED DURING LASCP

Structure Designation	Structure Description
TA-5-1	Laboratory building
TA-5-2	Magazine
TA-5-3	Magazine
TA-5-4	Control building
TA-5-5	Shop and darkroom
TA-5-7	Steel barricade, Firing Pit No. 1
TA-5-9	X-unit chamber
TA-5-11	Water tank
TA-5-12	Pump house
TA-5-14	Log barricade
TA-5-15	Steel barricade, Firing Pit No. 2
TA-5-17	Experimental concrete wall

reported to have been exhumed, confirmatory excavation in its former location was undertaken. Although no evidence of the tank or its associated lines was found, some disturbed soil was discovered (Scholl 1989, 0485).

During the LASCP site cleanup, depleted and/or natural uranium was detected at discrete spots of yellow uranium oxide. Uranium-contaminated surface soil was removed, monitored for radioactivity levels, and disposed of. Areas from which contaminated soils were removed were sampled to ensure that all above-background radioactivity was removed (Scholl 1989, 0485).

Most of the D&D work at TA-5 revolved around one central area at which uranium contamination was encountered. The larger contaminated area encompassed the control building (TA-5-4), the X-unit chamber (TA-5-9), the steel barricade Firing Pits No. 1 and No. 2 (TA-5-15 and TA-5-7), and a platform (TA-5-19 near TA-5-7). In addition to these areas, a gravel pile that may be the remains of the far firing point also contained radioactive contamination (Scholl 1989, 0485).

Most of the contamination at TA-5 was detected within the top 2 ft of soil. Contamination found in the control building area was believed to have entered the environment through a French drain that serviced that building (SWMU No. 5-005[a]). However, contamination of the X-unit chamber and the steel barricade Firing Pit No. 2 was more extensive, with radioactivity traced vertically down to 15 ft below the surface. Contamination found at such depths probably occurred because multiple shots in the same area loosened the tuff and created fractures. Contamination migrated northward from Firing Pit No. 2 to the X-unit chamber along these fractures and gravel seams underlain by clayey material. Tree roots within the fractures and seams also provided a route for migration, as positive readings were obtained near roots of three small trees growing in the contaminated area. These trees were cut down, their roots were excavated, and all their parts were disposed of at TA-54. Levels of radioactivity detected at these areas are listed in Table 3-9 (Scholl 1989, 0485).

A sample of the uranium collected on site was analyzed to determine the type of uranium found at TA-5. The sample was gamma analyzed using a germanium lithium (GeLi) detector and a 4,096-channel pulse-height analyzer. The sample was determined to be depleted uranium. Groups HSE-1, HSE-8, and HSE-12 also performed soil sampling in the main contamination area. Groups HSE-8 and HSE-12 used a Ludlum Model 2200 zinc sulfide (ZnS) alpha- and beta-counting system

TABLE 3-9

RADIOACTIVITY DETECTED AT TA-5 STRUCTURES IN 1985

Structure Designation	Structure Description	Activity[a] (mR/hr)
TA-5-4	Control building	3-20
TA-5-9	X-unit chamber	30-40
TA-5-15	Steel barricade Firing Pit No. 2	20-40
N/A	Gravel pile	15

[a] Detected with a Ludlum Model 3 open-shield probe (Scholl 1989, 0485).

and BNC Portanim Model AP-1 NaI (sodium iodide) soil-counting system. Six distinct soil samples were taken from the pit excavated at Firing Pit No. 2 and composited to trace the uranium and the area of migration between the pit and the X-unit chamber. Average results were approximately 4-nCi/g alpha and 6-nCi/g beta. Soil samples taken in the area after cleanup did not exceed background for radioactivity. Group HSE-12 took 36 samples on a grid over the area and also found that the samples did not contain above-background radioactivity (Montoya 1985, 04-0158; Scholl 1989, 0485).

After the X-unit chamber (TA-5-9) was removed, contamination was discovered in the gravel seams and tree roots. Soil, tuff, and vegetation were excavated until monitoring and soil sample results were negative for radioactive contamination (Montoya 1985, 04-0158; Scholl 1989, 0485).

Steel barricade Firing Pit No. 2 (TA-5-15) also contained uranium. When the metal structure was removed from the ground, more contamination was found. This contamination was traced vertically to a depth of about 15 ft. The pit created by excavating the uranium contamination measured approximately 20 ft wide in a north-south direction by 21 ft in an east-west direction, and was 15 ft deep. Composite soil samples were collected and monitored for radioactivity at varying depths in the pit and the pit bottom. When decontamination of the area was completed, the pit was backfilled with clean soil from TA-5-1, TA-5-2, and TA-5-3 (Montoya 1985, 04-0158; Scholl 1989, 0485).

Steel barricade Firing Pit No. 1, steel plates around the pit, a control box, and a wooden platform were also removed. No contamination was detected on the surface of the structures or in the soil directly beneath the firing pit; however, because soil in the area was contaminated in several spots, the structure and other material were taken to TA-54 for disposal (Montoya 1985, 04-0158; Scholl 1989, 0485).

Uncontaminated areas at TA-5 were located primarily on the western part of the area. Some cleanup of debris left from many of the buildings previously destroyed at TA-5 was required. These areas included laboratory buildings TA-5-1 and TA-5-6, magazines TA-5-2 and TA-5-3, and a shop and darkroom TA-5-5. After the areas were cleared of debris, they were contoured to the existing terrain. Excess clean soil from the magazine areas was used as fill at the TA-5-9 and TA-5-15 areas.

Three uncontaminated structures, a water tank (TA-5-11), a pump house (TA-5-12), and the experimental concrete wall (TA-5-17), were removed during the 1985 LASCP. Liquid in the tank was analyzed for radioactivity and found to be less than background and was drained to the ground through the tank plug. Surfaces of the structures were monitored before removal and shipment off-site and were found to be free of radioactive contamination. No radioactive contamination was found in soil samples that were taken in areas surrounding and beneath the structures (Montoya 1985, 04-0158; Scholl 1989, 0485).

In April 1988, results of a radiation survey were reported (Table 3-10) (Shafer circa 1989, 04-0187; LANL 1988, 04-0126; LANL 1988, 04-0127). Notes taken during the 1988 survey indicate evidence of outfalls near TA-5-1, TA-5-5, and TA-5-13, and surface debris visible in the vicinity of TA-5-5, TA-5-6, TA-5-1, and TA-5-15 (Shafer circa 1989, 04-0187).

TABLE 3-10

TA-5 RADIOACTIVE CONTAMINATION SURVEY MEASUREMENTS APRIL 1988

Location ID	Beta-Gamma (cpm)[a]	Gamma Exposure surface	(μR/hr)[b] 3ft
5-1 & 16	220	15	16
5-2	204	18	18
5-3	238	17	16
5-4	254	16	15
5-5	228	17	16
5-6	246	18	15
5-10	208	16	15
5-11 & 12	204	16	16
5-13 (trench)	210	22	18
5-15	228	_c	_c
5-15 & 9	_c	17	17
5-2 (outfall)	262	17	_c

Sources: LANL (1988, 04-0126); LANL (1988, 04-0127); Shafer (circa 1989, 04-0187).
[a] Background: 116 cpm.
[b] Background: 10-12 μR/hr.
[c] No data available.

3.2.3 Regulatory Activities

3.2.3.1 Permits

No previous or existing permits are associated with TA-5.

3.2.3.2 Interim Corrective Measures

The 1988 Inventory of Federal Hazardous Waste Activities forms completed for TA-5 indicate that CERCLA PA/SI corrective actions were completed in October 1987 as part of the Phase I CEARP investigation (LANL 1988, 04-0125). No additional documentation on corrective actions is available.

3.3 Description of TA-35, Ten Site

3.3.1 Site Location and Physical Description

TA-35, Ten Site, is currently used for safeguard studies, laser research and development, physical research, fusion work, and other experimental research. The following subsections provide a detailed description of the site.

3.3.1.1 Geographic Location and Local Area Description

TA-35 structures are located on a finger mesa between Mortandad Canyon on the north and Ten Site Canyon, which is a branch of Mortandad Canyon, on the south. The site is situated at an approximate latitude and longitude of 35°51'45" N and 106°17'30" W, respectively (USGS 1984,04-0239). TA-35 lies at elevations between about 6,950 ft and 7,250 ft and occurs within the boundaries of the Laboratory in Los Alamos County.

3.3.1.2 Physical Site Description

TA-35 is one of the largest TAs at the Laboratory, with approximately 300 designated structures. Many of these numbered structures, however, are storage tanks, manholes, transportable storage trailers, and mobile office trailers. Table 3-11 contains a brief description of the structures at TA-35, and Figures 3-3 and 3-4 show the locations of the major laboratory facilities at TA-35.

Various Laboratory groups use the several experimental laboratories located at TA-35. Seven groups from the Physics (P) Division, three groups from the Chemistry (CLS) Division, five groups from the Materials Science and Technology (MST) Division, two groups from the Energy (Q) Division (now N-Division), and two groups from the Applied Theoretical Physics (X) Division had significant operations at TA-35 in 1986 (DOE 1987, 0264). Most of the research and development work done by the P-, CLS-, MST-, and X-Divisions deals with lasers and laser fusion, and involves development, fabrication, and operation of lasers and laser targets. N-Division is involved primarily in nuclear safeguards research and development of assay instrumentation (DOE 1987, 0264). The following is a brief discussion of the major laboratory facilities at TA-35.

TA-35-2 is the original Ten Site Laboratory and office building. Completed in 1951, this building has been used for a wide variety of research operations. TA-35-2 has housed two experimental reactors (Los Alamos Power Reactor Experiment, LAPRE-I; and Los Alamos Molten Plutonium Reactor Experiment, LAMPRE), a hot cell used for preparing of kilocurie-sources of radioactive lanthanum (^{140}La), plutonium research laboratories, and a facility at which lithium tritide components were developed and handled (DOE 1987, 0264). Four laboratory groups currently occupy TA-35-2 and are involved in research in ceramics, robotics, polymer synthesis, lasers, high-speed impact studies, and strain-rate measurements on a variety of materials including plutonium. Several SWMUs are located either inside or near TA-35-2 (Figure 3-3).

TA-35-7, the Air Filter Building, housed the air-filtration components and ion-exchange columns associated with the Ten Site Waste Treatment Facility that operated from 1951 until the mid-1960s. The building is listed as SWMU No. 35-003(p) and is currently used only for storage.

TA-35-27, the Fast Reactor Core Test Building, was built in 1968 to house the LAMPRE-II reactor, but the reactor was never completed. N-Division currently uses TA-35-27 for nuclear safeguards research and development (DOE 1987, 0264). Two SWMUs have been designated inside this building (Figure 3-3).

TA-35-29, the Gas Laser Building, was built in 1961 to house a small reactor test pit. P-Division currently uses this building for housing the "Gemini" gas laser facility,

TABLE 3-11

DESCRIPTION OF STRUCTURES AT TA-35

The following list is a description of structures and their associated SWMUs.

(All information is from the Laboratory/Pan Am HistoryBook (LASL no date, 0402), the 1990 SWMU report (LANL 1990, 0145), and LANL TA Structure Plans unless otherwise indicated):

- **TA-35-1, Guard house.** Completed July 1951. Currently not in use.
- **TA-35-2, Laboratory and office building.** Completed July 1951. Incorporated former building TSL-26. The following SWMUs are associated with this building: SWMU Nos. 35-004(e and k), container storage areas in rooms C18 and A135 involving solvents, laser dyes, PCB oil, organics, lithium chloride; SWMU No. 35-011(a), two storage tanks in the basement installed to temporarily hold plutonium- contaminated solutions for transport to TA-50; SWMU No. 35-013(b), a sump in the basement for collecting sanitary wastes; SWMU No. 35-014(b), former site of a leaking drum near TA-35-2; SWMU No. 35-016(o), an unpermitted storm drain that discharges at the south rim of Mortandad Canyon; and SWMU No. 35-018(b), a transformer that leaked PCB-contaminated oil in the basement.
- **TA-35-3, Underground phase separator pit.** SWMU No. 35-003(n). Completed July 1951; currently inactive.
- **TA-35-4, -5, and -6, Underground holding tanks.** SWMU No. 35-003(a, b, and c). Currently inactive.
- **TA-35-7, Air Filter Building.** SWMU No. 35-003(p). Completed in August 2, 1951. Decommissioned and decontaminated in 1979 to 1980. Currently used as a warehouse (DOE 1987, 0264).
- **TA-35-8, Pump pit.** SWMU No. 35-003(l). Removed in 1984.
- **TA-35-9, Pipe trench.** SWMU No. 35-003(q). Removed in 1984.
- **TA-35-10, Concrete tank building.** SWMU No. 35-003(d). Removed in 1985.
- **TA-35-11, Manhole.** SWMU No. 35-004(h), container storage area, was located near this manhole.
- **TA-35-12, Manhole.** SWMU No. 35-003(o). Removed in 1985.
- **TA-35-13, Manhole.**
- **TA-35-14, Septic tank.** SWMU No. 35-009(a). A 1,500-gal.-capacity tank, abandoned in 1975.
- **TA-35-15, Dosing chamber.** Part of SWMU No. 35-009(a) Associated with TA-35-14. Abandoned in 1975.
- **TA-35-16, Distribution box.** Associated with SWMU No. 35-009(a). Associated with TA-35-14. Removed in 1973.
- **TA-35-17, Manhole.**

TABLE 3-11 (continued)

DESCRIPTION OF STRUCTURES AT TA-35

- **TA-35-18, Diesel fuel tank.** 3,000-gal.-capacity tank; completed July 12, 1951. Abandoned in 1973. Designated as SWMU No. 35-C-001.
- **TA-35-19 and -20, Fuel oil tanks.** 5,000-gal.-capacity each tank. Completed July 12, 1951, abandoned in 1973. Designated as SWMU Nos. 35-C-002, -003.
- **TA-35-21, Manhole.** Completed July 12, 1951. Abandoned in 1973.
- **TA-35-22, Sludge tank.** Installed in approximately June of 1953. Removed in August 1981. Designated as SWMU No. 35-003(m).
- **TA-35-23, Discharger.** Completed December 14, 1954. Removed November 22, 1957.
- **TA-35-25, Sodium Building.** Completed March 15, 1957. SWMU No. 35-004(a) is located near TA-35-25.
- **TA-35-26, Laboratory office building.** Completed April 17, 1961, this building has been incorporated into TA-2.
- **TA-35-27, Nuclear Safeguards Research Building.** Built before August 12, 1968. SWMU 35-004(l) is located in Room 105 of TA-35-27. SWMU No. 35-016(p), a 20-ft drain line with an outfall that drains into Mortandad Canyon, originates in this building.
- **TA-35-28, Pump pit.** Completed February 26, 1957. Removed in 1965.
- **TA-35-29, Gas Laser Building.** Located approximately 50 ft southwest of TA-35-27. SWMU Nos. 35-014(c and d) occur near TA-35-29. SWMU No. 35-016(l) is a storm-drain outfall into Ten Site Canyon from TA-35-29.
- **TA-35-30, Office building.** Completed January 23, 1957. Removed 1967.
- **TA-35-31, Retention tank.** Completed April 17, 1961. Removed February 14, 1985. Designated as SWMU No. 35-003(h).
- **TA-35-32, Transformer substation.** Completed April 17, 1961. Designated as SWMU No. 35-018(a).
- **TA-35-33, Cooling tower.** Completed October 7, 1966. SWMU No. 35-016(m), an inactive outfall that discharged into Mortandad Canyon, originates here.
- **TA-35-34, Sodium Testing Building.** Completed in August 1, 1958. SWMU No. 35-016(a), an inactive outfall, discharged from this building.
- **TA-35-35, Underground control tunnel.** Completed April 17, 1961.
- **TA-35-36, Storage tank.** Completed April 29, 1960. SWMU No. 35-003(e). Removed August 18, 1981.
- **TA-35-37, Flocculator tank.** Completed April 29, 1960, SWMU No. 35-003(f). Removed in 1980.

TABLE 3-11 (continued)

DESCRIPTION OF STRUCTURES AT TA-35

- **TA-35-38, Regenerant tank.** Completed April 29, 1960. SWMU No. 35-003(g). Removed in 1980.
- **TA-35-39 & 40, Ion exchange tanks.** Both completed April 29, 1960.
- **TA-35-41, Caustic Treatment Building.** Completed April 17, 1961. Removed February 14, 1985.
- **TA-35-42, Manhole, electrical.** Completed March 29, 1962.
- **TA-35-43, Sodium disposal tanks.** Material Disposal Area W, disposal site of sodium reactor coolant. Designated as SWMU No. 35-001.
- **TA-35-44, Septic tank.** Completed April 17, 1961. SWMU No. 35-009(c). A currently active 1,290-gal.-capacity tank, abandoned 1990.
- **TA-35-45, Distribution box.** Completed April 17, 1961. Associated with TA-35-44, part of SWMU No. 35-009(c).
- **TA-35-46, Reactor Components Development Building.** Completed May 3, 1962. SWMU No. 35-016(d), an inactive outfall, discharged into Ten Site Canyon from TA-35-46.
- **TA-35-47, Manhole.** Completed October 9, 1959.
- **TA-35-48, Exhaust stack.** Completed February 26, 1962.
- **TA-35-49, Storage building.** Relocated from Bayo site TA-10 in May 1963. Moved to TA-3-378.
- **TA-35-51, Engineering field office.** Relocated to TA-34 and renamed TA-3-284.
- **TA-35-52, Control panel.** Completed in October 1962. Removed in December 1984.
- **TA-35-53, Electrical substation.** Completed October 7, 1966.
- **TA-35-54, Electrical manhole.** Completed October 7, 1966.
- **TA-35-55, Retaining wall.** Completed November 17, 1975.
- **TA-35-56 to 59, Manifolds.** Completed October 7, 1966. All removed November 13, 1974. SWMU No. 35-004(i) was formerly located near TA-35 58.
- **TA-35-60 to -64, Manholes.** Completed at various times between February 19, 1964 and October 7, 1966.
- **TA-35-65, Septic tank.** Completed October 7, 1966. Abandoned 1990. Designated as SWMU No. 35-009(d). 1,600-gal. capacity.
- **TA-35-66, Switch gear station.** Completed February 19, 1964.
- **TA-35-67, Warehouse.** Completed October 9, 1964. SWMU No. 35-004(g) is on the south side of TA-35-67. SWMU No. 35-016(c), an inactive outfall to Ten Site Canyon, comes from this building.

TABLE 3-11 (continued)

DESCRIPTION OF STRUCTURES AT TA-35

- **TA-35-68, Office building.** Completed February 8, 1966.
- **TA-35-69 to -75, Office trailers.** Completed May 20, 1963 with the exception of TA-35-69, which was completed May 20, 1965. All have since been relocated.
- **TA-35-76, Septic tank.** Completed February 28, 1986. Abandoned in 1975. Designated as SWMU No. 35-009(b).
- **TA-35-77, Distribution box.** Completed February 28, 1986. Associated with septic tank TA-35-76. Part of SWMU No. 35-009(b).
- **TA-35-78, Storage tanks.** Completed October 4, 1966. Two vertical steel surge tanks for manifold gas. Identified as SWMU No. 35-003(i). Relocated to building TSL-27 on November 14, 1974.
- **TA-35-79, and -80, Office trailers.** Completed May 1965.
- **TA-35-81, Retaining wall.** Completed January 13, 1976.
- **TA-35-82, Electrical manhole.**
- **TA-35-83, Transformer station.** Completed in June 15, 1973, located 160 ft southwest of east end of building TSL-29.
- **TA-35-85, Chemical Laser Facility.** In place as of March 9, 1977. Three oil spill releases are associated with TA-35-85 (SWMU No. 35-014[e]). SWMU No. 35-008 is north of the center portion of TA-35-85. SWMU No. 35-005(a) and a satellite storage area, SWMU No. 35-004(b), are near the northeast corner of TA-35-85. SWMU No. 35-016(e and f) discharge from TA-35-85 into upper Mortandad Canyon.
- **TA-35-86, Carbon Dioxide Laser Building.** In place as of March 9, 1977. The building is roughly 150 ft by150 ft. SWMU No. 35-016(n) discharges into Ten Site Canyon. A satellite storage area, SWMU No. 35-004(m), is located at TA-35-86. Three stained-soil areas, SWMU No. 35 014 (g), are located near TA-35-86.
- **TA-35-87, Laboratory office building.** This structure was in place as of March 9, 1977. Satellite storage areas (SWMU No. 35-004 [n]) is located in rooms 175 and 158 of TA-35-87. SWMU No. 35-016(b) discharges into Ten Site Canyon from TA-35-87.
- **TA-35-88, Pump house.** Located approximately 1,000 ft south of TA-35-68 as of February 3, 1976.
- **TA-35-89 through 95.** Cancelled.
- **TA-35-96, and -97, Storage tanks.** Completed April 16, 1974. Removed after 1986. Identified as SWMU Nos. 35-003(j and k).
- **TA-55-98.** Cancelled.
- **TA-35-99, Transformer station.** Completed May 20, 1974.

TABLE 3-11 (continued)

DESCRIPTION OF STRUCTURES AT TA-35

- **TA-35-100 and -101, Electrical substations or transformer station .**
- **TA-35-103, Manhole.** Located approximately 5 ft from the northeast corner of TA-35-25.
- **TA-35-104 through -107.** Cancelled.
- **TA-35-108 and -109, Manhole.**
- **TA-35-110, Office building.**
- **TA-35-111 and -112.** Cancelled.
- **TA-35-113, Transformer station.** Completed October 29, 1974.
- **TA-35-114, Transportable office building.**
- **TA-35-115, Solvent storage shed.**
- **TA-35-116, Concrete pad.**
- **TA-35-117, Manifold.**
- **TA-35-118, Manhole, electrical.**
- **TA-35-119, Manhole, electrical.**
- **TA-35-120, Manhole, electrical.**
- **TA-35-121, Manhole, electrical.**
- **TA-35-122, Manhole, electrical.**
- **TA-35-123, Manhole, electrical.**
- **TA-35-124, Antares Target Building.**
- **TA-35-125, Antares Carbon Dioxide Laser Building.** Proposed October 6, 1975. SWMU No. 35-005(b), surface impoundment was located southwest of TA-35-125. Two satellite accumulation areas, SWMU Nos. TA 35-004(c and d), are located at TA-35-125. A waste oil treatment system, SWMU No. 35-007, is on the south side of TA-35-125.
- **TA-35-126, Truck access tunnel.** Built in 1975 to connect laser and target buildings.
- **TA-35-127, Office building.**
- **TA-35-128, Warehouse.** SWMU TA-35-004(j), is located on the southwest side.
- **TA-35-129, Water storage tank.** Completed September 21, 1976. A 200,000-gal. tank located 15 ft southeast of building TA-35-88.
- **TA-35-130, Retaining wall.** Proposed November 17, 1975. Located west of building TA-35-86.
- **TA-35-131 through -143, Manholes.**

TABLE 3-11 (continued)

DESCRIPTION OF STRUCTURES AT TA-35

- **TA-35-144, -145, and -146, Sewage lagoons.** Completed December 4, 1975. Located in Mortandad Canyon. Designated as SWMU No. 35-010. Handles sanitary wastes for TAs-35, -48, -50, and -64.
- **TA-35-147, and -148, Manholes.**
- **TA-35-149 through -153, Siege tanks.** Completed December 4, 1975. Part of tank farm designated as SWMU No. 35-015(a). Removed after 1986.
- **TA-35-154, Oil-heating tanks.** Completed December 4, 1975. Located approximately 80 ft west of TA-35-86. Associated with SWMU No. 35-015(a).
- **TA-35-155 through -157, Refrigerator coolant pads.** Completed December 4, 1975.
- **TA-35-158, Acid sewer storage tank.** Completed March 26, 1976. 1,000-gal. tank buried approximately 8 ft from the west side of TA-35-85. Designated as SWMU No. 35-012(a). Received solvent, oil, and chemical spills in TA-35-85.
- **TA-35-159, Oil reservoir.** Completed March 26, 1976. 5,000-gal.-capacity tank buried approximately 14 ft from the west wall of TA-35-85. Designated as SWMU No. 35-011(b). The 1990 SWMU report states that the capacity of the tank is 10,000 gal., but the same report states that DOE specifies the capacity of TA-35-159 to be 4,000 gal. (LANL 1990, 0145).
- **TA-35-160 through -165, Manholes, electrical and sewer.**
- **TA-35-166 through -169.** Cancelled.
- **A-35-170, Liquid nitrogen tank.** Completed September 20, 1976
- **TA-35-171, Insulating-oil storage tank.** Completed September 20, 1976. Located south and adjacent to the middle of TA-35-125.
- **TA-35-172, Manhole.**
- **TA-35-173 through -178.** Cancelled.
- **TA-35-179 through -183, Manholes.**
- **TA-35-184, Neutron time of field measurement line.** Completed September 20, 1976. Approximately 280 ft long running perpendicular to TA-35-125.
- **TA-35-185, Weather-shielding shed.**
- **TA-35-186, Transportable office building.**
- **TA-35-187, Transformer substation.**

TABLE 3-11 (continued)

DESCRIPTION OF STRUCTURES AT TA-35

- **TA-35-188, High-Voltage Development Laboratory.** Completed December 28, 1976. Located west of building TA-35-85. SWMU Nos. 35-014(f and n) and SWMU No. 35-011(d) are located on east side of TA-35 188.
- **TA-35-189, Optic Evaluation Laboratory.** Completed January 7, 1977.
- **TA-35-190 through -192, Manholes.**
- **TA-35-193 through -196, Trailer station.**
- **TA-35-197, Underground oil storage tank.** Designated as SWMU No. 35-011(c). Associated with SWMU No. 35-007, a waste oil treatment system. According to the 1990 SWMU report, the total capacity of this tank is 1,000 gal., but the same report states that the DOE describes the tank as having a 24,000-gal. capacity (LANL 1990, 0145).
- **TA-35-198, Trailer station.**
- **TA-35-199 through -203, Manholes.**
- **TA-35-204, Switchgear station.** Completed near September 5, 1979.
- **TA-35-205, Substation.** Completed near June 5, 1981. Fed from switchgear station TA-35-204.
- **TA-35-206, Manhole.**
- **TA-35-207, Experimental Support Laboratory.** SWMU No. 35-004 (f) was located inside Room 102.
- **TA-35-208 through -211, Transformer stations.**
- **TA-35-212, Storage shed.** Dimensions 6 ft by 8 ft
- **TA-35-213, Target Fabrication Facility.** Completed circa November 1979. Associated with SWMU Nos. 35-016(g and h), outfalls.
- **TA-35-215, Sand filter.** Completed circa April 1980. Located in Mortandad Canyon. Part of sanitary waste treatment lagoons, SWMU No. 35 010(d).
- **TA-35-216 and -217, Manholes.**
- **TA-35-218, Guard station.** Completed circa February 1981. Located southwest of TA-35-213.
- **TA-35-219, Manhole.**
- **TA-35-220, Gas-metering station.** Completed circa November 1981.
- **TA-35-223 through -252, Office trailers.**
- **TA-35-253 through -256, Transportable office buildings.**
- **TA-35-257, Guard station.**

TABLE 3-11 (continued)

DESCRIPTION OF STRUCTURES AT TA-35

• TA-35-258, Trailer.	
• TA-35-259, Trailer.	
• TA-35-260, Gold cart shed.	
• TA-35-261, Office trailer.	
• TA-35-262, Office trailer.	
• TA-35-263, Office trailer.	
• TA-35-264, Office trailer.	
• TA-35-265, Trailer pedestal.	
• TA-35-266. Cancelled.	
• TA-35-268, Portable office building.	
• TA-35-269, Portable office building.	
• TA-35-270, Portable office building.	
• TA-35-274, Transportable office.	
• TA-35-278 and -279, Storage tanks. 012(b).	Designated as SWMU No. 35
• TA-35-284, Electrical transformer.	
• TA-35-285, Retaining wall.	
• TA-35-286, Laser gas tank.	
• TA-35-287, Manhole.	
• TA-35-288, Manhole.	
• TA-35-289, Manhole.	
• TA-35-290, Manhole.	
• TA-35-291, Air-compressor building.	
• TA-35-292, Oil storage tank.	
• TA-35-295, Storage trailers.	
• TA-35-296, Storage trailers.	
• TA-35-297, Storage trailers.	
• TA-35-298, Storage trailers.	
• TA-35-299, Storage trailers.	
• TA-35-300, Storage trailers.	
• TA-35-303, Ocean cargo containers.	
• TA-35-304, Ocean cargo containers.	

TABLE 3-11 (concluded)

DESCRIPTION OF STRUCTURES AT TA-35

- **TA-35-308, Electrical transformers.**
- **TA-35-309, Storage containers.**
- **TA-35-310, Storage containers.**
- **TA-35-311, Storage shed.**
- **TA-35-312, Laser trailer.**
- **TA-35-313, Storage building.**
- **TA-35-314, Storage shed.**
- **TA-35-315, Concrete pad.**
- **TA-35-316, Electrical transformer.**
- **TA-35-317, Trailer.**
- **TA-35-318, Electrical manhole.**
- **TA-35-319, Electrical manhole.**
- **TA-35-320, Switching station.**
- **TA-35-321, Switching station.**
- **TA-35-322, Switching station.**
- **TA-35-323, Switching station.**
- **TA-35-324, Manhole.**
- **TA-35-325, Storage building.**
- **TA-35-326, Transportainer.**
- **TA-35-327, Transportainer.**
- **TA-35-330, Transportainer.**
- **TA-35-331, Transportainer.**
- **TA-35-332, Transportainer.**
- **TA-35-333, Transportainer.**

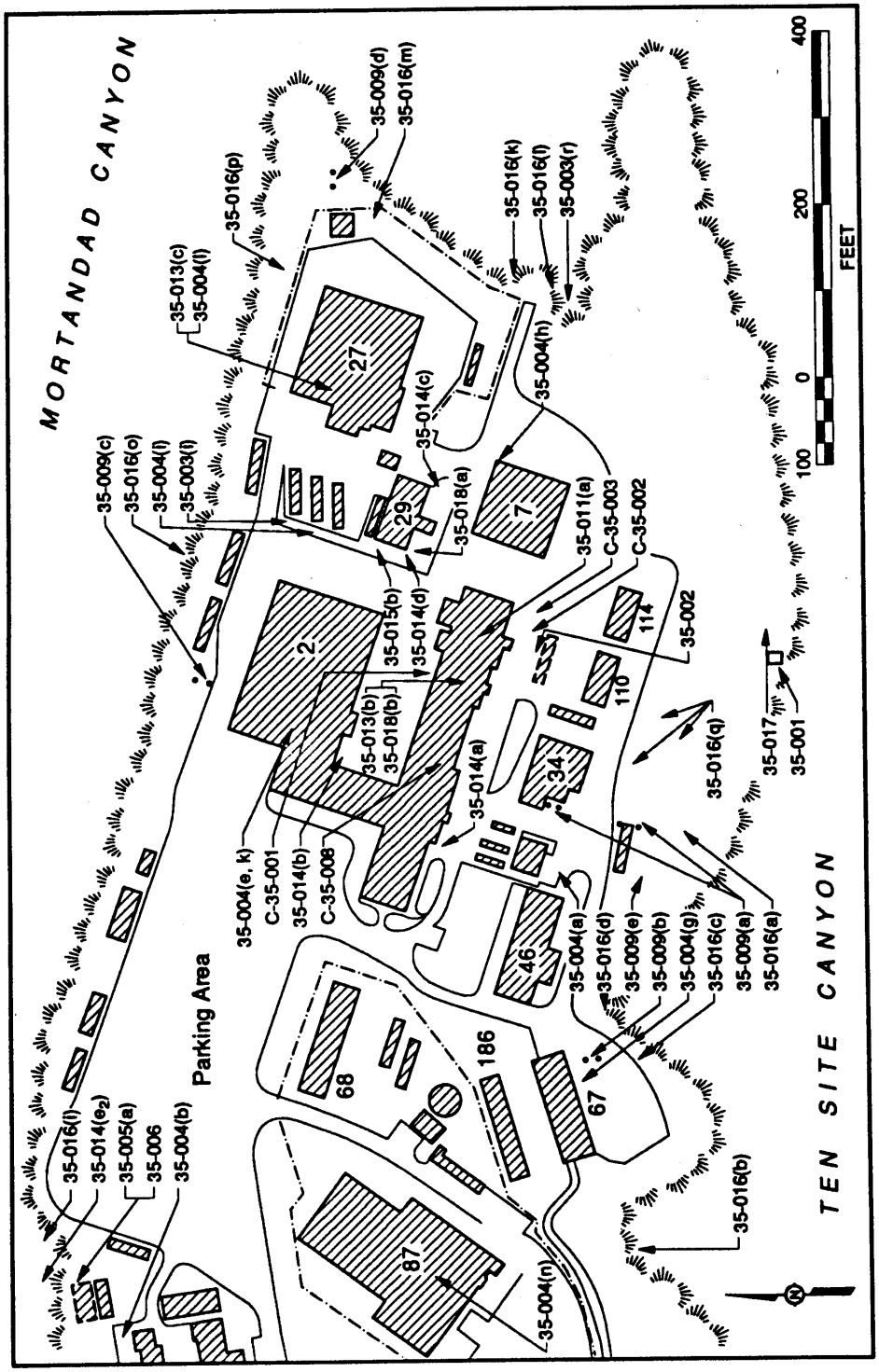


Figure 3-3. Locations of structures and SWMUs at TA-35 (LANL 1986, 04-0249).

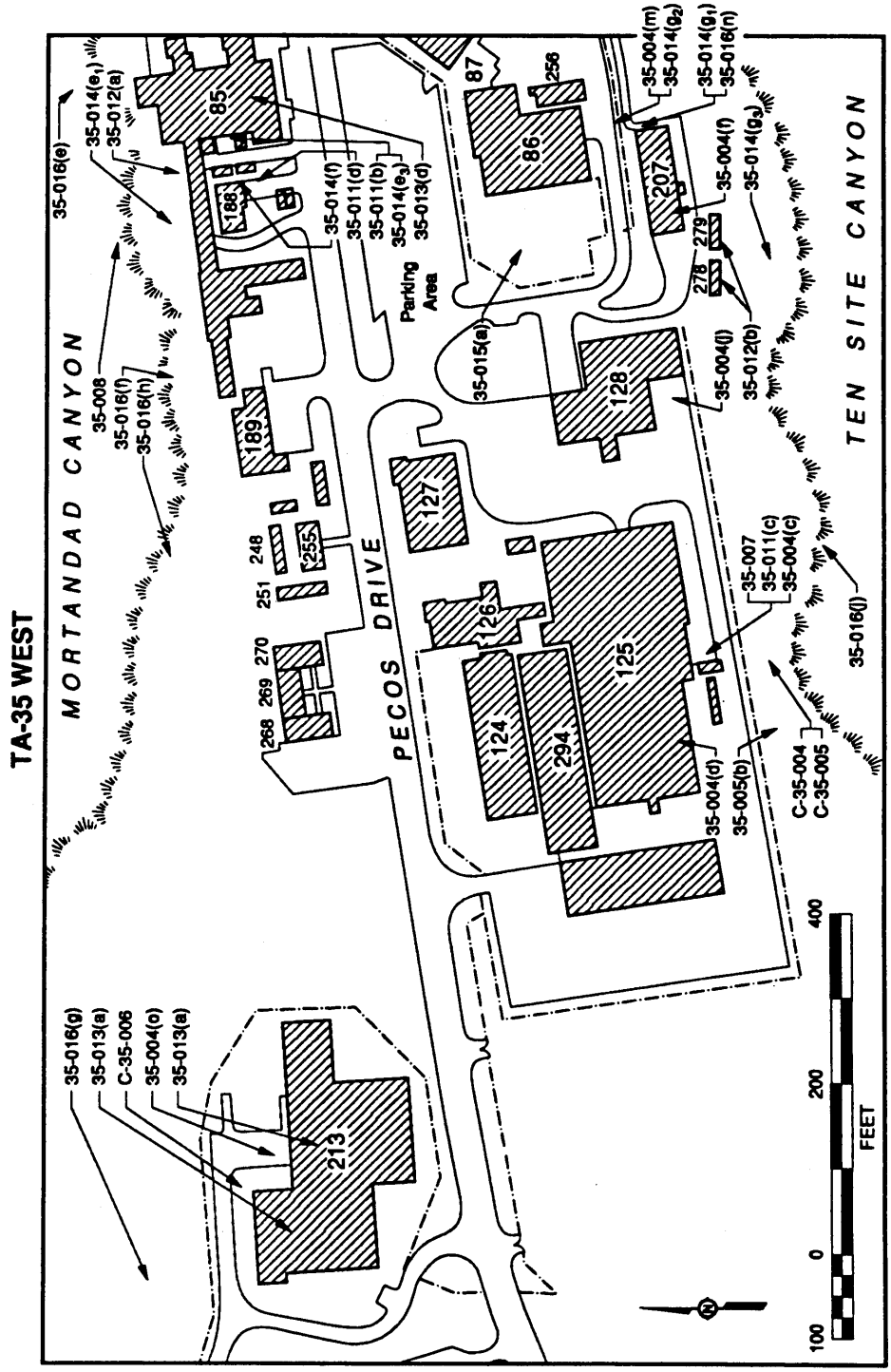


Figure 3-4. Locations of structures and SWMUs at TA-35 (LANL 1986, 04-0249).

which uses helium and nitrogen lasers (DOE 1987, 0264; LASL no date, 0402). Several SWMUs related to the use of dielectric oils occur around TA-35-29 (Figure 3-3).

TA-35-34, called the Sodium Testing Building, was completed in 1958. This building is used as a high- voltage switching laboratory (DOE 1987, 0264; LASL no date, 0402). Several SWMUs are located on the south side of this building (Figure 3-3).

TA-35-85, the Chemical Laser Facility, was completed in 1977 and is used for research and development of krypton fluoride (KrF) lasers. Several SWMUs related to the use of dielectric oils are located near TA-35-85, particularly on the north and east sides of the building (Figures 3-3 and 3-4).

TA-35-86 was built to house the "Helios" carbon dioxide (CO_2) laser facility. Part of this building is now used for the "Z-Pinch" machine, which is used to focus electron beams on targets. Associated with each of these buildings is a large number of outdoor siege tanks that are used for storage and handling of dielectric oil for Marx generators and capacitors (DOE 1987, 0264). Several SWMUs are associated with oil handling facilities on the west side of this building (Figure 3-4).

Buildings TA-35-124, -125, and -126 housed the "Antares" CO_2 laser experiment, which was completed in the mid-1980s. The Antares experiment used large CO_2 lasers and tritium/deuterium microsphere targets. Targets were fabricated in the Antares Target Building (TA-35-124), and the lasers were housed in the Laser Building (TA-35-125). TA-35-126 is a truck access tunnel between TA-35-124 and -125 (DOE 1987, 0264; LASL no date, 0402). Several SWMUs are located on the south side of TA-36-126 (Figure 3-4).

TA-35-188, the High-Voltage Development Laboratory, was completed in 1976. Assembly of components for the KrF laser facility, TA-35-85, is performed in this building (DOE 1987, 0264; LASL no date, 0402). Two SWMUs are located on the east side of this laboratory (Figure 3-4).

TA-35-213 is the Target Fabrication Facility, which is used for housing the processing of deuterium and tritium microsphere targets for various laser operations at TA-35. The building also contains a beryllium processing facility used to manufacture various structural shapes from beryllium (DOE 1987, 0264). The building was completed in late 1979 (LASL no date, 0402). Several SWMUs are located either inside or on the north side of this facility (Figure 3-4).

Several other small laboratories and offices are also located throughout TA-35. Table 3-11 provides a list of TA-35 structures.

3.3.1.3 Ownership Profile and Land Uses

DOE owns TA-35 and Laboratory personnel currently use TA-35 for experimental laboratory operations and offices.

3.3.2 Historical Overview

The first laboratories and offices at Ten Site were completed in 1951. Initial operations involved the preparation of kilocurie sources of radioactive lanthanum-^{140}La. This was performed in a hot cell located in the basement at the east end of

TA-35-2. Waste liquids generated by washings of this hot cell were stored in four 50,000-gal. concrete tanks (TA-35-10) to allow decay of the short-lived ^{140}La. The discovery that other radionuclides with longer half-lives, especially ^{90}Sr, were being concentrated in these stored wastes necessitated construction of a wastewater treatment plant with ion-exchange and air-filtration capacities. The wastewater treatment plant was constantly beset with problems and required numerous retrofittings and additions of equipment. A discussion of this treatment plant (SWMU No. 35-003) is provided in Section 3.3.2.1, Waste Management Activities. A discussion of spills and releases associated with this facility is discussed in Section 3.3.2.3, Past Waste Spills, Releases, and Incidents.

Experimentation with several radionuclides, especially plutonium and tritium, was conducted at TA-35 in the 1950s and 1960s. Three experimental nuclear fission reactors were developed and operated for short periods between 1956 and 1964. These reactors included LAPRE-I, which operated in 1956; LAPRE-II, which operated in 1959; and LAMPRE, which operated from 1960 to 1964. LAPRE-I and LAMPRE were operated in the basement of TA-35-2, and LAPRE-II was operated in a below-grade pit near the southeast corner of TA-35-2. A tritium facility operated in the basement of TA-35-2 from 1954 until 1974 (Harper and Garde 1981, 0458).

By the 1970s, most of the work with radioactive materials was phased out (DOE 1987, 0264), and attention was focused on laser operations. Experimentation and development of laser technology continues to the present. Research on optics, robotics, and nuclear safeguards are also ongoing at TA-35.

3.3.2.1 Waste Management Activities

The wide variety of research and development work that has been conducted at TA-35 over the past 40 years has resulted in the production and release of a variety of hazardous wastes and radionuclides. A list of known and suspected wastes managed at TA-35 is provided in Section 3.3.2.2, Summary of Potential Waste Materials. Ninety-four SWMUs were designated at TA-35 in the 1990 SWMU report (LANL 1990, 0145). These SWMUs are listed in Table 3-12, and discussed in the following text.
In addition to the sites designated as SWMUs, eight AOCs were listed in the 1990 SWMU report (LANL 1990, 0145). These AOCs are designated as C-35-001 through C-35-008 and are discussed in Table 3-19.

SWMU No. 35-001, Material Disposal Area W: MDA-W, SWMU No. 35-001, is located along the edge of Ten Site Canyon due south of the southeast corner of TA-35-2 (Figure 3-3). The site consists of two 4-in.-diameter by 125-ft-long buried stainless-steel storage "tanks," each containing approximately 150 liters (500 to 650 lb) of liquid sodium coolant from the decommissioned LAMPRE reactor (Warren 1974, 04-0197; LANL circa 1981, 04-0209). When LAMPRE was shut down in 1964, the sodium coolant was drained into the tanks so that each tank was about half-filled, the remaining space was backfilled with nitrogen gas under positive pressure, and the tanks were sealed (Harper 1979, 04-0097). Before filling and after installation, the tanks were helium tested for leaks (LASL 1977, 0649). After being sealed, the stainless-steel sodium tanks were suspended vertically inside two separate 120-ft-deep carbon steel-lined well casings drilled approximately 3 ft apart. The bottoms of the wells are not sealed, and the tops of the tanks extend a few feet above grade (LASL 1977, 0649). Radiation levels measured at the tops of the tanks immediately after their emplacement were about 10 mR/hr (Warren 1974, 04-0197). The sodium in the tanks is slightly contaminated with ^{239}Pu and associated fission products

(^{137}Cs, ^{22}Na, ^{60}Co, and ^{59}Ni). The ^{239}Pu content is very low, less than 0.1 parts per million (ppm) (LASL 1977, 0649).

In 1980, the original metal shed that covered the exposed portion of the tanks was removed, and the site was entombed in concrete. This decommissioning effort was funded under the Surplus Los Alamos Scientific Laboratory (LASL) Facility Disposition Project (LANL circa 1981, 04-0209). The concrete structure that covers the tanks was intended to be a permanent closure, and is designated as TA-35-43. Releases of hazardous constituents from the tanks have not been documented.

TABLE 3-12

TA-35 SWMUs

SWMU No.	Description
35-001	Material Disposal Area W
35-002*	Material Disposal Area X
35-003(a-q)*	Wastewater Treatment Plant
35-003(miscellaneous)	Industrial Waste Lines
35-003(r)	Receiving Canyon
35-004(a-o)*	Active/Inactive Container Storage Areas
35-005(a-b)	Inactive Surface Impoundments
35-006*	Decommissioned Surface Impoundment
35-007	Waste Oil Treatment System
35-008*	Canyonside Disposal Area
35-009(a-e)*	Septic Systems
35-010(a-e)*	Sanitary Lagoons And Sand Filters
35-011(a-d)	Underground Storage Tanks
35-012(a-b)	Inactive Storage Tanks
35-013(a-d)	Sumps and Drains
35-014(a-g)*	Operational Releases
35-015(a-b)*	Decommissioned Waste Oil Treatment
35-016(a-q)	Drains And Outfalls
35-017	Soil Contamination From Reactor Operations
35-018(a-b)	Leaking PCB Transformers

*The SWMUs listed in Tables A and B of the HSWA Module VIII were the following (EPA 1990, 0306): Nos. 35-002, 35-003(a-q), 35-004(e), 35-006, 35-008, 35-009(a-d), 35-010(a-d), 35-014(a-b), and 35-015(b)

SWMU No. 35-002, Material Disposal Area X: MDA-X, SWMU No. 35-002, lies under 0.05 acres of parking lot near the southeast corner of building TA-35-2 (DOE 1987, 0264) (Figure 3-3). It is the burial site for the LAPR- II reactor, which was defueled and decommissioned in 1959 (Harper 1979, 04-0097). Portions of the reactor that were buried in place included the reactor pressure vessel, the fuel reservoir, the connecting pipe, and possibly other components (Warren 1974, 04-0197; Montoya personal communication in Roberson 1991, 04-0227). The 2-ft-diameter reactor pressure or "core" vessel is located inside an 8-ft-diameter, heavy-walled, stainless-steel vessel. The fuel reservoir is a copper-lined stainless-steel tank approximately 1 ft in diameter by 10 ft long. The reservoir and pipe are contaminated with residual $^{235}UO_2$/phosphoric acid fuel solution and associated fission products. When buried, the space between the core and the outer vessel was filled with sand. Although the $^{235}UO_2$ fuel solution was drained from the reactor and fuel reservoir in 1959, as much as 30 g (0.1 Ci) of the liquid fuel solution and neutron-activation and fission products were believed to remain within the system (Warren 1974, 04-0197; Graf and Howard 1978, 04-0090). After removal of the fuel solution, the outer vessel was capped and both the vessel and fuel reservoir were buried in place, about 8 ft below grade. The area was later covered with soil and asphalt. Also remaining inside the reactor is approximately 50 kg of radioactively contaminated gold, which was used as a corrosion-resistant lining of internal parts.

LAPRE-II and associated structures were removed from MDA-X in the summer of 1991, under the Laboratory Work Order No. 6575723 (Gonzales 1991, 04-0089). Details of the removal are discussed in Section 3.3.2.4, Environmental Surveys and D&D Activities. Soil sampling carried out as part of the 1990 site characterization (Phase I of the D&D effort) revealed minimal soil contamination at a depth of 15 ft on the east side of the reactor. One sample collected from the sand backfill material 2 ft from the reactor contained ^{152}Eu as the primary contaminant at 217 pCi/g (Montoya 1990, 04-0161). ^{137}Cs was also discovered in the soil in concentrations up to 8 pCi/g (Montoya personal communication in Roberson 1991, 04-0227). Five other holes drilled for samples yielded no radioactive contamination. Additional soil samples will be taken and analyzed after removal of the vessel is complete to verify cleanup to background or as low as reasonably achievable (ALARA) levels (Fresquez 1991, 04-0080).

SWMU Nos. 35-003(a-q), Wastewater Treatment Plant: A wastewater treatment plant located at the east end of Ten Site Mesa (Figure 3-5) operated from 1951 until 1963. It consisted of waste lines, storage tanks, an Air Filter Building, ion-exchange columns, and chemical-treatment and precipitation tanks. The facility, formerly referred to as "Area W" (not equivalent to MDA-W), covered an area of 1.7 acres. Plant operations began in 1951 as a simple system of holding tanks, but by 1963 the plant had grown into a complex operating facility, consisting of the structures listed in Table 3-13 (SWMU Nos. 35-003[a-q]), plus an array of underground pipelines (SWMU No. 35-003[miscellaneous]) and overhead air-filtration ducts. The locations of these structures are shown in Figure 3-5.

Waste treated at this plant originated from the radiochemistry laboratories and operations of the radioactive lanthanum-140 hot cells in TA-35-2, at which kilocurie sources of ^{140}La were prepared. The radioactivity in the waste was due to ^{140}Ba, ^{140}La, ^{89}Sr, ^{90}Sr, and ^{90}Y isotopes, as well as traces of other radionuclides such as ^{137}Cs and ^{106}Ru (Emelity 1958, 04-0060). Liquid waste from the laboratories was routed into a phase separator pit (SWMU No. 35-004[n]), and was stored in three 600-gal. reinforced-concrete underground storage tanks (TA-35-4, -5, -6; SWMU Nos. 35-003[a, b, c], respectively). The liquid was caustic-treated for acidity in these tanks and then routed to four 50,000-gal. concrete storage tanks (TA-35-10, SWMU

No. 35-003[d]), which were designed to provide an estimated six-month holding time to allow for decay of ^{140}La and ^{140}Ba.

Radioactively contaminated air from the hot cells in TA-35-2 was sent to the Air Filter Building (TA-35-7, SWMU No. 35-003[p]). There, the contaminated air passed through a series of air-cleaning filters, which were washed by tap water and/or long-decayed waste from the tank farms. This method, which relied on high-evaporation loss in the filters, was expected to balance the incoming waste volumes. In practice, the system worked as designed, with ^{140}La and ^{140}Ba decaying out. Other radionuclides, however, became concentrated during storage and evaporation. ^{90}Sr and ^{89}Sr became major constituents in the longest-stored wastes, accounting for over 50% of the remaining activity. Buildup of radiostrontium in the "closed system" became a problem in the air-cleaning equipment and required numerous hot cell washings, which in turn produced greater volumes of radioactively contaminated wastewater. The large volumes of wastewater overwhelmed the storage capacity of the system, and led to spills, overflows, and unplanned releases of waste into the canyon (SWMU NO. 35-003[r]) (Emelity 1958, 04-0060).

Concentrations of ^{90}Sr up to 1,000 times discharge tolerance sometimes prevented discharge of the wastewater and required the addition of equipment for strontium removal. In 1955, a single-column cation exchanger designed for removal of ^{90}Sr in the acid cycle was added to the system in TA-35-7. The success of this column justified the building of a pilot-plant scale unit for removal of ^{90}Sr from the waste. The pilot plant was built in a corner of TA-35-7 and consisted of a flow-rate regulator and a resin column 16 in. in diameter by 8 ft high with 5 ft^3 of cation-exchange resin. The plant also required the addition of a regeneration acid tank with air-pressure controls; a 150-gal. hopper-bottomed, spent-regenerant tank with a flash mixer, and drains for supernatant and sludge removal (TA-35-38, SWMU No. 35-003[g]); and a 1,000-gal. concrete sludge tank (TA-35-22, SWMU No. 35-003[m]). The system could treat waste from any one of the four tanks in TA-35-10 (SWMU No. 35-003[d]). Because of erratic results and gamma radiation buildup at the exchange columns and equipment, the plant was redesigned for an additional resin column, automatic pH control, electronic-operating controls, and lead shielding for operator protection (Emelity 1958, 04-0060).

In 1958, a second ion-exchange column was added at TA-35-7. The new ion-exchange unit consisted of two columns containing a total of 10 ft^3 of Dowex 50 resin and necessary pumping, control, and regenerating equipment for acid regeneration, pH control, and regenerant treatment. The waste was retained in storage as long as practicable to reduce radioactivity to the lowest possible level by decay. It was then pumped to the ion-exchange columns, which were operated in series, and the effluent was discharged or recirculated depending on its level of radioactivity. The radioactive material retained in the columns was removed at the end of each run by regeneration with 100 gal. of 30% nitric acid after a backwash with tap water. The spent-acid regenerant was drained to the regenerant tank (TA-35-38, SWMU No. 35-003[g]) with approximately 40 gal. of final rinse water. The spent regenerant was then neutralized with caustic, sodium carbonate, and strontium nitrate to excess, followed by iron sulfate as a flocculation aid. After complete mixing in a flocculator tank (TA-35-37, SWMU No. 35-003[f]), the radioactive material was then finally precipitated as 25 to 30 gal. of concentrated sludge that was drained to concrete sludge tank TA-35-22 (SWMU No.35-003[m]) southeast of TA-35-7 or mixed with cement in a 55-gal. drum. Drums were hauled directly to the hot dump at TA-54 (Emelity 1958, 04-0060; Emelity 1975, 04-0061).

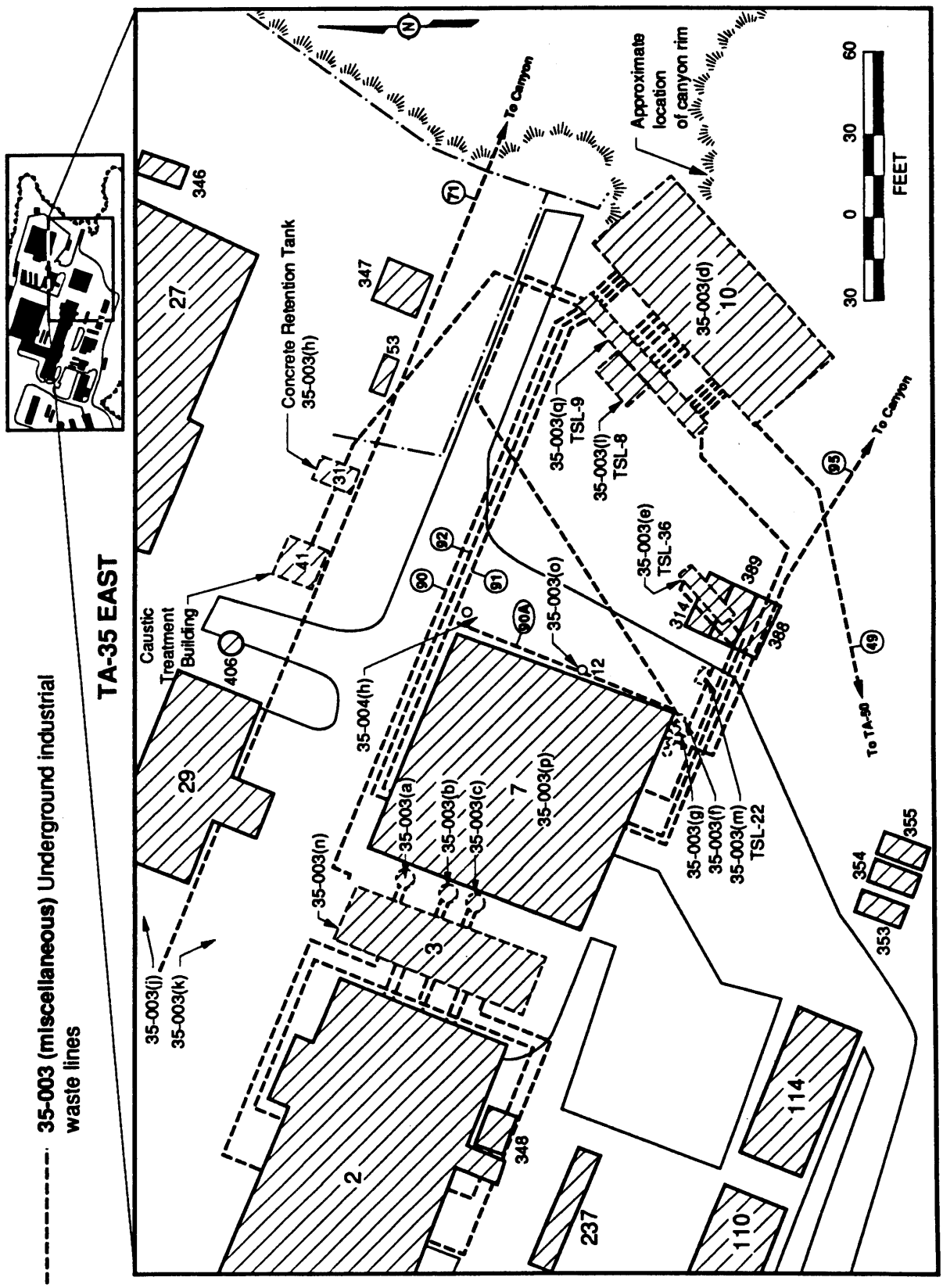


Figure 3-5. Locations of structures and SWMUs at TA-35 (LASL 1975, 04-0250).

TABLE 3-13

STRUCTURES AT TA-35 WASTEWATER TREATMENT PLANT

SWMU No.	Structure	Structure Type	Status
35-003(a)	TA-35-4	storage tank	inactive[a]
35-003(b)	TA-35-5	storage tank	inactive[a]
35-003(c)	TA-35-6	storage tank	inactive[a]
35-003(d)	TA-35-10	holding tank building	removed February 1985
35-003(e)	TA-35-36	storage tank	removed August 1981
35-003(f)	TA-35-37	flocculator tank	removed 1980
35-003(g)	TA-35-38	regenerant tank	removed 1980
35-003(h)	TA-35-31	retention tank	removed February 1985
35-003(i)[b]	TA-35-78	surge tanks	relocated November 1974
35-003(j)[b]	TA-35-96	storage tank	removed after 1986
35-003(k)[b]	TA-35-97	storage tank	removed after 1986
35-003(l)	TA-35-8	pump pit	removed December 1984
35-003(m)	TA-35-22	sludge tank	removed August 1981
35-003(n)	TA-35-3	phase separator pit	inactive[a]
35-003(o)	TA-35-12	manhole	removed January 1985
35-003(p)	TA-35-7	Air Filter Building	decommissioned and decontaminated 1980
35-003(q)	TA-35-9	pipe trench	removed December 1984
35-003 (miscellaneous)	Lines 68 through 112	underground lines	most lines removed in 1981 and 1984

a Removal is planned (Gonzales 1991, 04-0088), but the date of removal is not established.

b These tanks were incorrectly identified as part of the wastewater treatment plant in the 1988 and 1990 SWMU reports (International Technology Corporation 1988, 0329; LANL 1990, 0145).

In 1960, a new waste treatment plant with much greater cation-exchange capability was put into operation at TA-35. It provided chemical precipitation capability and cation-exchange treatment at a rate of 50 gal. per minute (gpm) through two 50 ft^3 resin cation-exchange columns in series. Among the equipment added to the treatment facility in 1960 was a 25,000-gal. tank, TA-35-36 (SWMU No. 35-003[e]), which was used for storage of liquid radioactive waste. The tank was connected to the Air Filter Building (TA-35-7) by two lines, each 3 in. in diameter, totaling 156 ft in length.

In 1963, a new wastewater treatment plant at TA-50 became operational, and from that time on wastes were no longer treated at TA-35; all wastes were pumped to TA-50 through Line 49 (refer to Figure 3-5) (Emelity 1975, 04-0061). Most of the Ten Site wastewater treatment plant was decommissioned and decontaminated in 1981 and 1985; this process is discussed in Section 3.3.2.4, Environmental Surveys and D&D Activities. The present status of structures at the plant is given in Table 3-13. Soil contamination associated with this facility was extensive, especially at SWMUs 35-003(d, m, n, and o). Radioactive soil contamination that remained after D&D activities is also discussed in Section 3.3.2.4, Environmental Surveys and D&D Activities. No data are available on the extent of contamination by hazardous chemicals.

It should be noted that SWMU Nos. 35-003(i, j, and k) appear to be totally unrelated to the wastewater treatment plant. SWMU No. 35-003(i) consists of two vertical steel surge tanks (TA-35-78) that were probably associated with the gas laser facility in TA-35-29. The tanks were used to accommodate pressure excursions (surges) and most likely managed only helium and nitrogen, which were the gases used in the gas laser facility. The tanks were installed in 1966, three years after shutdown of the wastewater treatment plant, and were relocated to TA-35-27 in 1974 (LASL no date, 0402).

SWMU Nos. 35-003(j and k) were two aboveground storage ("Baker") tanks formerly located on the west side of TA-35-29. The tanks were probably used for storage of dielectric oil in association with the oil handling facility (SWMU No. 35-015[b]) on the east side of TA-35-29. The tanks were installed in 1974, well after the wastewater treatment plant was shutdown (LASL no date, 0402). The tanks were still present in a 1986 aerial photograph, but were removed before 1990.

SWMU No. 35-003(miscellaneous), Industrial Waste Lines: SWMU No. 35-003(miscellaneous), as designated in the 1990 SWMU report, consists of the network of underground lines that connected the various structures that composed the Ten Site wastewater treatment plant (SWMU No. 35-003). The locations of these lines are shown in Figure 3-5. Most of these lines were removed during the 1981 to 1985 Radioactive Liquid Waste Lines Removal Project; however, some sections of line remain in place (Elder et al. 1986, 0456). These lines transported wastes contaminated with various radionuclides (e.g., ^{239}Pu, ^{140}La, ^{140}Ba, ^{137}Cs, ^{90}Sr, ^{89}Sr, and ^{90}Y) and possibly hazardous chemical contaminants from laboratories and hot cells in TA-35-2 to various portions of the treatment facility.

Releases of radioactive contamination to the environment from these lines have been documented (Cox 1985, 04-0047; Cox 1985, 04-0048; Cox 1985, 04-0049; Cox 1985, 04-0052). Most of these releases apparently occurred through leaks in the lines. Soils contaminated by these leaks typically occur at depths of 15 to 20 ft below grade in the trenches in which the lines were laid. Gross-beta contamination from $^{90}Sr/^{90}Y$ up to 3,243 pCi/g was found at depths of 17 to 20 ft in the trench from which Lines 90, 90B, 91, and 92 were removed (along the north side of TA-35-7)

(Figure 3-5) (Cox 1985, 04-0052). Up to 7,000 pCi/g gross-beta contamination was found near manhole TA-35-12 (SWMU No. 35-003[o]) along the east wall of TA-35-7, the location of Line 90A (Figure 3-5) (Cox 1985, 04-0049). Similar levels of contamination are suspected along the traces of other lines included in this SWMU. Downward and lateral extent of contaminant migration has not been addressed. More information on the removal of these lines and radioactivity levels encountered during removal is provided in Section 3.3.2.4, Environmental Surveys and D&D Activities.

In addition to the releases from leaking lines, two of the lines (71 and 95) had direct outfalls into the small canyon immediately east of the treatment facility (SWMU No. 35-003[r]). The outfall from Line 71 enters the canyon beside the road that runs eastward south of TA-35-27 (Figures 3-5). The outfall from Line 95 enters a daylight discharge channel southeast of TA-35-7 that runs into the canyon along the south side of the former location of the holding-tank building, TA-35-10 (Figures 3-5). Radioactive and chemical contamination is suspected at these outfalls, although this has not been documented.

SWMU No. 35-003(r), Receiving Canyon: A small shallow canyon located immediately east of the former location of the wastewater treatment plant (refer to Figure 3-3) was the site of effluent discharge and spills from the holding tanks, SWMU No. 35-003(d). This canyon is designated as SWMU No. 35-003(r) in the 1990 SWMU report (LANL 1990, 0145), and will be addressed in this OU 1129 Work Plan. This canyon is known to be contaminated with radioactivity, primarily from ^{90}Sr, but ^{137}Cs and ^{239}Pu are also present. Contamination by hazardous chemicals has not been characterized. Spills and releases from the wastewater treatment plant into this canyon are summarized in Section 3.3.2.3, Past Waste Spills, Releases, and Incidents (refer to Tables 3-20, 3-21, 3-22). Environmental surveys in the canyon are discussed in Section 3.3.2.4, Environmental Surveys and D&D Activities.

SWMU Nos. 35-004(a-o), Container Storage Areas: Areas used to store containers of potentially hazardous waste are located throughout TA-35. These areas are designated as SWMU Nos. 35-004(a-o). These satellite storage areas include designated rooms or areas both inside and outside of buildings. Table 3-14 lists the storage areas and describes the types of wastes believed to have been stored at these areas (LANL 1990, 0145). Locations of these storage areas are shown in Figure 3-4.

Spills and releases have been documented at several active and inactive container storage areas. Releases were apparent at container storage areas at TA-35-25 and -125 (SWMU Nos. 34-004[a, c, and d]) during the 1990 site inspection, but these areas were reportedly cleaned up. During an ER Program site reconnaissance in 1988, stained soils were noted at TA-35-25, -85, -125, -2, -67, -11, and -128 (SWMU Nos. 34-004[a, b, c, d, e, k, g, h, and j], respectively). SWMU No. 35-004(c) is located inside a bermed area that encloses the waste oil treatment system, SWMU No. 35-007. Stains on the asphalt inside the bermed area were noted in 1991. Leaking drums and capacitors in these same areas are mentioned in the CEARP (DOE 1987, 0264). The storage area near TA-35-67 (SWMU No. 34-004[g]) was investigated as part of "Environmental Problem 19" in the DOE Environmental Survey (DOE 1987, 04-0251). Three soil samples were collected and analyzed for alpha and gamma activities, metals, pesticides/PCBs, and volatiles. The samples had low-alpha and -gamma activities; some metals (unspecified) and acetone were the only chemical contaminants detected. Hazardous releases from other container storage areas have not been documented.

TABLE 3-14

CONTAINER STORAGE AREAS

SWMU No.	Location	Waste Stored	Status
35-004(a)	East and south sides of TA-35-25	Solvents, Stoddard solvent, oil	Active
35-004(b)	Outside at northeast corner of TA-35-85	Acetone, alcohols, solvents, oils, VOCs, rags	Active
35-004(c)	Outside on south side of TA-35-125 at Oil Treatment Facility (SWMU No. 35-007)	Dielectric oils	Active
35-004(d)	Room 104; Basement of TA-35-125	Laser dye, oils, solvents, acetone	Active
35-004(e)	Room C18; Basement of TA-35-2	Solvents, laser dye, VOCs, PCB oils, LiCl	Active
35-004(f)	Room 102; TA-35-207	Laser dye, solvents, oil, acetone, alcohol	Inactive
35-004(g)	Outside, south side of TA-35-67	Oils, solvents, Freon™, vacuum pumps	Active
35-004(h)	Outside, at northeast corner of TA-35-7	Oils, capacitors, solvents, Freon™	Inactive
35-004(i)	Outside, formerly located near the west end of TA-35-244	Oils, capacitors, solvents, Freon™	Inactive
35-004(j)	Loading dock on southwest side of TA-35-128	Oils, capacitors, solvents, Freon™	Active
35-004(k)	Fume hood in Room A135; TA-35-2	Solvents, laser dye, VOCs, PCB oils, LiCl	Active
35-004(l)	Room 105; TA-35-27	Stoddard solvent, solvents, rags	Inactive
35-004(m)	Along fence on south side of TA-35-86	Solvents, Freon™, oil, rags	Inactive
35-004(n)	Room 175, Room 158; TA-35-87	Photo-processing wastes, rags	Active
35-004(o)	North dock, outside; TA-35-213	Solvents, chemicals, Kimwipes®	Active

Source: LANL (1990, 0145).

SWMU Nos. 35-005(a-b), Inactive Surface Impoundments: Two gunite-lined surface impoundments at TA-35 were formerly used for storage of waste dielectric oil. One, SWMU No. 35-005(a), was located near Mortandad Canyon northeast of the Chemical Laser Facility, TA-35-85 (Figure 3-3), and the other, SWMU No. 35-005(b), was on the south side of the Antares Carbon Dioxide Laser Building, TA-35-125 (Figure 3-4). Both impoundments were closed in the summer of 1989 in accordance with Resource Conservation and Recovery Act (RCRA) interim status closure standards (Fresquez 1990, 04-0074).

The impoundment east of TA-35-85, SWMU No. 35-005(a), was constructed in 1985 to replace the impoundment that previously existed at this location, SWMU No. 35-006. The impoundment was built to collect the following: oil spills that might occur within the bermed area around the oil-handling facilities on the west side of TA-35-85; liquid wastes (i.e., solvents and oils) from drains that serviced the oil-handling equipment (i.e., Marx tanks and switch sections) of the KrF laser in TA-35-85; and precipitation run-off. When the impoundment was in use, it was periodically pumped and the oil was recycled. Stained soil and rock along the rim of Mortandad Canyon indicates that this impoundment had overflowed in the past (LANL 1990, 0145).

The second impoundment, SWMU No. 35-005(b), was located near Ten Site Canyon south of Building TA-35-125 (Figure 3-3). It received waste oil and solvents from electrical equipment inside buildings TA-35-124, -125, and -126, as well as storm water run-off (DOE 1987, 0264). When it was in operation, it was also periodically pumped and the oil recycled. A stained area approximately 6 ft wide that extends to the floor of Ten Site Canyon indicates past overflows from the pond. SWMU No. 35-005(b) was investigated as "Environmental Problem 16" in the DOE Environmental Survey (DOE 1987, 04-0252). Three sludge samples were collected from within the impoundment. Gamma activity screens of the sludge indicated only natural activities. Some volatile organic compounds (VOCs) and metals were detected; lead concentrations were below extraction procedure (EP) toxic levels (DOE 1987, 04-0252; LANL 1990, 0145).

Both impoundments were drained in August 1988, and samples of liquid and sludge from both impoundments were collected. Liquids samples were analyzed for VOCs, PCBs, EP-toxicity metals, and radionuclide activity. Sludge samples from SWMU No. 35-005(a) were analyzed for VOCs and EP-toxicity metals; samples from SWMU No. 35-005(b) were analyzed only for VOCs. Analysis of the liquid sample at SWMU No. 35-005(a) detected some VOCs and above-background alpha activity; however, no PCBs were detected and metals were below EP-toxicity levels. The sludge sample from this pond contained detectable VOCs, and lead was the only metal detected in concentrations that exceeded the EP-toxicity levels. The liquid sample from SWMU No. 35-005(b) contained detectable VOCs, but radioactivity was measured at background and metals were below the EP-toxicity levels. The sludge sample from this pond contained several detectable VOCs (LANL 1990, 0145). No information is available on which VOCs were detected or what the concentration levels were for any of the contaminants encountered.

When these impoundments were decommissioned in 1989, soil samples immediately beneath the gunite liners indicated the presence of RCRA VOCs. Consequently, soils beneath the impoundments were removed. Approximately 1 to 2 ft of soil was excavated from the location of the pond near TA-35-85 (SWMU No. 35-005[a]), and between 10 and 15 ft of soil was removed from beneath SWMU No. 35-005(b) (Fresquez 1990, 04-0074). At these depths, confirmation samples showed that soils still contained petroleum hydrocarbons, but VOCs were detected at concentrations too low to pose a health concern (Fresquez 1990, 04-0074).

In 1990, soil samples were taken again at these sites to verify cleanup. Samples were collected near the surface, and at 5-ft increments from core holes that penetrated to depths of 45 ft (SWMU No. 35-005[a]) and 55 ft (SWMU No. 35-005[b]). At SWMU 35-005(a), all samples were measured at background for gross-alpha, -beta, and -gamma activity, and below detection limits for VOCs and semivolatile organic compounds (SVOCs). All subsurface samples tested negative for total petroleum hydrocarbons, but the two surface soil samples measured 314 ± 62 ppm and 97 ± 19 ppm total hydrocarbons (Fresquez 1991, 04-0081).

At SWMU No. 35-005(b), all samples were measured at background for beta and gamma activity. Gross-alpha activity ranged from background to 60 pCi/g and was observed throughout the soil profile, although the highest readings were near the surface. Samples from the 20 ft depth in one core contained over 20 target VOCs (not specified in the report). Three VOCs were present in concentrations greater than 1 ppm (trichlorotrifluoroethane at 8 ppm; tetrachloroethane at 1.5 ppm; and 1,1,1 trichloroethane at 13.4 ppm). Acetone was detected at 86 parts per billion (ppb) in a sample collected at a depth of 25 ft. Total petroleum hydrocarbons were present in almost all samples at concentrations ranging from 4.9 to 339 ppm. In the other core, most samples collected from greater than 15 ft depth contained trichlorotrifluoroethane in concentrations less than 30 ppb. Acetone was detected (24 ppb) at 30 ft, and 1,1,1-trichloroethane (10 ppb) at 15 ft depth. Total petroleum hydrocarbons were present in most samples at concentrations ranging from 3.18 and 9.44 ppm. No SVOCs were detected in samples from either core (Fresquez 1991, 04-0076).

Whether the stained overflow areas that extended from the ponds to the canyons were remediated during the 1989 Interim Action Closure of the impoundments is unknown. The stained areas around both impoundments were sampled for PCBs in 1985, and yielded no samples with concentrations greater than the detection limit of 1 ppm (LANL 1990, 0145). The overflow area south of TA-35-125 was investigated as "Environmental Problem 21" in a DOE Environmental Survey (DOE 1987, 04-0253). Three samples collected at 50-ft intervals down the slope below the impoundment indicated low levels of alpha and gamma emitters, PCBs, and VOCs (DOE1987, 04-0253; LANL 1990, 0145).

SWMU No. 35-006, Decommissioned Surface Impoundment: A decommissioned surface impoundment, SWMU No. 35-006, was situated northeast of Building TA-35-85 (Figure 3-3). It was replaced in 1985 with a gunite-lined impoundment, SWMU No. 35-005(a). The original impoundment was used for disposal of waste oil from the KrF laser building, TA-35-85. Other wastes such as solvents may also have been discharged to the impoundment. The CEARP survey reported that oil from spills at the impoundment had run to the bottom of Mortandad Canyon, at which point it intercepted the effluent stream from TA-50. Soil samples collected from this spill area in 1985 did not detect PCB contamination (DOE 1987, 0264). New Mexico groundwater discharge regulations were violated when the impoundment overflowed into Mortandad Canyon (Martz 1986, 04-0152). This impoundment was closed concurrently with the impoundment that replaced it, under the same RCRA closure action described for SWMU Nos. 35-005(a and b).

SWMU No. 35-007, Waste Oil Treatment System: TA-35 has an active waste oil treatment system, SWMU No. 35-007, located on the south side of TA-35-125 (Figure 3-4). The system recycles and reprocesses dielectric oils from laser operations in TA-35-125 by removing water and other contaminants. The oil is then reused in the Marx generators. The system includes an oil-recovery unit enclosed in a trailer, a vacuum system, molecular sieves that are used for water and carbon

removal, and a 28,000-gal. underground storage tank, TA-35-197 (SWMU No. 35-011[c]), located immediately beneath the oil-recovery unit (Umphres personal communication in Roberson 1991, 04-0226). (Note: The SWMU report (LANL 1990, 0145) lists the capacity of this tank as 1,000 gal., and according to the DOE description of the underground storage tanks, the capacity of tank TA-35-197 is 24,000 gal.). The treatment facility is enclosed in a 1-ft-high concrete berm designed to contain spills. According to the SWMU report, this curbed-spill retention area formerly discharged to the waste oil pond south of TA-35-125 (SWMU No. 35-005[b]), but the unit is now equipped with underground storage tanks (USTs) and sumps that contain spills of oil, and pumps that return the oil to the treatment unit (Umphres personal communication in Roberson 1991, 04-0226). The treatment unit does not discharge to the environment, and no hazardous releases from this unit are known (LANL 1990, 0145). However, oil spills have occurred in this vicinity, from Marx tanks inside TA-35-125 (see the discussion on AOC Nos. 35-C-004 and 35-C-005). A container storage area (SWMU No. 35-004[c]), in which drums of transformer oils are stored, is also located within this bermed area.

SWMU No. 35-008, Canyonside Disposal Area: A canyonside disposal site, SWMU No. 35-008, is located along the Mortandad Canyon rim north of the center portion of Building TA-35-85 (Figure 3-4). The debris, which includes scrap metal and pipe, paint cans, a 55-gal. drum, and miscellaneous building materials, extends from the canyon rim to the canyon floor. Nonhazardous debris includes concrete, conduits, asphalt, pipe, reinforcing rod, and soil. Releases of hazardous materials from this surface disposal area are not documented (LANL 1990, 0145). During a 1991 ER Program site inspection, only a small amount of debris (tubing, scrap metal, and soda cans) was observed at this location (Roberson 1991, 04-0226).

SWMU No. 35-009 (a-e), Septic Systems: When the SWMU report was written, two active and two inactive septic systems existed at TA-35 (LANL 1990, 0145). In 1990, the two active systems, SWMU Nos. 35-009(c and d), were abandoned and left in place (Smithour 1991, 04-0221). Sewage from the buildings formerly served by these septic systems is now transported by force main to a central collection point, and from there it is sent to the sanitary-waste stabilization lagoons in Mortandad Canyon (SWMU No. 35-010). All of the sanitary waste from TA-35 now goes to the lagoons (Smithour 1991, 04-0221). The four systems handled primarily sanitary wastes, but industrial wastes, possibly containing radionuclides, could have been released to the systems.

The four inactive septic systems at TA-35 are identified as SWMU Nos. 35-009 (a-d) and are listed in Table 3-15. The locations of these systems are shown in Figure 3-3.

SWMU Nos. 35-009(a and b) discharged to drain fields on the south rim of the mesa, and both were abandoned in place in 1975 (LANL 1990, 0145). The drain field for SWMU No. 35-009(a) is located on the south side of trailer TA-35-236, which is south of the Sodium Testing Building, TA-35-34 (Figure 3-3). A 1968 memorandum indicated that the drain field for SWMU No. 35-009(a) was plugged, and the system was daylighted (Daniels 1968 0613). The location of the drain line is unknown. The location of the drain field for SWMU No. 35-009(b) is uncertain, but a 1965 aerial photograph shows a rectangular, newly engineered area lacking vegetation on the southeast side of TA-35-67. This area probably represents the drain field for SWMU No. 35-009(b), which was installed in 1965. Septic system TA-35-44 (SWMU No. 35-009[c]) discharged to a leach field that consists of three trenches covering a total area of 1,600 ft^2. This leach field is located under the dirt access road that runs east and west along the mesa edge on the west side of the trailer, TA-35-261. The leach field

at SWMU No. 35-009(d) consists of three trenches covering an area of 1,800 ft^2. This leach field was installed beneath the dirt access road that extends eastward from the cooling tower, TA-35-33. TA-35-65 was previously registered as an unpermitted waste stream with NMED registration number LA-41 (LANL 1990, 0145). (The tanks associated with SWMU Nos. 35-009[c and d] were pumped on a weekly basis [The Zia Company 1986, 04-0205].)

SWMU No. 35-009(e) is a sewage drain line from TA-35-25, which discharges to an outfall in Ten Site Canyon about 30 ft south of the building (LANL 1990, 0145). This drain does not pass through a septic tank or leach field. The status of this drain line is unknown.

SWMU No. 35-010(a-e), Sanitary Lagoons and Sand Filters: The sanitary waste treatment system at TA-35 consists of three lagoons (SWMU Nos. 35-010[a-c]) and four sand filters (SWMU No. 35-010[d]). The system is used for biological treatment of liquid waste (Table 3-16). The lagoons, installed in 1975, and the sand filters, installed in 1980, are all currently active. The lagoon and the sand filters are located in a shallow tributary of Ten Site Canyon about 300 ft east of the mesa upon which TA-35 is located (Figure 3-6). Bentonite and soil line the bottom of the lagoons and the sides are concrete. The four sand filters are plastic-lined (LANL 1990, 0145).

TABLE 3-15

SEPTIC SYSTEMS AT TA-35

SWMU No.	Associated Structures	Period of Use	Location/Overflow
35-009(a)	TA-35-14, 1,500-gal. tank	1951-1975	West side of TA-35-34 (south of TA-35-2); discharged to drain field and outfall on south rim of the mesa to Ten Site Canyon
	TA-35-15, dosing chamber	1951-1975	
	TA-35-16, distribution box	1951-1975	
35-009(b)	TA-35-76, reinforced concrete tank	1966-1975	South of TA-35-67; discharged to drain field and outfall on south rim of mesa to Ten Site Canyon
	TA-35-77, reinforced concrete distribution box	1966-1975	
35-009(c)	TA-35-44, 1,290-gal. tank	1961-1990	North of TA-35-2; discharged to leach field on north rim and two outfalls in Mortandad Canyon
	TA-35-45, distribution box	1961-1990	
35-009(d)	TA-35-65, 1,600-gal. tank	1966-1990	Northeast corner of Ten Site Mesa; discharged to leach field and outfall in Mortandad Canyon

Source: 1990 SWMU report (LANL 1990,0145).

TABLE 3-16

SANITARY-WASTE TREATMENT SYSTEM

SWMU No.	Structure Number	Structure Type	Dimensions
35-010(a)	TA-35-144	Lagoon	240 ft x 59 ft
35-010(b)	TA-35-145	Lagoon	100 ft x 115 ft
35-010(c)	TA-35-146	Lagoon	105 ft x 115 ft
35-010(d)	TA-35-215	Sand Filters	100 ft x 45 ft
35-010(e)	TA-35-215	Discharge Headwall	N/A

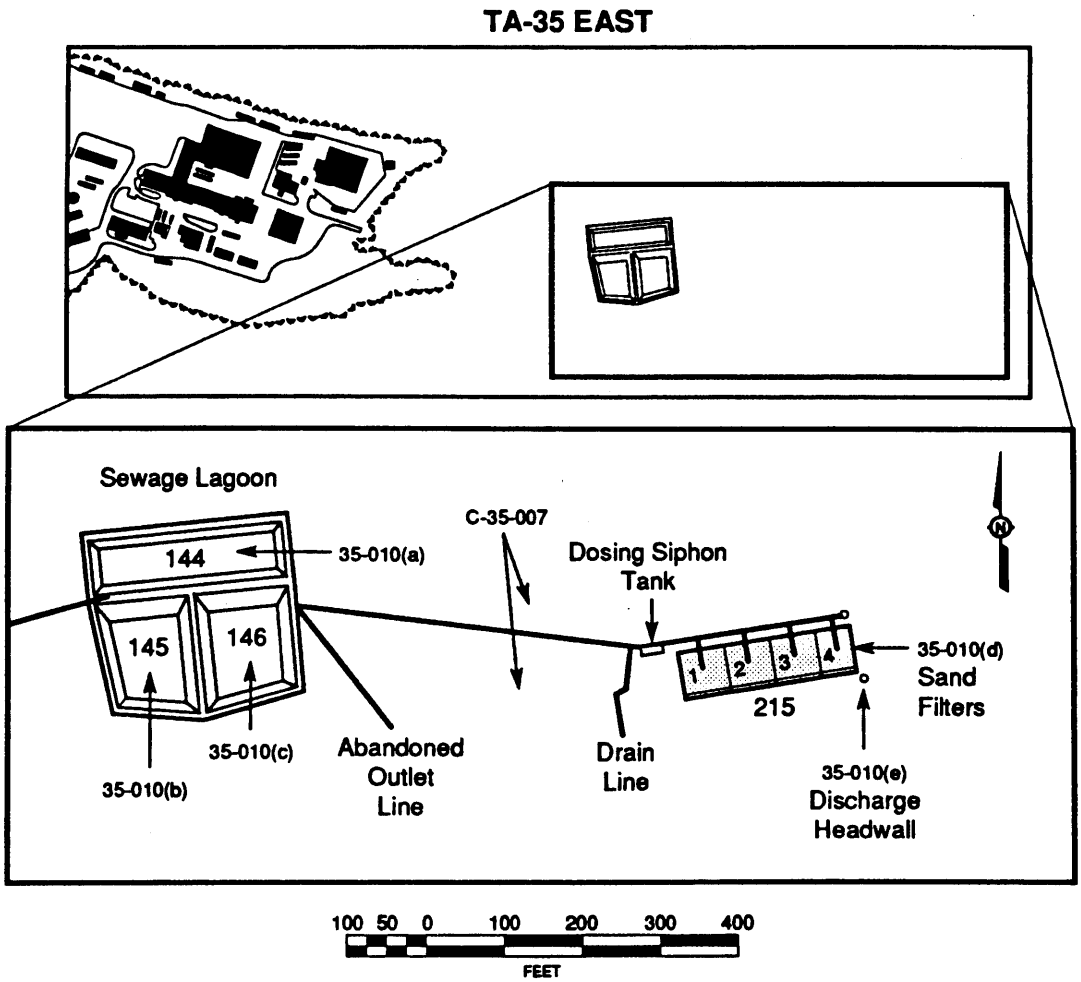


Figure 3-6. Locations of structures and SWMUs at TA-35 (LANL 1986, 04-0249).

The lagoons receive liquid wastes from TA-35, -50, -55, -48, and -64, the new Central Guard Facility (LANL 1990, 0145; Smithour 1991, 04-0221). Liquid effluent treated in the lagoons flows through the sand filters to a National Pollutant Discharge Elimination System (NPDES) outfall (Number 10S) in Ten Site Canyon east of TA-35. The lagoons receive primarily sanitary waste from these TAs, but some waste from photo-processing and other industrial drains is also received. In past years, small quantities of radionuclides, solvents, and other chemicals were present in the waste streams (LANL 1991, 04-0133). Drains in the laboratory hoods in TA-35-124, -125, and -126 are used to dispose of small amounts of acids, bases, and solvents. These drains are believed to connect to the central sanitary sewer system of TA-35, which ends in the lagoons (DOE 1987, 0264). Sumps in the Target Fabrication Facility, TA-35-213, also discharge effluent below a certain radioactivity level to these lagoons. The sumps in TA-35-2 and -27 may also discharge to these lagoons. It is not known if the lagoons and/or sand filters have released contaminants to the underlying soil and sediment, or if possible hazardous substances have been released at the sand filter outfall. Contamination may be associated with the abandoned outlet line that was used for discharge before the construction of the sand filters in 1980 (Figure 3-6).

SWMU Nos. 35-011(a-d), Underground Storage Tanks: Two active 1,000-gal. fiberglass storage tanks, SWMU No. 35-011(a), are located in the basement of Building TA-35-2 (LANL 1990, 0145). These tanks are not USTs, as stated in the SWMU report, but are entirely above-the-surface (Roberson 1991, 04-0226). These tanks reportedly have received plutonium-contaminated solutions, solvents, and other chemicals (e.g., spent fixer solutions, developer solutions, etc.) from various activities at TA-35-2 (LANL 1990, 0145). According to Laboratory personnel, however, the tanks currently receive only wastewater (Hansen personal communication in Roberson 1991, 04-0228). The liquid from the SWMU No. 35-011(a) tanks is removed by Group HSE-7 and transported to TA-50 for treatment (LANL 1990, 0145). The tanks were inspected in August 1991 during an ER Program site visit, and no evidence of leads was found (Roberson 1991, 04-0228).

SWMU No. 35-011(b) is a UST (TA-35-159), located on the west side of Building TA-35-85 (Figure 3-4). The tank was emptied and abandoned in place in approximately 1990, and the ground above the tank near several transportable buildings has been covered with concrete. Because of limited access, the Laboratory does not plan to remove the tank, which will probably be filled with sand and left in its present position (Umphres personal communication in Roberson 1991, 04-0226). The capacity of this tank is uncertain. The SWMU report states that it holds 10,000 gal.; the DOE description of USTs specifies the capacity of TA-35-159 to be 4,000 gal.; and the Laboratory/Pan Am History Book of structures states TA-35-159 is a 5,000-gal. tank (LANL 1990, 0145; LASL no date, 0402). The waste formerly stored in TA-35-159 consisted of contaminated oil from activities in TA-35-85 (LANL 1990, 0145).

Another UST (TA-35-197) and an associated aboveground tank located on the south side of TA-35-125 (Figure 3-4) compose SWMU No. 35-011(c). Both of these tanks are associated with the oil-reprocessing facility (SWMU No. 35-007) and are used to store oil for the Marx capacitor banks in Building TA-35-125 (DOE 1987, 0264; LANL 1990, 0145). The aboveground tank is located within a bermed area, as discussed under SWMU No. 35-007. UST TA-35-197 was leak tested in September 1991 and found to be tight (International Technology Corporation 1991, 0648). Therefore, the tank has unlikely leaked in the past.

Two 6,000-gal. USTs, SWMU No. 35-011(d), were located at the southeast corner of the High-Voltage Development Laboratory, TA-35-188 (Figure 3-4). These tanks

were installed in 1969 and were used to store contaminated dielectric oil used in TA-35-188 (LANL 1990, 0145). These tanks were removed in accordance with NMED UST regulations in the summer of 1991. The tanks were inspected and found to be in good condition with no evidence of leaks (Carmichael 1991, 04-0215). Extensive soil contamination in the area (SWMU No. 35-014[f]) was determined to be from a leaking oil-handling facility formerly located above the tanks and not from the tanks. The pit from which the tanks were removed was observed during an ER Program inspection in August 1991. By September 1991, the pit had been filled with soil and paved over with asphalt. Because soil contamination was so widespread, the pit was backfilled, and the extent of contamination was assessed through a soil sampling/ reconnaissance survey (Carmichael 1991, 04-0215).

Hazardous releases to the environment from any of these tanks has not been documented. However, until site characterization or leak testing provides supporting information that the tanks experienced no releases, the old USTs are assumed to have leaked (LANL 1990, 0145). No evidence of releases from the fiberglass tanks in the basement of TA-35-2 (SWMU No. 35-011[a]) exists.

SWMU Nos. 35-012 (a-b), Inactive Storage Tanks: One 1,000-gal. UST (TA-35-158), SWMU No. 35-012(a), was located on the north side of the Chemical Laser Facility, TA-35-85 (Figure 3-4). Waste oils and possibly solvents and chemicals from spills in TA-35-85 may have been discharged to this tank through the floor drains in TA-35-85 (SWMU No. 35-013[d]). This UST was connected to decommissioned surface impoundment, SWMU No. 35-006. According to Laboratory personnel, the tank was removed in 1990, and the pit was backfilled and covered with asphalt (Umphres personal communication in Roberson 1991, 04-0226). Because the tank removal was a RCRA interim status closure, soil samples were collected from the site during the tank removal. Results of the soil samples are not yet available (McInroy 1991, 04-0219). More information is provided in Section 3.3.3.2, Interim Corrective Measures.

According to the SWMU report, two USTs (TA-35-278 and TA-35-279, SWMU No. 35-012[b]), were located southwest of the Experimental Support Laboratory, TA-35-207 (Figure 3-4). These "oil siege tanks" were reportedly removed (LANL 1990, 0145). In actuality, the two tanks are aboveground and are still in place near the canyon edge southwest of TA-35-207 (Roberson 1991, 04-0226). According to Laboratory personnel, the tanks were installed many years ago, but were never hooked up to lines and were never used for storage (Umphres personal communication in Roberson 1991, 04-0226).

SWMU Nos. 35-013 (a-d), Sumps and Drains: Some liquid wastes from TA-35 are temporarily stored in sumps in buildings TA-35-2, -27, -85, and -213 before treatment and discharge. The basement of TA-35-213, the Target Fabrication Facility, contains two large sumps and seven catch basins beneath metal-plating tanks (SWMU No. 35-013[a]), which have 50- to 100-gal. capacities. The two sumps contain sanitary and industrial wastes with possible radionuclide contamination. The wastes are monitored for radioactivity and are sent to TA-50 if the liquid in the sump exceeds a standard for radioactivity. Wastes containing radioactivity less than this standard are discharged to the TA-35 lagoon system (SWMU No. 35-010) (LANL 1990, 0145). According to Laboratory personnel, the catch basins beneath the metal-plating tanks have never been used.

A sump pump in the basement of TA-35-2 (SWMU No. 35-013[b]) collects industrial wastewater that contains solvents, chemicals, and small quantities of radionuclides, which is discharged to the lagoons in the canyon east of TA-35 (LANL 1990, 0145).

Treated fixer and developer solutions from photography labs go to drains in TA-35-2, which are possibly connected to the sumps (DOE 1987, 0264). The TA-35-2 sump pump does not receive sewage or sanitary waste, as stated in the SWMU report (LANL 1990, 0145).

Two sump pumps in the basement of TA-35-27 (SWMU No. 35-013[c]) receive industrial wastewater that may contain solvents and other hazardous chemicals. The sumps probably do not receive radionuclides. The wastewater from TA-35-27 is also released to the lagoons.

The ground floor of TA-35-85 contains two pairs of floor drains (SWMU No. 35-013[d]). One pair has been filled with concrete or asphalt. This set of drains was designed to discharge spills of oils and solvents to a UST, TA-35-158 (SWMU No. 35-012[a]) (LANL 1990, 0145). The other pair of drains in TA-35-85 remains open and is designed to catch spills of deionized water. These two drains are connected to the sanitary sewer line that goes to the lagoons in Mortandad Canyon (SWMU No. 35-010). According to Laboratory personnel, these drains have never been used, except for tests to ensure that they are functional (Umphres personal communication is Roberson 1991, 04-0226).

SWMU Nos. 35-014(a-g), Operational Releases: Numerous spills and/or releases of waste materials, including oils, radioactive wastewater, and radioactively contaminated air, occurred during early operations at TA-35. The site also has a long history of planned releases of liquid and atmospheric wastes. Several areas within the boundaries of TA-35 have also been contaminated because of operations at various facilities. Some of these areas have been designated collectively as SWMU No. 35-014 and are described in Table 3-17 and in the following text.

SWMU No. 35-014(a) consists of soils contaminated by radionuclides released to the atmosphere from a laboratory exhaust stack that is located on the south side of TA-35-2. The stack was used to exhaust, among other things, a tritium glovebox facility that operated in the basement of TA-35-2. This facility released several thousand curies of tritium to the atmosphere annually between 1954 and 1979. A patch of grass-covered soil along the south side of TA-35-2 would likely have received the highest concentrations of radionuclides (Figure 3-3). Two peach trees located just beneath the exhaust stack are sampled annually as part of the Laboratory's environmental surveillance program. Analyses of peach and leaf samples from these trees indicate slightly elevated concentrations of tritium, ^{90}Sr, total uranium, ^{239}Pu, and ^{238}Pu, but the concentrations of radionuclides are too low to represent a significant health hazard to the general public (ESG 1982, 0620). Radionuclide concentrations for several years are presented in Tables 3-25, 3-26, 3-27, and 3-28, and discussed in Section 3.3.2.4, Environmental Surveys and D&D Activities. Although the trees indicate very low levels of radionuclide uptake, the radionuclide content of soils may have never been analyzed.

A leaking drum found near the southwest corner of the northwest wing of TA-35-2 (SWMU No. 35-014[b]) contained oil with 50.4 µg/g PCBs (Scholl Fritz 1985, 04-0083). The drum was removed, but if all the contaminated soil was removed is unknown. The precise location of this release is also unknown.

SWMU No. 35-014(c) is a 10-ft wide by 20 ft-long stained area observed on a sloping surface near the southeast corner of TA-35-29 (Figure 3-3). This stained area is probably the result of past dielectric oil spills from nearby aboveground tanks that were labeled as PCB-free. An additional stained area (SWMU No. 35-014[d]) is present at the former location of two oil siege tanks at the southwest corner of

TABLE 3-17

OPERATIONAL RELEASES AT TA-35

SWMU No.	Location	Type of Release	Contaminants
35-014(a)	Southwest side of TA-35-2	Soil contaminated with radionuclides	^{239}Pu, ^{235}U, ^{90}Sr, tritium[a]
35-014(b)	Southwest corner of the northeast wing of TA-35-2	Leaking drum, removed	Oil w/50.4 µg/g PCBs
35-014(c)	Near TA-35-29	Stained soil from oil spills	Dielectric oil, PCB-free
35-014(d)	Near TA-35-29	Stained soil from oil spills	Dielectric oil
35-014(e_1)	North side of TA-35-85	Oil spill area	Dielectric oil w/PCBs
35-014(e_2)	Northeast side of TA-35-85	Oil spills from waste oil impoundment	Dielectric oil
35-014(e_3)	West side of TA-35-85	Oil spill area	Dielectric oil w/PCBs
35-014(f)	East side of TA-35-188	Stained soil from oil spills	Dielectric oil w/PCBs
35-014(g_1)	South of TA-35-86 oil treatment facility	Stained soil from oil spills	Dielectric oil
35-014(g_2)	South side of TA-35-86	Stained soil from oil spills	Dielectric oil
35-014(g_3)	Canyon rim and parking lot south of TA-35-207	Stained soil from oil spills	Dielectric oil

Source: LANL (1990, 0145).

[a] Results of surveys in Section 3.3.2.4 and in Tables 3-25, 3-26, 3-27, and 3-28.

TA-35-29 (Figure 3-3). Dielectric oil may have leaked from the valve system of the siege tanks. These tanks were associated with the decommissioned oil treatment facility, SWMU No. 35-015(b). Oil-stained soil occurs at the entry point of a culvert that drains this area, and also at the point at which the culvert ends near the southeast corner of TA-35-29.

Three dielectric oil spill areas are associated with past operations at the Chemical Laser Facility, TA-35-85, and have been designated as SWMU No. 35-014(e_1-e_3). SWMU No. 35-014(e_1) is located on the north side of TA-35-85, but has been bulldozed off the mesa (Figure 3-4). A pile of dirt and debris on the canyon slope is marked with a sign that says, "Do Not Remove. Contact Jay Wenzel, HSE-8." Two dead trees were noted immediately downslope from the dirt pile (Roberson 1991, 04-0226). SWMU 35-014(e_2) is an area stained by overflows from the decommissioned waste oil impoundment, SWMU No. 35-005(a). Soil samples for these stained areas showed detectable PCB concentrations (LANL 1990, 0145), but these

data have not been obtained. SWMU No. 35-014(e_3) is another oil spill located on the west side of TA-35-85 between TA-35-85 and TA-35-222 (Figure 3-4). This entire area has been covered with concrete and new structures (Roberson 1991, 04-0226).

Stained soil (SWMU No. 35-014[f]) was also noted on the east side of the High-Voltage Development Laboratory, TA-35-188 (Figure 3-4). The staining was apparently from a leaking dielectric oil-handling system that connected a pair of USTs (SWMU No. 35-011[d]) to the building. When the USTs were removed in 1991, extensive surface and subsurface soil contamination was discovered in the entire area along the east side of TA-36-188. Total petroleum hydrocarbons (TPH) levels were as high as 22,500 mg in soil samples (Carmichael 1991, 04-0215). Earlier soil samples from this area also showed detectable PCB concentrations (LANL 1990, 0145). Another area, presumably stained by crankcase oil, was noted in 1991 at the base of a compressor at the northeast corner of TA-35-188 (Roberson 1991, 04-0226). This area will be addressed as part of SWMU No. 35-014(f).

Three stained soil areas collectively designated as SWMU No. 35-014(g) are located near the Carbon Dioxide Laser Building, TA-35-86. The stains are probably the result of dielectric oil spills. The Carbon Dioxide Laser Building currently uses only mineral oil without PCBs; however, the types of oil used in past operations are unknown. One of the stained areas, SWMU No. 35-014(g_1) is a 4-ft-long by 2-ft-wide stain in the discharge area of the storm drain system. This discharge point is located near the northeast corner of TA-35-207, and coincides with outfall SWMU No. 35-016(n) (Figure 3-4). The second stained area, SWMU No. 35-014(g_2), occurs on an asphalt covered area adjacent to the fence south of TA-35-86 (Figure 3-4). The stains are near two dumpsters and resulted from leaking containers that formerly were stored at this area (SWMU No. 35-004[m]). While the contaminants that were released at this site are unknown, the stains appear to be oil. The third stained area, SWMU No. 35-014(g_3), is from a major oil spill that occurred at the tank farm on the west side of TA-35-86 (SWMU No. 35-015[a]) in 1986. This spill flowed southward through a culvert under the road on the south side of TA-35-86, then ran across the parking lot west of TA-35-207, down an embankment, between tanks TA-35-278 and -279, and southward across the mesa through a natural drainage pathway into Ten Site Canyon (Figure 3-4). The trace of the spill is clearly visible in a 1986 aerial photograph. Eleven samples were collected in 1987 along the trace of the spill to the canyon bottom and 100 ft downstream as part of Environmental Problem 25 (DOE 1987, 04-0256). Metals, pesticides/PCBs, alpha and gamma emitters, SVOCs, and VOCs were detected in the samples (LANL 1990, 0145). The stained area was observed in August 1991 and still smelled strongly of oil. All vegetation in the path of the spill was dead (Roberson 1991, 04-0226).

SWMU Nos. 35-015 (a-b), Decommissioned Waste Oil Treatment: A tank farm and waste oil treatment system, SWMU No. 35-015(a), was formerly located on the west side of Building TA-35-86 (Figure 3-4). The system reprocessed used oil from the Helios CO_2 laser in TA-35-86 and included oil siege tanks TA-35-149 through -154, a grease trap, and an oil treatment unit. When the oil-recycling process was complete, separated water was discharged into Ten Site Canyon through a storm sewer (DOE 1987, 0264). Spills from the tank farm were also discharged to a storm sewer and into Ten Site Canyon near TA-35-207 (LANL 1990, 0145). In 1985, samples taken in the region of the oil siege tanks (TA-35-149 through -154) indicated no PCB contamination. Field notes recorded during a 1988 ER Program environmental survey noted a "bad bad" oil spill at the siege tanks (Shafer circa 1989, 04-0187). This is believed to be the same spill, designated SWMU No. 35-014(g_3), that ran into Ten Site Canyon south of TA-35-207. The oil treatment facility and tank farm

were still in existence when ER Program photographs were taken in April 1988, but the facility was subsequently removed in late 1988 or 1989, according to Laboratory personnel (Umphres personal communication in Roberson 1991, 04-0226). Extensive staining of soils is visible in the 1988 photographs. Although much of the area was paved after the facility was removed, stained areas in unpaved portions of the tank farm area indicate that contaminated soils were not completely removed when the facility was decommissioned (LANL 1990, 0145). According to the SWMU report, the oil at the tank farm contained no hazardous constituents (LANL 1990, 0145). Samples taken from an area stained by a spill at this site (SWMU No. 35-014[g_3]), however, contained detectable quantities of several contaminants (LANL 1990, 0145). Similar contamination is therefore expected in stained areas at this site.

Another oil-handling facility, SWMU No. 35-015(b), was located on the southwest side of Building TA-35-29 (Figure 3-3). This unit was used for treating oil from the old Gemini gas laser in TA-35-29. This facility was also found to be leaking dielectric oil in 1988 and was removed (Shafer circa 1989, 04-0187; LANL 1990, 0145). It is not known if the oil spilled at this site contained hazardous constituents, or if the contaminated soils were cleaned up when the facility was removed. Stained soil and asphalt occurs in this general area, especially at the entry point of a drainage culvert (SWMU No. 35-014[d]).

SWMU Nos. 35-016(a-q), Drains and Outfalls: A number of drain lines and outfalls are associated with TA-35. Most of these outfalls were located during an ER Program site reconnaissance in 1988. Information about these drains and outfalls is summarized in Table 3-18. The types of waste managed by most of these drain lines and outfalls are unknown. The extent of hazardous or radioactive contamination associated with the outfalls is also unknown (LANL 1990, 0145).

SWMU No. 35-016(a) is an inactive outfall that was established in 1958 to discharge noncontact cooling water from TA-35-34, the Sodium Testing Building. The drain line ran about 70 ft southward to its point of discharge into Ten Site Canyon (Figure 3-3) (LANL 1990, 0145). The outfall, which formerly had NPDES Permit No. 04A089, was eliminated from the permit in 1985 (LANL 1985, 04-0121).

SWMU No. 35-016(b) is an active outfall (NPDES Permit No. 06A132) that was established in 1977 to discharge photographic processing effluents from TA-35-87. The waste is passed through a silver and cyanide recovery process before entering the drain lines in Room 175. Effluent is limited to 3,000 gal. per day (gpd) and travels southward about 175 ft to its point of discharge into Ten Site Canyon (LANL 1985, 04-0121; LANL, 1990, 0145). This outfall is sampled for silver and cyanide under NPDES requirements (LANL 1990, 0145).

SWMU No. 35-016(c) consists of two inactive outfalls (former NPDES Permit Nos. 04A088 and 04A012) that were established in 1964 to discharge noncontact cooling water coming from warehouse TA-35-67. The drain line to outfall 04A088 ran about 75 ft southward to its point of discharge into Ten Site Canyon. Outfall 04A088 was combined with outfall 04A012 by 1985 (LANL 1985, 04-0121). Outfall 04A012 ran about 125 ft from TA-35-67 to its point of discharge into Ten Site Canyon (LANL 1990, 0145). It was deactivated in 1987 (LANL 1990, 0145).

SWMU No. 35-016(d) is an inactive outfall that was constructed in 1962 to handle noncontact cooling water from TA-35-46, the Reactor Components Development Building. This outfall, which formerly had NPDES Permit No. 04A087, was still listed on the permit as an active outfall in 1985. When use of the outfall was discontinued is unknown. The drain line runs about 50 ft southward to its point of discharge into

Ten Site Canyon (Figure 3-3) (LANL 1990, 0145).

TABLE 3-18

DRAINS AND OUTFALLS AT TA-35

SWMU No.	Type/Status	Waste Discharged	Outfall Location
35-016(a)	Inactive outfall	Noncontact cooling water	Ten Site Canyon, south of TA-35-34
35-016(b)	Active outfall	Photo-processing waste	Ten Site Canyon, south of TA-35-87
35-016(c)	Inactive outfall	Noncontact cooling water	Ten Site Canyon, south of TA-35-67
35-016(d)	Inactive outfall	Noncontact cooling water	Ten Site Canyon, south of TA-35-46
35-016(e)	Inactive outfall	Noncontact cooling water	Mortandad Canyon, north of TA-35-85
35-016(f)	Active storm drain	Storm run-off	Mortandad Canyon, north of TA-35-85
35-016(g)	Active outfall	Noncontact cooling water	Mortandad Canyon, north of TA-35-213
35-016(h)	Active storm drains	Storm run-off/ wastewater	Mortandad Canyon, north of TA-35-213
35-016(i)	Active discharge channel	Storm run-off	Mortandad Canyon, east of TA-35-85
35-016(j)	Active storm drains	Storm run-off/ wastewater	Ten Site Canyon, south of TA-35-125
35-016(k)	Inactive outfall	Noncontact cooling water	Ten Site Canyon, east of TA-35-29
35-016(l)	Active discharge channels	Storm run-off/ wastewater	Ten Site Canyon, east of TA-35-29
35-016(m)	Inactive outfall	Treated cooling tower water	Mortandad Canyon, north of TA-35-33
35-016(n)	Active discharge channels	Storm run-off	Ten Site Canyon, south of TA-35-86
35-016(o)	Active storm drains	Storm run-off/ wastewater	Mortandad Canyon, north of TA-35-261
35-016(p)	Active outfall	Cooling water	Mortandad Canyon, north of TA-35-27
35-016(q)	Active discharge channels	Storm run-off	Ten Site Canyon, south of TA-35-34

An inactive outfall, SWMU No. 35-016(e), was established in 1977 to handle noncontact cooling water from the Chemical Laser Facility, TA-35-85. The drain line runs about 50 ft northward to its point of discharge on the south rim of Mortandad Canyon (Figure 3-4) (LANL 1990, 0145). The outfall, which formerly had NPDES Permit No. 04A090, was still listed on the permit as an active outfall in 1985 (LANL 1985, 04-0121).

An active storm drain, SWMU No. 35-016(f), runs about 50 ft from TA-35-85 northward to the south rim of Mortandad Canyon (Figure 3-4). Oil spills have occurred near the source areas for this storm drain (see SWMU No. 35-014[e]). Soil samples from stained areas showed detectable concentrations of PCBs (LANL 1990, 0145).

SWMU No. 35-016(g) is an active outfall (NPDES Permit No. 04A127) that was established in 1979 to handle reverse osmosis discharge from Room 29 in the basement of TA-35-213, the Target Fabrication Facility. This outfall now handles cooling tower blowdown from the same room (LANL 1991, 04-0133). The drain line runs about 100 ft northward to its point of discharge on the south rim of Mortandad Canyon (Figure 3-4). This drain line is suspected of containing tritium (LANL 1990, 0145) and may also contain chemicals added to the cooling water to prevent corrosion, scaling, and algal growth.

SWMU No. 35-016(h) includes several active storm drains installed in 1979 to handle rainwater run-off from TA-35-213 and brine from the water deionizer in TA-35-213 (LANL 1991, 04-0133). The drains run about 300 ft to their points of discharge on the south rim of Mortandad Canyon (Figure 3-4). This drain line is also suspected of containing tritium (LANL 1990, 0145).

SWMU No. 35-016(i) is an active daylight discharge channel that handles storm water run-off from the area between the east end of TA-35-85 and the TA-35 parking lot. The channel runs about 50 ft northward to its point of discharge on the south rim of Mortandad Canyon (Figure 3-3) (LANL 1990, 0145).

SWMU No. 35-016(j) includes active storm drains installed in 1975 to handle rainwater run-off from TA-35-125 and electro-polishing wastewater from Room B102 of TA-35-125 (LANL 1991, 04-0133). The channels run southward to their points of discharge into Ten Site Canyon (Figure 3-4). SWMU No. 35-016(k), an inactive outfall that had former NPDES Permit No. 04A116, was installed in 1961 and deactivated in 1987 (LANL 1990, 0145). It handled once-through cooling water from a closed heat-exchange system that served a gas laser in TA-35-29, the Gas Laser Building (LANL 1991, 04-0133). The drain line runs eastward to its point of discharge into a shallow tributary of Ten Site Canyon (SWMU No. 35-003[r]) at the east end of Ten Site Mesa (Figure 3-3).

Active daylight discharge channels, SWMU No. 35-016(l), were established in 1961 and handle rainwater run-off from TA-35-29 and sterilized water leaks from an ultraviolet water sterilizer in Room 001A of TA-35-29. The channels run eastward and discharge to a tributary of Ten Site Canyon (SWMU No. 35-003[r]) at the east end of Ten Site Mesa (Figure 3-3) (LANL 1990, 0145). Stained areas from past dielectric oil spills (SWMU Nos. 35-014[c-d]) are present in the source areas for these drains. The concrete catch basin for these drains measured 50% greater than background gamma radiation readings during the 1988 ER Program site visit (LANL 1990, 0145).

SWMU No. 35-016(m), an inactive cooling tower outfall that formerly had NPDES Permit No. 03A039, was established in 1966 and deactivated in 1982. It handled treated cooling tower blowdown from TA-35-33. The drain line ran about 10 ft to its point of discharge into Mortandad Canyon (Figure 3-3) (LANL 1990, 0145). The water discharged at this outfall contained water treatment chemicals to prevent scaling, corrosion, and algal growth.

SWMU No. 35-016(n) includes several active daylight channels established in 1977 to handle rainwater run-off from TA-35-86, the Carbon Dioxide Laser Building. The channels run approximately 75 ft southward to their points of discharge into Ten Site Canyon near the northeast corner of TA-35-207 (Figure 3-4). Three soil areas stained by oil spills (SWMU Nos. 35-014[g_1-g_3]) are present near this facility. One stained area (SWMU No. 35-014[g_1]) is at the point of discharge from these storm drains. Samples analyzed from one of the stained areas (SWMU No. 35-014[g_3]) tested positive for metals, pesticides/PCBs, alpha and gamma emitters, and SVOCs and VOCs. Concentrations of these contaminants are not given (LANL 1990, 0145).

SWMU No. 35-016(o) includes several active storm drains established in 1951 to handle rainwater run-off from TA-35-2 and possible floor drain effluents from the following rooms and processes within TA-35-2: Room A10, in which there are floor drains to receive leaks and overflow from two 2,000-gal. tanks containing low-level radioactive/acid liquid wastes; Room A13, in which there are floor drains and four 55-gal. drums of PCB-contaminated waste oil; and Room A22, the high-velocity projectile testing room next to Room A23, which is sealed off because of high background radiation from the LAPR- I and LAMPRE reactors that were formerly housed in the room (LANL 1991, 04-0133). The storm drain channels travel 125 ft northward from TA-35-2 and discharge into Mortandad Canyon north of office trailer TA-35-261 (Figure 3-3).

SWMU No. 35-016(p) is an unpermitted active cooling-water outfall that was established in 1968 to handle discharge from TA-35-27, the Nuclear Safeguards Research Building. The drain runs about 20 ft to its point of discharge on the south rim of Mortandad Canyon (Figure 3-3) (LANL 1990, 0145).

SWMU No. 35-016(q) includes several active storm water collection basins that are located between TA-35-34 and the edge of Ten Site Canyon (Figure 3-3). The basins have eroded into large gullies that drain southward into Ten Site Canyon. Three sediment samples were collected from one of the basins as part of Environmental Problem 24 in the DOE Environmental Survey (DOE 1987, 04-0257). The samples contained detectable quantities of SVOCs, PCBs, metals, and alpha- and gamma-emitting radioactive materials. No VOCs or beta emitters were detected in quantities above detection limits (LANL 1990, 0145).

Outfall 03A160 (not listed in the 1990 SWMU report [LANL 1990, 0145]) was submitted to the EPA for inclusion under NPDES Permit No. NM 0028355 in May 1990 (LANL circa 1990, 04-0131). The outfall discharges treated cooling-water blowdown from open cooling-water systems located in building TA-35-124. TA-35-124 houses a cooling tower that receives 1,500 gph of potable water as well as water treatment chemicals. Evaporation loss is 900 gph, and 600 gph go to the outfall. In an emergency, water from an oil/water separator located in the CPRF Generator Building, TA-35-301, would also go to this outfall (LANL circa 1990, 04-0131). Because this outfall is new and NPDES-permitted, it is not considered a SWMU.

SWMU No. 35-017, Soil Contamination from Reactor Operations: Three experimental nuclear power reactors were operated at TA-35 (Ten Site) between 1956 and

1964: LAPRE-I, LAPRE-II, and LAMPRE-I. LAMPRE-II was planned, but the project was canceled before completion of reactor construction; it was to have been built in the Fast Reactor Core Test Facility building (TA-35-27). Although the three reactors were decontaminated and decommissioned, remnant soil contamination from atmospheric releases and spills may exist. SWMU No. 35-017 comprises soil contamination that resulted from operating these reactors.

The following is a description of the reactor programs and potential contamination that may have resulted at the sites.

LAPRE-I and LAMPRE-I were operated in Cell J (Room 203) in the basement of Building TA-35-2. LAPRE-II was installed in an underground pit on the south-east exterior of TA-35-2. One purpose of the LAPRE reactors was to develop and demonstrate a practical, portable power reactor.

LAPRE-I was a 2 Mw-thermal, high-temperature, homogeneous reactor fueled with enriched uranium (93.5% ^{235}U) trioxide (UO_3) dissolved in phosphoric acid (H_3PO_4). The nominal fuel-solution composition was 0.5M UO_3 + 7.25M H_3PO_4 (approximately 17 w/o UO_3 in 83 w/o H_3PO_4). Design operating conditions were 800°F at 3700 psi.

The LAPRE-I experiment consisted of two operational tests: the first on February 15, 1956 and the other on October 16, 1956. Each test lasted approximately eight hours. The reactor was shut down on both occasions because of a fuel-solution leak in the heat exchanger. The leaks resulted from failure of the gold cladding and the heat exchanger design, which caused corrosion of the stainless-steel tubes in the exchanger. The reactor was disassembled in late 1956 and a diagnostic investigation conducted (Peterson 1959, 04-0240).

On February 20, 1956, during the initial run of the LAPRE-I reactor, a "substantial quantity" of "enriched uranium soup'" was lost through a steam control valve on a steam blow-off line (Christenson 1956, 04-0043; LASL 1962, 04-0142). The exact location of this release is unknown, but it is believed to have occurred near the edge of Ten Site Canyon directly south of the southeast corner of TA-35-2, near the present location of MDA-W (SWMU No. 35-001).

Soil near the steam valve was contaminated with enriched uranium and associated alpha, beta, and gamma activity. Soil samples collected in March 1956 had a gross-alpha contamination of 1420 counts per minute per gram (c/m/g) near the point of release (H-Division 1956, 0469). Gross-beta counts were 304 and 400 c/m/g in March 1956; it decayed to 250 c/m/g within six months. Gamma counts in the soil were initially 44,000 c/m/g, but decayed to near background by August 1956 (LASL 1962, 04-0142).

LAPRE-II was also a high-temperature homogeneous reactor, but employed uranium dioxide (UO_2) fuel rather than uranium trioxide (UO_3). The fuel was a solution of enriched uranium (93.5% ^{235}U) dioxide (UO_2) dissolved in phosphoric acid (H_3PO_4). The nominal fuel solution composition was 0.35M UO_2 + 17.5M H_3PO_4 (approximately 5 w/o UO_3 in 95 w/o H_3PO_4). It was rated at 800 kw-thermal with design operating conditions of 800°F and 650 psi. Superheated steam was generated in the reactor vessel. The steam was condensed and the heat dumped to the atmosphere through an air radiator. The reactor and other primary loop components were located below ground to provide shielding in the event of induced or leakage-type radioactivity in the loop (Clark 1960, 04-0217).

The LAPRE-II experiment was successfully operated from February into May of 1959. Full power operation of 745 kw with steam conditions of 745°F at 670 psi was achieved on April 22, 1959, and satisfactorily maintained for 12 hours. Maximum power was limited by the capacity of the primary-loop coolant pumps; not by the nuclear or heat-transfer characteristics of the reactor.

Some fission-product activity (^{131}I, ^{133}I, ^{135}I, and ^{135}Xe) was observed in the primary loop. No alpha activity was detected and, thus, no fuel escaped. Since no alpha activity was found, all leakage must have occurred in the vapor space of the reactor. The precise manner in which the fission products escaped into the steam system was not determined. However, leakage may have occurred either through holes in the gold cladding or the tube sheets, or through the heat exchanger tube seals in the tube sheets. No documentary evidence has been found that the soils were contaminated by the operation of LAPRE-II.

Defueling, dismantling, and postmortem analysis began on May 8, 1959. Because of the construction of the fuel reservoir and its emplacement, not all of the fuel could be drained. A heel having a volume of approximately 0.5 liter containing about 30 g of ^{235}U was left in the reservoir.

The total mixed fission product (MFP) activity for the heel was calculated as 0.1 Ci in March 1978, 20 years after reactor shutdown. Of this, the ^{90}Sr and ^{137}Cs activity was estimated at 0.02 Ci each. In 1978, the only significant remaining activation products in the stainless-steel reactor vessel was calculated as 0.04 Ci of ^{60}Co. The activity was produced by neutron activation of ^{59}Co by the (n,γ) reaction. Stainless steel contains ^{59}Co. The two nickel isotopes (^{59}Ni and ^{63}Ni) that are present emit no gamma radiation (Graf and Howard 1978, 04-0090).

The reactor vessel, fuel reservoir, connecting piping, and possibly other equipment were buried in place about 8 ft below grade and covered with asphalt paving in 1968 (Garcia 1968, 04-0084; Warren 1974, 04-0197). This burial site has been designated MDA-X and identified as SWMU No. 35-002. Additional information about LAPRE-II and its disposal site is contained in the discussion of SWMU No. 35-002.

LAMPRE-I was a plutonium-fueled, sodium-cooled research reactor built for developing plutonium fuels for fast breeder reactor applications. The fuel, an alloy of 90 a/o Pu and 10 a/o Fe, was sealed in tantalum capsules. The most likely isotopic mixture was approximately 94% ^{239}Pu and 6% ^{240}Pu, with a small quantity of ^{238}Pu. The reactor core contained 140 capsules, although spaces for many more existed. Total mass of fuel alloy was 25 kg. During operation, the fuel was in the liquid phase. The coolant system employed about 7.5 ft^3 of very high-purity sodium. Design operating conditions were 1 Mw-thermal with a sodium coolant outlet temperature of 1200°F at about 20 psi. Generated heat was dumped to the atmosphere through a Na-air heat exchanger. The reactor vessel and associated piping were stainless steel. Operation began by October 1960.

In the event of a ruptured fuel capsule, fission gases escaping into the Na coolant were collected in the He cover gas in the reactor vessel or the Na surge tank. Fission gases were transferred to a holdup tank for decay and controlled release to the atmosphere.

Contaminated sodium could be transferred to a standby sodium disposal system that included two 4-in.- diameter, 120-ft-long tubes, or wells, located on the north rim of Ten Site Canyon (TA-35-43; SWMU No. 35-001, MDA-W). Use of the disposal system was not necessary during operation of LAMPRE-I, although two fuel

capsules ruptured (Harper and Garde 1981, 0467). The system was used as a depository for the sodium coolant after the reactor was shutdown and dismantled (Warren 1974, 04-0197). Although the coolant was contaminated with Pu, no documentary evidence confirms that fuel was released.

The reactor was retired and defueled in about 1964 at which time the sodium and sodium-cooling system, including pumps, dump tank, hot traps, surge tank, and heat exchanger were removed. Activated metals in the reactor cell and lack of funding prevented further decommissioning.

Complete decommissioning was accomplished in 1980. All areas except the reactor cell were released for unrestricted use. The reactor cell (Cell J) had a maximum of 70 mR/hr from the activated cell liner and underlying concrete structures, which was considered ALARA. All wastes, including the reactor vessel, were buried or retrievably stored at the TA-54 waste disposal site. Decommissioning operations are fully described by Harper and Garde (1981, 0467).

SWMU Nos. 35-018(a-b), Leaking PCB Transformers: Two transformers at TA-35 were reported to be leaking PCB-contaminated dielectric oil during a transformer assessment survey in 1985. One transformer, with ID No. 5024 (SWMU No. 35-018[a]) was located at Substation TA-35-32, near the southwest corner of Building TA-35-29 (Figure 3-3). The transformer was dripping onto a porous concrete pad with no spill containment and no drip pan and was put on a daily transformer inspection list (Atencio 1985, 04-0021). The extent of release to the underlying pad and surrounding soil is unknown. The transformer at TA-35-32 (SWMU No. 35-018[a]) was observed during a site inspection in August 1991. No evidence of past or present leakage was observed (Roberson 1991, 04-0228).

SWMU No. 35-018(b) is a transformer (ID No. 5547) located in the basement of TA-35-2. A leak from this transformer was discovered and cleaned up in 1985. This release was assessed as a moderately active leak with no spill containment. Swipe samples taken from the vicinity of the transformer after the spill cleanup contained up to 164-$\mu g/100\text{-}cm^2$ PCBs (Atencio 1985, 04-0021). This transformer is believed to have had no releases to the environment.

The transformer in the basement of TA-35-2 (SWMU No. 35-018[b]) was removed in August 1991 (Roberson 1991, 04-0228) and was not observed during the site inspection. When the transformer was removed, a routine check for radioactive contamination indicated that there was some contamination. The contamination was found to be ^{239}Pu (Nunes 1991, 04-0220). The source of the plutonium on the transformer is unknown.

C-35-001 through C-35-008, Potential Release Sites: Eight other potential releases of contaminants to the environment at TA-35 are summarized in Table 3-19.

TABLE 3-19

POTENTIAL RELEASE SITES AT TA-35

Site No.	Associated Structure	Description
C-35-001	TA-35-18	Former location of an underground storage tank for diesel fuel; removed in 1988 with no visible evidence of contamination. No soil samples were taken when the tank was excavated (McInroy 1991, 04-0219).
C-35-002	TA-35-19	Former location of an underground storage tank for fuel oil; removed in 1988 with no visible evidence of contamination. No soil samples were taken when the tank was excavated (McInroy 1991, 04-0219).
C-35-003	TA-35-20	Former location of an underground storage tank for fuel oil; removed in 1988 with no visible evidence of contamination. No soil samples were taken when the tank was excavated (McInroy 1991, 04-0219).
C-35-004	TA-35-125	1,000-gal. Shell Dela Oil spill south of TA-35-125 that discharged into Ten Site Canyon through the storm water drain on Oct. 9, 1986. The oil reached the canyon and extended 30 ft downstream. Analyses of the oil indicated that PCB content was below the detection limit. The spill was cleaned up with absorbent materials (Bohn 1986, 04-0030; Umphres 1986, 04-0193).
C-35-005	TA-35-125	100-gal. spill from overfilling MARX Generator Tank on December 3, 1986. The oil was spilling inside TA-35-125 and oil flowed out the door and into Ten Site Canyon. Oil and water were discharged to the canyon for a distance for 400 yd. Oil and water froze on the snow in the canyon and was easily cleaned up. Analyses of the oil in the MARX tank and of the spilled oil indicated PCBs in concentrations between detection limit and 11.7 ppm (Bailey 1986, 04-0023).
C-35-006	TA-35-213	Spill of 5 gal. of organic waste (toluene, styrene, and water mixtures) in the receiving area on May 25, 1988. Group HSE-7 cleaned up the spill; all cleanup materials were placed in a 30-gal. drum (reference not provided).
C-35-007	east of TA-35 sanitary lagoons	Unknown spilled material observed over an area extending 0.25 mi on a dirt road. The spilled material was reported on June 27, 1988 when it was observed to be killing vegetation. A spill report filed on July 1, 1988 indicated that a composite sample had been collected and corrective actions were pending analytical results. No records of analytical results or corrective action are available (reference not provided).
C-35-008	TA-35-2 basement	Leaking PCB transformer in basement; the oil mixed with water that was leaking from a condensate pipe. The leak required two cleanup sessions (PCB ID No. 5618) (reference not provided).

Source: LANL (1990, 0145).

3.3.2.2 Summary of Potential Waste Materials

Radionuclides

- Barium-140 (^{140}Ba)
- Lanthanum-140 (^{140}La)
- Neptunium-237 (^{237}Np)
- Plutonium (^{239}Pu, ^{238}Pu)
- Strontium (^{90}Sr, ^{89}Sr)
- Sodium-22 (^{22}Na)
- Cesium-137 (^{137}Cs)
- Uranium (^{235}U, ^{238}U)
- Yttrium-90 (^{90}Y)
- Cobalt-60 (^{60}Co)
- Europium-152 (^{152}Eu)
- Nickel-59 (^{59}Ni)
- Tritium (^{3}H)
- Ruthenium-106 (^{106}Ru)
- Uranium-contaminated H_3PO_4

Hazardous Chemicals

- Germanium hydride
- Acetone, toluene, and other unspecified solvents
- Styrene
- Trichlorotrifluoroethane
- Tetrachloroethane
- 1,1,1- Trichloroethane
- Alcohols
- Dielectric oils
- PCBs
- Laser dyes
- Cyanide
- Hydrofluoric acid (HF)
- Nitric acid (HNO_3)
- Phosphoric acid (H_3PO_4)
- Uranium-contaminated gold
- Lead
- Mercury
- Sodium
- Sodium/potassium eutectic (NaK)
- Phosphorus pentoxide (P_2O_5)
- Fluorine gas (F_2)
- Photo-processing wastes (i.e., silver nitrat silver cyanide)
- Water treatment chemicals
- PuO_2
- Plutonium oxylate
- UO_2
- UO_3

3.3.2.3 Past Waste Spills, Releases, and Incidents

Numerous accidental waste spills and intentional releases of waste materials have occurred at TA-35. From 1951 to 1963, one of the primary functions at Ten Site was the operation of a wastewater treatment plant. This facility treated radioactive wastes produced by various reactor and hot cell experiments at TA-35. The wastewater treatment plant (designated as SWMU No. 35-003) was constantly

beset by problems, which resulted mainly from production of wastes at rates that overwhelmed the treatment capacity of the facility. Inadvertent spills of insufficiently treated, radioactively contaminated wastewater from the facility into the small canyon (SWMU No. 35-003[r]) off the east end of Ten Site Mesa were abundant. Also, effluent from the treatment facility was routinely released into this canyon. This effluent very often contained long-lived radionuclides (e.g., ^{90}Sr, ^{137}Cs) in quantities well-above allowable discharge tolerance. Spills and releases from the Ten Site treatment plant are discussed in the following text.

Several areas on TA-35 property have also been contaminated by spills of oil that was required for the laser operations. Many of these sites are designated as SWMUs and are discussed in Section 3.3.2.1, Waste Management Activities. Atmospheric releases of tritium, ^{235}U, ^{239}Pu, and other radionuclides that occurred at TA-35 are also summarized in the following text.

Spills and Releases from the Wastewater Treatment Facility

The following spills from the TA-35 wastewater treatment plant (SWMU No. 35-003) into the receiving canyon (SWMU No. 35-003[r]) have been documented in Laboratory memoranda and reports dating from 1952.

In late August or early September 1952, an estimated 2,000 to 3,000 gal. of liquid waste overflowed from the holding tanks at TA-35-10 (SWMU No. 35-003[d]) into Ten Site Canyon. Above-tolerance radioactivity (0.5 mR/hr) was found in Mortandad Canyon 3 mi from TA-35 during a survey conducted about 2 months after this spill (Aeby 1952, 04-0002). The wastewater probably did not travel more than 200 yd or so down the canyon, and subsequent rainfall was responsible for transporting the radioactive residue from the effluent farther down the canyon (Aeby 1952, 04-0002; Buckland 1952, 04-0035). The total amount of activity released during this incident was believed to be about 1,800 mCi (Aeby 1954, 04-0004).

Highly contaminated water was reportedly inadvertently dumped from tank T-4 (one of the four holding tanks at TA-35-10) in May 1954; one day before a routine soil-sampling mission was conducted in Mortandad Canyon. The amount of water dumped and an estimate of the activity of that water are not given, but samples taken from a clay layer immediately above bedrock were soaked with contaminated water. These samples, collected from a distance of 550 yd from the Ten Site fence and from a depth of 12 in. yielded counts as high as 770 c/m/g (Aeby and Garcia 1954, 04-0006). An accidental release reported on May 1, 1954 probably corresponds with this spill, which was estimated at 160-mCi total activity (Aeby 1954, 04-0003). Table 3-20 contains additional information on this spill.

TABLE 3-20

RADIOACTIVITY IN TEN SITE CANYON SEDIMENTS

Gross Beta-Gamma	Distance from east fence (in yards)			
(d/m/g)	20	100	220	320
Spring 1954[a]	2,500,000	30,000	60,000	55,000
Fall 1954	20,000	1,800	1,200	650
Spring 1955	16,000	–[b]	–[b]	–[b]

Source: LASL (1955, 0492).
[a] Following accidental spill on May 1, 1954 (Aeby and Garcia 1954, 04-0006).
[b] Data not available.

In late January 1955, a leak in a water line caused the four holding tanks at TA-35-10 (SWMU No. 35-003[d]) to be filled. Approximately 3,000 gal. of wastewater overflowed from the tank farm, and another 2,000 gal. was purposely discharged into the canyon. This incident resulted in the release of a total of about 20-mCi beta-gamma activity, of which as much as 25% (4 mCi) was ^{90}Sr (Aeby 1955, 04-0004; Keenan 1975, 04-0106).

In early September 1955, "the chronic wastewater problem" at Ten Site became "rather acute" as two of the storage tanks began to overflow, and "a few gallons" of waste flowed into the canyon (Aeby 1955, 04-0005). No estimate is given for the amount of radioactivity released to the canyon by this spill.

On February 11 and 12, 1956, the entire contents of Tank T-6 at TA-35-10, or about 21,200 gal. of radioactive lanthanum-140 wastewater, were accidently leaked into the canyon. A large amount of the highly radioactive, concentrated sludge at the bottom of the tank was also lost. Surveys conducted about a week later indicated activity of 1.5 R/hr 50 yd downstream from the discharge point (Christenson 1956, 04-0042). Soil samples taken at various points downstream from the tank farm at monthly intervals following this spill (see Table 3-21) revealed the following trends: concentrations of gross beta, gross gamma, and radiostrontium were initially much higher at locations near the discharge point, and decreased considerably with distance downstream. Activities of all types were essentially negligible at distances greater than 200 yd from the discharge point. Activities also remained highest at and near the point of release. These trends are believed to be due to the limited mobility of the sludge, in which radionuclides, especially the longer-lived varieties such as radiostrontium, were concentrated. Although radiostrontium initially represented a large percentage of gross-beta activity at the points nearest the tank farm, a sharp decline in gross-beta and radiostrontium levels with time suggested that ^{90}Sr accounted for only a small portion of total radiostrontium (LASL 1962, 04-0142). This spill released an estimated 0.64 Ci of ^{90}Sr (Keenan 1975, 04-0106). No figures for total release of radioactivity for this spill have been found.

In addition to the spills previously discussed, large volumes of radioactive liquid waste effluent were routinely discharged into Ten Site Canyon from the TA-35 wastewater treatment plant. Following original plant design, these wastes were simply held in storage tanks so that the activity of the ^{140}La and ^{140}Ba in the effluent would decay to a level within acceptable limits. In 1953, it was discovered that while ^{140}La and ^{140}Ba were indeed decaying out, longer-lived radionuclides, especially ^{90}Sr, were being concentrated in the waste and then released to the receiving canyon in amounts up to 1,000 times drinking water tolerance (Buckland 1953, 04-0037; Meyer 1954, 04-0156). In June 1955, an ion-exchange column was installed in the plant to remove radiostrontium (Emelity 1958, 04-0205). The assumption was that releases before that date likely contained radiostrontium in excess of tolerance even though total radioactivity levels may have been acceptable. Also, in 1956 plutonium became a constituent of the Ten Site waste stream (Christenson 1956, 04-0043; H-Division 1956, 0471). The ion-exchange columns removed only about half of the plutonium from the wastewater, and other attempts at plutonium removal produced little success (H-Division 1956, 0472). Concentrations of ^{238}Pu and ^{239}Pu as high as 100 times background levels found in soil samples taken near the outfall in Ten Site Canyon (SWMU No. 35-003[r]) attest to the presence of plutonium in effluent released from the Ten Site facility (Purtymun 1971, 0190).

Contaminated water was probably not discharged into Mortandad Canyon before September 1, 1951, according to a LASL memorandum (Aeby 1954, 04-0003). This memorandum also contains an account of radioactivity discharged into the canyon

TABLE 3-21

RADIOACTIVITY IN TEN SITE CANYON SEDIMENTS

Gross Beta (c/m/g)	Distance from outfall (in meters)				
	0	60	400	670	930
Feb. 20, 1956[a]	824,000	885,000	29,600	2,000	1,200
Mar. 21, 1956	160,700	—[b]	—[b]	—[b]	—[b]
Apr. 26, 1956	485,860	—[b]	—[b]	—[b]	—[b]
June 4, 1956	231,060	—[b]	—[b]	—[b]	—[b]
Aug. 7, 1956	345,370	—[b]	—[b]	—[b]	—[b]
Aug. 26, 1957	23,480	3,270	2,510	750	20
Feb. 5, 1958	87,420	1,910	2,440	130	—[b]
Sep. 11, 1959	4,990	—[b]	—[b]	—[b]	—[b]
Nov. 19, 1959	2,801	237	294	33	<1
July 25, 1960	830	370	1470	260	<1
Apr. 4, 1961	2,130	590	1530	1440	850
Sep. 6, 1961	870	—[b]	—[b]	—[b]	—[b]
Strontium (pCi/g)					
1956	320,000	210,000	56,000	42,000	2,000
1957	3,800	1,400	87	350	14
1958	2,500	750	1,400	69	10
1959	61	39	110	34	—[b]
1960	130	76	89	76	—[b]
1961	30	22	20	20	—[b]

Sources: LASL (1962, 04-0142), and LASL (1972, 04-0145).

[a] Following accidental spill of wastewater and sludge, February 11-12, 1956 (Christenson 1956, 04-0042).

[b] Data not available.

from Ten Site and the Incinerator Site (TA-42) between September 1951 and August 1954. Of the eight discharges listed, only two exceeded tolerance for radioactivity, and both of these were accidental spills previously discussed. The list of discharges totals about 2.3-Ci activity, of which 1.8 Ci was from the spill in early September 1952.

On October 21, 1952, 50,000 gal. of "hot" water, containing about 1.5 mCi per liter (well above tolerance), was released from the Ten Site wastewater treatment plant, with Laboratory approval. This release was monitored and disappeared into the ground within a distance of 175 yd from the point of release. At 175 yd from the point of release, activity of the water was measured at 100 mR/hr (Aeby 1952, 04-0002). The total activity of this release was estimated at 110 mCi (Aeby 1954, 04-0003).

In late May or June 1953, 100,000 gal. of wastewater from Ten Site were released into Ten Site Canyon (H-Division 1953, 0466). Total activity of this effluent was reported to be less than the discharge tolerance level, and the highest activity observed in the canyon after the release (the time of survey was unspecified) was 2 mR/hr. A total of 300,000 gal. of wastewater was released from Ten Site during

1953. This waste reportedly contained 1.9 Ci of mixed $^{89}Sr/^{90}Sr$, of which about 25 percent was ^{90}Sr (Keenan 1975, 04-0106).

The amounts of liquid waste treated at Ten Site, on a monthly basis for the period from July 1955 (when ion-exchange treatment began) through December 1967, are summarized in a handwritten document (LASL circa 1972, 04-0145). Information from this source for the period from July 1955 through July 1963 (when the TA-50 waste treatment facility came on line) is presented in Table 3-22. The figures given in the table are for the volume of waste treated, and not necessarily the volume discharged (not all treated water is discharged, some is recirculated). However, unless otherwise noted, the amount of wastewater discharged to Ten Site Canyon as effluent closely approximates the amount treated. For example, during the year 1957, a total of 465,850 gal. was treated (H-7 circa 1958, 0700). Of this amount, 430,400 gal. (92%) was discharged, while the remaining 7% was recirculated. In terms of effluent quality, 93% of the radioactivity was removed by treatment. Even so, the effluent exceeded drinking water standards for ^{90}Sr. At the end of 1957, insufficient tank storage capacity at TA-35 necessitated the discharge of "some effluent of a quality which normally would have been recirculated...Discharge was the only practical alternative to direct overflow" (H-Division 1958, 0478).

After June 1963, no more wastes were released from the TA-35 waste treatment facility. From this time on, all wastes from TA-35 were either sent directly to the new treatment plant at TA-50 or temporarily stored in the tanks at TA-35 and then sent to TA-50.

Incidents

On November 6, 1957, an accidental "spill" of ^{140}La occurred in the Ten Site hot cell in TA-35-2 (H-Division 1957, 0626). Cleaning this spill required the passage of large volumes of wash water through the cell, and resulted in "extremely high gamma radiation at the tank farm" (H-7 circa 1957, 0700). Activity of the wastewater in the storage tanks was so high (100,000 c/m/ml) that the wastes could not be treated by ion exchange, so the wastes were chemically precipitated by treatment with iron, caustic, and lime. The chemical treatment lowered the activity of the water to 5,000 c/m/ml and made ion exchange of the supernatant again feasible, but left a highly concentrated, radioactive sludge in the bottom of the tanks. The high level of radioactivity at the treatment facility caused by this incident presented an extreme radiation hazard to personnel. To circumvent the closing of a portion of Ten Site laboratory and to prevent the dumping of this highly radioactive waste into the canyon, four workers were allowed to receive doses in excess of allowable yearly amounts (Christenson 1957, 04-0216; Shipman 1957, 04-0230; H-7 circa 1957, 0700).

On March 11, 1958, another incident occurred whereby 1 to 1.5 KCi of ^{140}La was lost from the hot cell during processing of several lanthanum sources. This led to tanks T-4 and T-5 at TA-35-10 becoming extremely "hot." Activity exceeded 2.5 million c/m/ml in T-4, which necessitated chemical treatment because the waste was too hot to treat by ion exchange. Extremely high radiation at the tank farm again presented a very hazardous situation for Ten Site workers (Christenson 1958, 04-0044; Emelity 1958, 04-0205).

TABLE 3-22

WASTEWATER TREATED AT THE TA-35 TREATMENT FACILITY (1955-1963)

Year	Month	Total Treated [a]	Comments
1955	July	22,000	
	Aug.	18,000	
	Sept.	—	Possible raw discharge.
	Oct.	—	Possible raw discharge.
	Nov.	—	Possible raw discharge.
	Dec.	—	Possible raw discharge.
1956	Jan.	—	Effluent did not meet standard for ^{90}Sr.
	Feb.	—	Effluent did not meet standard for ^{90}Sr.
	March	—	Effluent did not meet standard for ^{90}Sr.
	April	—	Effluent did not meet standard for ^{90}Sr.
	May	0	Plant did not operate.
	June	42,630	
	July	?	No information available.
	Aug.	13,360	
	Sept.	44,800	
	Oct.	110,000	
	Nov.	35,000	
	Dec.	25,300	
1957	Jan.	—	
	Feb.	30,000	
	March	43,000	
	April	23,000	
	May	27,000	
	June	43,600	
	July	75,130	
	Aug.	60,000	
	Sept.	61,500	
	Oct.	—	
	Nov.	—	Tank farm and pump house too "hot" to operate because of a spillof 1-10 KCi of ^{140}La source (November 6, 1957).
	Dec.	—	
1958	Jan.	56,600	
	Feb.	32,140	
	March	61,600	Waste highly radioactive because of second lanthanum source spill (March 11, 1958).
	April	9,130	
	May	38,800	
	June	57,300	
	July	37,800	
	Aug.	—	No treatment, storage only.
	Sept.	—	No operation of plant.
	Oct.	—	No operation of plant.
	Nov.	"limited"	Difficult to produce effluent of
	Dec.	"limited"	satisfactory quality.

TABLE 3-22 (continued)

WASTEWATER TREATED AT THE TA-35 TREATMENT FACILITY
(1955-1963)

Year	Month	Total Treated [b]	Comments
1959	Jan.	"limited"	Operated as required.
	Feb.	—	No treatment, storage only.
	March	62,250	
	April	92,000	
	May	54,000	
	June	85,290	
	July	71,688	
	Aug.	114,000	
	Sept.	33,370	
	Oct.	23,100	
	Nov.	44,900	
	Dec.	—	Storage only.
1960	Jan.	—	Storage only.
	Feb.	26,400	
	March	—	Storage only.
	April	—	Storage only.
	May	—	Storage only.
	June	98,100	
	July	—	Storage only.
	Aug.	45,700	
	Sept.	25,000	
	Oct.	25,132	
	Nov.	97,800	Treated and stored; not discharged.
	Dec.	74,100	
1961	Jan.	48,400	
	Feb.	93,200	
	March	68,670	
	April	—	Storage only.
	May	—	Storage only.
	June	49,050	
	July	107,760	
	Aug.	19,350	Possible leaks in raw waste line.
	Sept.	—	Storage only.
	Oct.	—	Storage only.
	Nov.	—	Storage only.
	Dec.	—	Storage only.
1962	Jan.	—	Storage only.
	Feb.	—	Storage only.
	March	—	Storage only.
	April	90,150	
	May	50,800	
	June	—	Storage only.
	July	85,300	
	Aug.	32,000	
	Sept.	63,200	
	Oct.	—	Storage only.
	Nov.	—	Storage only.
	Dec.	—	Storage only.

TABLE 3-22 (concluded)

WASTEWATER TREATED AT THE TA-35 TREATMENT FACILITY (1955-1963)

Year	Month	Total Treated [b]	Comments
1963	Jan.	—	Storage only.
	Feb.	—	Storage only.
	March	—	Storage only.
	April	105,530	
	May	—	Storage only.
	June	—	Storage only.

Source: LASL (circa 1972, 04-0145).
[a]Volume of waste treated is in gals.

Oil Spills

Numerous oil spills have occurred at TA-35, primarily in the 1980s. Most spills are from siege tanks and holding tanks for dielectric oils used in capacitors and Marx generators associated with laser operations. Oil spill areas designated as SWMUs and AOCs have been discussed in Section 3.3.2.1, Waste Management Activities. SWMUs related to oil spills include SWMU Nos. 35-011(b and c), 35-016(f, l, and n), and 35-018(a and b). Also, AOCs involving oil spills and potential oil releases include C-35-001, C-35-002, C-35-003, C-35-004, C-35-005, and C-35-008.

Atmospheric Releases

Both planned and unplanned releases of radioactive constituents to the atmosphere have occurred at TA-35. Nonradioactive hazardous substances may also have been released, although this has not been documented. Radionuclides released to the atmosphere during early operations at TA-35 were primarily ^{140}La and ^{90}Sr. These radionuclides were released from TA-35-7, the Air Filter Building, during operation of the radioactive lanthanum-140 program (^{140}La source processing) during the 1950s (LASL circa 1973, 04-0147). No data have been obtained that provide information on quantities of radionuclides released while the ^{140}La source processing program was in operation. Significant atmospheric releases are suspected. In 1956, air samples taken during a run in the ^{140}La hot cell were determined to be "too hot to count." Modifications were made to continuously monitor emissions from the Ten Site stack (H-Division 1956, 0473), but monitoring data have not been found.

In the mid to late 1950s, experimentation with other radionuclides (primarily plutonium and tritium) began in TA-35-2. Quantities of normal airborne releases of radionuclides from TA-35-2 from 1967 through 1971 are presented in Table 3-23. In 1972, airborne radioactive effluent from TA-35 included minor amounts of ^{238}Pu and ^{239}Pu and significant releases of tritium (Herceg 1973, 0440). Thousands of curies of tritium were released to the atmosphere each year from the tritium facility in TA-35-2 between 1953 and 1974 (Harper and Garde 1981, 0458). In 1970, a total of 25,000 Ci of tritium was released (Voelz 1971, 04-0194). Even after use of the tritium facility was discontinued in 1974, significant amounts of tritium were released by degassing (Harper and Garde 1981, 0458). Potential soil contamination from atmospheric releases from the stack of TA-35-2 is addressed as SWMU No. 35-014(a).

Atmospheric releases of ^{238}Pu, ^{239}Pu, and tritium from TA-35 between the years 1974 and 1988 are summarized in Table 3-24.

TABLE 3-23

AIRBORNE RELEASES OF RADIONUCLIDES FROM TA-35-2, 1967 THROUGH 1969 AND 1971

Source of Pollutant	Pollutant	Total Discharge (Ci) 1967	1968	1969	1971
TA-35-2, FE-2	^{235}U, ^{239}Pu[a]	1.8×10^{-6}	1.7×10^{-6}	2.0×10^{-6}	3.0×10^{-6}
TA-35-2, FE-3	^{239}Pu	8.0×10^{-7}	7.0×10^{-7}	9.0×10^{-6}	1.0×10^{-6}
TA-35-2, FE-6	^{239}Pu	2.9×10^{-6}	2.3×10^{-6}	2.0×10^{-6}	1.0×10^{-6}
TA-35-2, FE-7	^{239}Pu	3.0×10^{-7}	4.0×10^{-7}	4.5×10^{-7}	2.0×10^{-6}
TA-35-2, FE-8	^{239}Pu	8.0×10^{-7}	8.0×10^{-7}	2.2×10^{-7}	0.2×10^{-6}

Source: Wingfield (1971, 04-0204); Voelz (1971, 04-0194); LASL (1972, 04-0146).
[a] Only ^{239}Pu for 1971.

TABLE 3-24

ATMOSPHERIC RELEASES OF RADIONUCLIDES FROM TA-35, 1974 THROUGH 1988

Year	$^{238,239}Pu$ (μCi)	^{3}H (Ci)	Reference
1988	0.2[a]	118	(ESG 1989, 0308)
1987	0.6[a]	155	(ESG 1988, 0408)
1986	0.4[a]	48	(Purtymun and Maes 1987, 0203)
1985	0.6[a]	5.3	(Becker 1986, 0027)
1984	0.4[a]	206	(Becker et al, 1985, 0029)
1983	0.9[a]	6	(Purtymun et al. 1984, 0210)
1982	1.3	—	(ESG 1983, 0621)
1981	0.27	—	(ESG 1982, 0620)
1980	0.21	25	(ESG 1981, 0424)
1979	7.4	1300	(ESG 1980, 0406)
1978	2.0	676	(Hakonson et al. 1979, 0119)
1977	0.8	786	(ESG 1978, 0095)
1976	2.4	1657	(ESG 1977, 0618)
1975	5.9	2394	(Apt and Lee 1976, 0617)
1974	8.0	1400	(Apt and Lee 1975, 0616)

[a]Total includes ^{240}Pu for 1983-1988.

3.3.2.4 Environmental Surveys and D&D Activities

Environmental Surveys

As early as 1952, surveys for radioactivity in soil, sediment, and water (when present) were taken on a regular basis and after known waste spills in Mortandad and Ten Site canyons. Samples were also taken in the small canyon at the east end of Ten Site Mesa (SWMU No. 35-003[r]). The results of many of these specific surveys are provided in Section 3.3.2.3, Past Waste Spills, Releases, and Incidents, and will not be repeated here. Data from some longer-term surveys and studies are discussed in the following paragraphs. In general, these surveys revealed significantly high levels of radioactivity at and within a few hundred yards from the point of discharge from the treatment plant, and a rapid decrease in activity with distance down canyon from the tank farm (refer to Tables 3-20 and 3-21). After major spills, detectable levels of activity were found as far as 3 mi down Mortandad Canyon from the Ten Site east fence (Aeby 1952, 04-0002). Following major spills, surveys also showed a substantial decrease in radioactivity over time because of radioactive decay. For example, in 1956, environmental surveys in Ten Site Canyon picked up ^{89}Sr and ^{90}Sr at levels of 0.94 Ci/g and 0.17 Ci/g, respectively. By 1973, ^{89}Sr, ^{140}Ba, and ^{140}La had decayed away in Mortandad Canyon to undetectable levels (Fowler 1973, 04-0069). Residual radioactive contamination of Ten Site Canyon is primarily due to the presence of long-lived radionuclides, particularly ^{90}Sr, that were present in the wastewater released from the treatment facility in the early to mid-1950s, before the installation of effective ion-exchange columns and the implementation of treatment by chemical precipitation methods.

Sediment in Ten Site Canyon below TA-35 also contains plutonium (^{238}Pu, ^{239}Pu) in levels as high as 0.819 d/m/g (two orders of magnitude greater than background) (Purtymun 1971, 0190). This is probably residual from effluent released from Ten Site in the late 1950s, when small quantities of plutonium were used in experiments. Efforts to remove plutonium from the Ten Site waste stream were ineffective (H-Division 1956, 0471; H-Division 1956, 0472). Shallow groundwater in the alluvial aquifer of Mortandad Canyon also contains above-background levels of tritium, which can possibly be attributed to liquid waste released from TA-35 in the late 1950s or early 1960s (Purtymun 1973, 0191). Because of past spills and releases from the Ten Site waste treatment facility, a small tributary of Ten Site Canyon directly east of TA-35 (SWMU No. 35-003[r]) remains "hot." In April 1988, during a radiation site surveillance of TA-35 for the ER Program, readings of 100 µR/hr were detected in this canyon immediately east of the former location of TA-35-10, and 80 µR/hr were detected 50 ft further down in the canyon (Shafer circa 1989, 04-0187).

Subsurface soils at the eastern end of Ten Site Mesa are also radioactively contaminated by leaks and spills from structures associated with the wastewater treatment plant. On February 12 and 13, 1985, a total of 86 soil samples were taken in the vicinity of TA-35-10 (SWMU No. 35-003[d]). Measurements greater than the subsurface soil guideline for beta activity (≤75 pCi/g) were found in 37 of the samples, with 356 pCi/g as a maximum level. The activity was primarily from $^{90}Sr/^{90}Y$. Most of the samples were taken at depths of 18 to 20 ft. Because of problems with further excavation at these depths, Laboratory employees made the decision to backfill the area and to halt further remediation (Cox 1985, 04-0050).

Since 1977, fruit and vegetable samples have been collected at the Laboratory and at several locations in the surrounding area to monitor foodstuffs for possible radioactive contamination from Laboratory operations (ESG 1977, 0618). Samples

are analyzed for tritiated water, ^{90}Sr, ^{238}Pu and ^{239}Pu, and total uranium (ESG 1982, 0620). Tables 3-25, 3-26, 3-27, and 3-28 summarize the analytical results for peach samples collected from TA-35 over past years. The peach trees are located on the south side of TA-35-2 immediately beneath the stack from which off-gasses containing tritium and other radionuclides were released (SWMU No. 35-014[a]). The conclusion was that the slightly elevated concentrations of tritium in these peaches represented no significant health hazard to the general public for three reasons: the trees are within the TA-35 Laboratory fence; the peaches represent a very small volume of ingestible water; and the samples contain considerably less tritium than the DOE's Concentration Guide for Water in Uncontrolled Areas, which is 3,000 pCi/ml, and the EPA's National Interim Primary Drinking Water Standard for tritium in drinking water, which is 20 pCi/ml (ESG 1982, 0620). In the 1978 survey, the trees produced a small crop of peaches, which disappeared before the

TABLE 3-25

URANIUM CONCENTRATION IN TA-35 PEACHES

Year	Water Source	No. of Samples	Uranium Concentration (ng/g)[a] Average (± 10)	Range
1977	LA County/DOE	1	1.1	—[b]
1978[c]	LA County/DOE	1	184	—[b]
1980	Community System	1	—[b]	18.7

Sources: LASL Environmental Surveillance Reports (ESG 1978, 0095; Hakonson et al. 1979, 0119; ESG 1981, 0424).

[a] Dry weight.

[b] No data available.

[c] 1978 data are from analysis of peach leaves.

TABLE 3-26

TRITIATED WATER CONTENT OF TA-35 PEACHES

Year	Water Source	No. of Samples	Tritiated Water Concentration (10^{-6} µCi/ml) Average (± 15)	Range	Average Moisture (%)
1977	LA County	2	66 ± 22	50-81	—[a]
1978[b]	LA County	1	17	—[a]	60-96
1979	Community System	1	21.5	—[a]	86
1980	Community System	1	8.3 ± 0.5[c]	—[a]	85 ± 5
1981	Community System	1	17.0 ± 0.4[d]	—[a]	87
1982	Community System	1	15.7	—[a]	47 > 96

Sources: LASL/LANL Environmental Surveillance Reports (ESG 1978, 0095; Hackonson et al. 1979, 0119; ESG 1980, 0406; ESG 1981, 0424; ESG 1982, 0620; ESG 1983, 0621).

[a] No data available.

[b] 1978 data are from analysis of peach leaves.

[c] Counting uncertainty.

[d] Dry weight.

TABLE 3-27

^{90}SR CONTENT OF TA-35 PEACHES

Year	Water Source	No. of Samples	^{90}Sr Concentrations(pCi/ml)[a] Average (±10)	Range
1978[b]	LA County	1	1.58 ± 0.06	—[c]
1980	Community System	1	- 0.005	—[c]

Sources: LASL Environmental Surveillance Reports (Hackonson et al. 1979, 0119; ESG 1981, 0424).
[a]Dry weight.
[b]1978 data are from peach trees.
[c]No data available.

TABLE 3-28

PLUTONIUM CONTENT OF TA-35 PEACHES

Year	Water Source	No. of Samples	^{239}Pu (10^{-3} pCi/g)[a] Average (±15)	Range	^{239}Pu (10^{-3} pCi/g)[a] Average (±15)	Average Moisture (%)
1977	Plutonium concentrations were less than detection limits (~0.01 pCi/g)					
1978[b]	LA County	1	—[c]	—[c]	0.85	0.85
1979	Community System	1	-0.50	—[c]	-0.40	—[c]
1980	Community System	1	0.0002 ± 0.0001[d]	—[c]	0.0006 ± 0.00007[d]	—[c]
1981	Community System	1	-0.1	—[c]	1.6	—[c]

Sources: LASL/LANL Environmental Surveillance Reports (ESG 1978, 0095; Hackonson et al. 1979, 0119; ESG 1980, 0406; ESG 1981, 0424; ESG 1982, 0620).
[a]Dry weight.
[b]1978 data are from analysis of peach leaves.
[c]No data available.
[d]Counting uncertainty.

Laboratory was able to sample them. That year, leaves were analyzed as being representative of the peaches. Uranium and plutonium levels found on the leaves were determined to be from fallout or contamination on the leaf surface and not from the water supply (Hakonson et al. 1979, 0119).

Results of the 1978 peach tree sampling indicated slightly elevated ^{90}Sr concentrations. This contamination at TA-35 was likely because of early work at the site on radioactive lanthanum sources in which ^{90}Sr was a contaminant. The conclusion was that the peach leaves were not a route of ingestion of uranium, and the peaches would not have as much ^{90}Sr contamination as the leaves because of the lower surface to volume ratio of the peaches (Hason et al. 1979, 0119).

D&D Activities

Several facilities at the east end of TA-35 became highly contaminated with radioactivity during the early operations at the Ten Site Laboratory. Most of these portions of the TA have been decommissioned and at least partially decontaminated. Decommissioned Ten Site facilities include the wastewater treatment plant (SWMU No. 35-003); the tritium glovebox facility in TA-35-2 (proposed SWMU No. 35-020); three reactors (LAPRE-I, LAPRE-II, and LAMPRE); and the sodium disposal tanks (SWMU No. 35-001).

The waste treatment facility, previously discussed as SWMU No. 35-003, was used between 1951 and the mid-1970s to handle radioactive liquid wastes produced by operations at TA-35. Waste treatment stopped in 1963 because of the discontinuation of the radioactive lanthanum-140 program and the opening of a new treatment plant at TA-50, to which TA-35 wastes were then piped. However, the tanks at TA-35 were used at times for storage of low-level wastes as late as 1974 (Kennedy 1968, 04-0107; Emelity et al. 1975, 0282). Most portions of the treatment plant became radioactively contaminated during the course of operation and were considered a high priority for D&D efforts after discontinuation of their use (H-Division 1958, 0478; Bradshaw 1977, 04-0031; Emelity 1979, 04-0062).

Most structures and lines associated with the waste treatment facility were removed and/or decontaminated between 1980 and 1985. A major portion of the treatment facility (air washers, ion-exchange columns, and associated piping) was housed in the Air Filter Building (TA-35-7; SWMU No. 35-003[p]). These components were disassembled, removed, and disposed of during the Surplus LASL Facility Disposition in 1980 (LANL circa 1981, 04-0209). The air washers were contaminated primarily with ^{90}Sr and ^{137}Cs from air filtration during operation of the radioactive lanthanum-140 facility in the mid-1950s (LASL 1977, 0649). The ion-exchange columns became highly contaminated several times because of accidents in the radioactive lanthanum-140 cell.

The sludge-holding tank (TA-35-22; SWMU No. 35-003[m]), a 25,000-gal. storage tank (TA-35-36; SWMU No. 35-003[e]), and several waste lines were removed in August 1981 as part of Sub-Project B of Work Project I.2, the Radioactive Liquid Waste System Improvements Project. Soil around and beneath the sludge tank (SWMU No. 35-003[m]) was found to be contaminated to as high as 46,000 d/m/g with ^{90}Sr and ^{137}Cs. Soil was excavated laterally until above-background activity could not be detected and downward to solid bedrock (about 4 ft beneath the bottom of the tank, or 10-ft-below surface). At this depth, fractures in the tuff contained activity levels as high as 5,000-pCi/g gross beta (McAtee 1981, 04-0154). Because further decontamination would have required "large heavy equipment and an inordinate quantity of soil removal," and because "the probability of significant exposure due to any future intrusion into the contaminated area" was very low, the excavation pit was backfilled with clean soil. Laboratory personnel determined that the area was decontaminated, an ALARA decision was made (McAtee 1981, 04-0154). The extent of soil contamination in the vicinity of TA-35-36 is unknown. Excavated structures, lines, and associated contaminated soil were taken to TA-54 for disposal.

Several other structures and lines associated with the Ten Site wastewater treatment plant were removed, decontaminated, and taken to TA-54 for disposal in 1984-1985, during Phase II.5 of Sub-Project B. A pump house and pipe trench (TA-35-8 and -9; SWMU Nos. 35-003[l and q]) and associated piping were removed in December 1984. No radioactive contamination was detected on these structures (Cox 1985,

04-0047). Removal of a manhole (TA-35-12; SWMU No. 35-003[o]) and Line 90A, along with 66 m^3 of contaminated soil adjacent to the east wall of the Air Filter Building (TA-35-7), was completed in January 1985 (Cox 1985, 04-0049). Up to 7-nCi/g gross-beta contamination was left in the soil next to TA-35-7 at a depth of about 9 ft. Because continued excavation was thought to endanger the integrity of the wall, which was also contaminated, the area was decontaminated and backfilled; an ALARA decision was made (Cox 1985, 04-0048).

Removal of the four 50,000-gal. liquid-waste holding tanks (TA-35-10; SWMU No. 35-003[d]) was completed in February 1985. Numerous spills and overflows of radioactive waste from these tanks occurred in the 1950s, and the soil around and beneath the tanks was highly contaminated. Decommissioning of this structure required excavation to a depth of 18 to 20 ft below grade, and removal of 340 m^3 of soil. Up to 356-pCi/g gross-beta activity from $^{90}Sr/^{90}Y$ was left in the soil at that depth, and the pit was backfilled with clean soil. The area was determined to be decontaminated; an ALARA decision was made (Cox 1985, 04-0050). The Caustic Treatment Building (TA-35-41) and a retention tank (TA-35-31; SWMU No. 35-003[h]) and associated soils were also removed in February 1985. No contamination was associated with these structures or underlying soils (Cox 1985, 04-0051).

Several sections of radioactive waste lines (SWMU No. 35-003[miscellaneous]) and associated soils, many of which were contaminated, were also removed during this period. Gross-beta contamination as high as 3,243 pCi/g ($^{90}Sr/^{90}Y$) was found in the soil at depths of 17 to 20 ft below grade in the trench from which Lines 90, 90B, 91, and 92 were removed. These lines ran east/west along the north side of TA-35-7, and connected the Air Filter Building to the holding tanks (TA-35-10). An ALARA decision was made concerning the decontamination of these lines during excavation; however, up to 1,100-pCi/g beta activity remains in the soil in the backfilled trench (Cox 1985, 04-0052). Although most of the waste lines associated with structures TA-35-8, -9, and -10 were removed during decommissioning in 1985, small segments of piping remain. An 18-ft-long contaminated section of 4-in-diameter stainless-steel pipe remains at a depth of 6 ft under the foundation of a transformer oil storage bank. Another 17-ft section of this same pipe remains under two concrete-encased water mains (Elder et al.1986, 0456; LANL 1990, 0145).

The phase separator pit (TA-35-3; SWMU No. 35-003[n]) and three 600-gal. concrete underground storage vaults (TA-35-4, -5, -6; SWMU No. 35-003[a, b, and c]), used for temporary storage of radioactive liquid waste, were left in place during D&D activities in the 1980s. Removal and decontamination of these portions of the Ten Site waste treatment plant were planned to begin in late 1991 under Lab Job No. 10724-35 (Gonzales 1991, 04-0088). Soil samples taken from the phase separator pit in 1980 showed radioactive contamination with activities up to 2,000 dpm/60 cm^2. Samples taken from the pit in 1990 showed activities as high as 10,000 dpm/60 cm^2. D&D plans include the removal of the phase separator pit, the three storage tanks, and any soils contaminated with radionuclides or hazardous chemicals. These materials will be disposed of at TA-54.

The tritium facility, which operated in Rooms A-12, A-12A, and A-12B in the basement of TA-35-2 from 1953 until 1974, released large volumes of tritium to the atmosphere. Because the exhaust system was not equipped for tritium removal, a few thousand curies of tritium were released each year while the facility was in operation. A total of 25,000 Ci of tritium were released to the atmosphere in 1970 (Voelz 1971, 04-0194). Even after discontinuation of use, the facility represented the largest single source of tritium released annually by the Laboratory (LASL 1977, 0649). The need to decontaminate the tritium glovebox line and associated

equipment and piping was documented in the mid-1970s (Jordan 1975, 04-0104; Garde 1976, 04-0085). Because of the extreme radiation hazard to workers in TA-35-2, the tritium facility was considered a very high priority for D&D (second of all Laboratory facilities) in the "LASL Ten-Year Decontamination/Decommissioning Site Plan" (LASL 1977, 0649). Removal and decontamination of the gloveboxes was considered to be the highest priority at the Laboratory in a DOE National D&D Planning Survey (Garde 1978, 04-0086).

Removal of the "tritium works" was accomplished during April until June 1979 (Winburn 1979, 04-0201). Decommissioning generated almost 600 ft^3 of waste contaminated with an estimated 6,000 Ci of tritium, which was disposed of in a pit at TA-54. Also, of the 1,300 Ci of tritium released to the atmosphere from TA-35-2 in 1979, 1,080 Ci can be attributed to D&D activities (Harper and Garde 1981, 0458). Laboratory personnel certified adequate decontamination of the glovebox room in TA-35-2 (Harper 1979, 04-0096). However, cleanup of soils contaminated by atmospheric release of tritium was not addressed in the decontamination of the tritium facility. Uptake of tritium and other radionuclides by fruit trees on the south side of TA-35-2 near the tritium exhaust stack suggests soils at the east end of TA-35 may be contaminated with tritium (refer to SWMU No. 35-014[a]).

The three reactors that operated at TA-35 between 1956 and 1964 (LAPRE-I, LAPRE-II, and LAMPRE I) have all been disassembled and decommissioned. Details on these experimental reactors are given in the discussions of SWMU No. 35-002 (MDA-X) and SWMU No. 35-017 (Soil Contamination from Reactor Operations). LAPRE-I was built in 1955 in the basement of TA-35-2, and operated less than one year, beginning in February 1956 (H-Division 1955, 0482; H-Division 1956, 0468). The disassembly of LAPRE-I and the removal of associated waste lines is mentioned in the H-Division Progress Report (H-Division 1957, 0474). The fate of this reactor after discontinuation of operation is poorly documented, but the LAMPRE reactor was built at the former site of LAPRE I, and at least portions of LAPRE-I may have been used in construction of LAMPRE (LANL 1990, 0145).

LAPR- II was constructed in a pit south of TA-35-2 in the late 1950s, operated from February until May of 1959, and was defueled and disassembled the same year (H-Division 1959, 0480; LASL 1977, 0649; Montoya 1991, 04-0162). The reactor was fueled by a solution of $^{235}UO_2$ dissolved in 95% phosphoric acid, and was cooled by water and moderated by phosphoric acid and water (Montoya 1991, 04-0162). The reactor vessel, a fuel reservoir, and the pipe that connected the two were buried in place about 8 ft below grade and covered with dirt and asphalt in 1968 (Garcia 1968, 04-0084; Warren 1974, 04-0197) at the site called MDA-X (SWMU No. 35-002). All other equipment associated with LAPRE-II was removed in 1959; the location to which this material was taken is not documented (LASL 1977, 0649). The reactor vessel and related systems are expected to be neutron-activated and contaminated with fission products (Montoya 1991, 04-0162). The fuel reservoir is thought to contain an estimated 30 g (0.1 Ci) of residual ^{235}U fuel solution (Warren 1974, 04-0197; Graf and Howard 1978, 04-0090). Excavation and removal of LAPRE-II to TA-54 was planned as part of the "LASL Ten-Year Decontamination / Decommissioning Plan" for the 1980s, but because of the low-level radiation hazard was given relatively low priority (16 out of 17 D&D projects) (LASL 1977, 0649).

Removal of the LAPRE-II reactor and fuel reservoir was under way during the summer of 1991 under Work Order No. 6575723 (Gonzales 1991, 04-0089). The goals of this D&D project include the removal and disposal of the reactor vessel, the fuel reservoir, the connecting pipe, and contaminated soil in accordance with DOE guidelines. Soils will be monitored for radioactive and hazardous chemical

contamination during the excavation process. Although the vessel was flushed of all liquids before burial and no chemical contamination is expected, some residual phosphoric acid may be present (Montoya 1991, 04-0162).

The vertical sodium tanks, in which contaminated liquid sodium coolant from the LAMPRE reactor was disposed (MDA-W, or SWMU No. 35-001), were decommissioned in 1980 during the "Surplus LASL Facility Disposition Project." This process consisted of the removal of the metal shed that covered the aboveground portions of the tanks, and then of the entombment of the tanks in a concrete structure (TA-35-43) (LANL circa 1981, 04-0209).

3.3.3 Regulatory Activities

3.3.3.1 Permits

Permits associated with TA-35 operations other than the NPDES permits for the drains and outfalls do not exist. NPDES permitted outfalls are discussed in Section 3.3.2.1, Waste Management Activities, under SWMU No. 35-016.

3.3.3.2 Interim Corrective Measures

Surface impoundments listed as SWMU No. 35-005(a and b) and SWMU No. 35-006 were closed under RCRA interim status closure standards in 1989. As part of the closure procedure at SWMU No. 35-005(a), a UST (SWMU No. 35-012[a]), which was connected to the surface impoundment, was removed in 1990. The final closure report and closure certification letter for these closure procedures were submitted to NMED in 1991. Also, two USTs listed as SWMU No. 35-011(d) were removed in accordance with NMED UST regulations in 1991. Other interim corrective measures taken at TA-35 include the 1991 removal and decontamination of LAPRE-II (SWMU No. 35-002) and the planned removal and decontamination of the phase separator pit (SWMU No. 35-003[n]) and associated underground holding tanks (SWMU Nos. 35-003[a, b, and c]). These corrective measures are being conducted by Group EM-7 (formerly Group HSE-7) of the Laboratory with concurrence from the EPA.

3.4 Description of Former TA-42, Incinerator Site

3.4.1 Site Location and Physical Description

Former TA-42 was located within the current boundaries of TA-55, the Plutonium Processing Facility. In 1951, an incinerator was built at this site for volume reduction of low-level plutonium-contaminated wastes. The incinerator, which was never fully operational, was shut down in 1952, and all structures associated with the facility were removed in 1978. The following subsections provide a detailed description of the site.

3.4.1.1 Geographic Location and Local Area Description

Former TA-42 was located north of Pajarito Road and Pecos Drive at an approximate latitude and longitude of 35°51'45" N and 106°18'00" W (USGS 1984, 04-0239). The

site is located on a narrow mesa formed between Mortandad Canyon on the north and Two Mile Canyon, a branch of Pajarito Canyon, on the south. The former site is near the north edge of the mesa adjacent to the steep slope of the Mortandad Canyon wall. The elevation at TA-42 is about 7,250 ft (LANL 1990, 0145). The mesa on which former TA-42 was situated lies within the present boundaries of the Laboratory in Los Alamos County.

3.4.1.2 Physical Site Description

Former TA-42 was located in the area that lies between Mortandad Canyon and the current position of the north fence of TA-55 (Figure 3-7). None of the structures from TA-42 presently exist; all were removed during a 1978 D&D project (Harper and Garde 1981, 0457). The site has since remained undeveloped, and serves as a buffer for TA-55, which was constructed immediately south of former TA-42. The structures that composed TA-42 are described in Table 3-29, and the former locations of these structures are shown in Figure 3-7.

TABLE 3-29

DESCRIPTION OF STRUCTURES AT TA-42

- **TA-42-1, Incinerator and control building.** Constructed in 1951, removed in 1978. The major features of the steel-frame structure covered with corrugated metal included a 185-m^2 floor-area control building, incinerator, cyclone dust collector, spray cooler, Venturi scrubber, filter bank, and ash separator (Harper and Garde 1981, 0457). The area has been designated as SWMU Nos. 42-00122(a) and 42-002(a).

- **TA-42-2, TA-42-3, Ash storage tanks.** Constructed in 1951, removed in 1978. Dimensions of the tanks were 22 ft in diameter and approximately 13 ft high. Tank volume was approximately 37,000 gal. Designated as SWMU Nos. 42-001(b and c).

- **TA-42-4, Septic tank.** Constructed in 1951, removed along with sewer lines and drain-field tile pipe as part of the 1978 D&D (Harper and Garde 1981, 0457). Designated as SWMU No. 42-003.

- **TA-42-5, Gas drip pot manhole.** This structure housed the gas valves and other plumbing that supplied the incinerator fuel. It was removed during the 1978 decommissioning (Harper and Garde 1981, 0457).

- **TA-42-6, Water manhole and firehouse box.** This structure was located approximately 650 ft west-southwest of TA-42-1. It was removed during the 1978 decommissioning (Harper and Garde 1981, 0457).

- **TA-42-7, Water manhole**. Removed 1978.

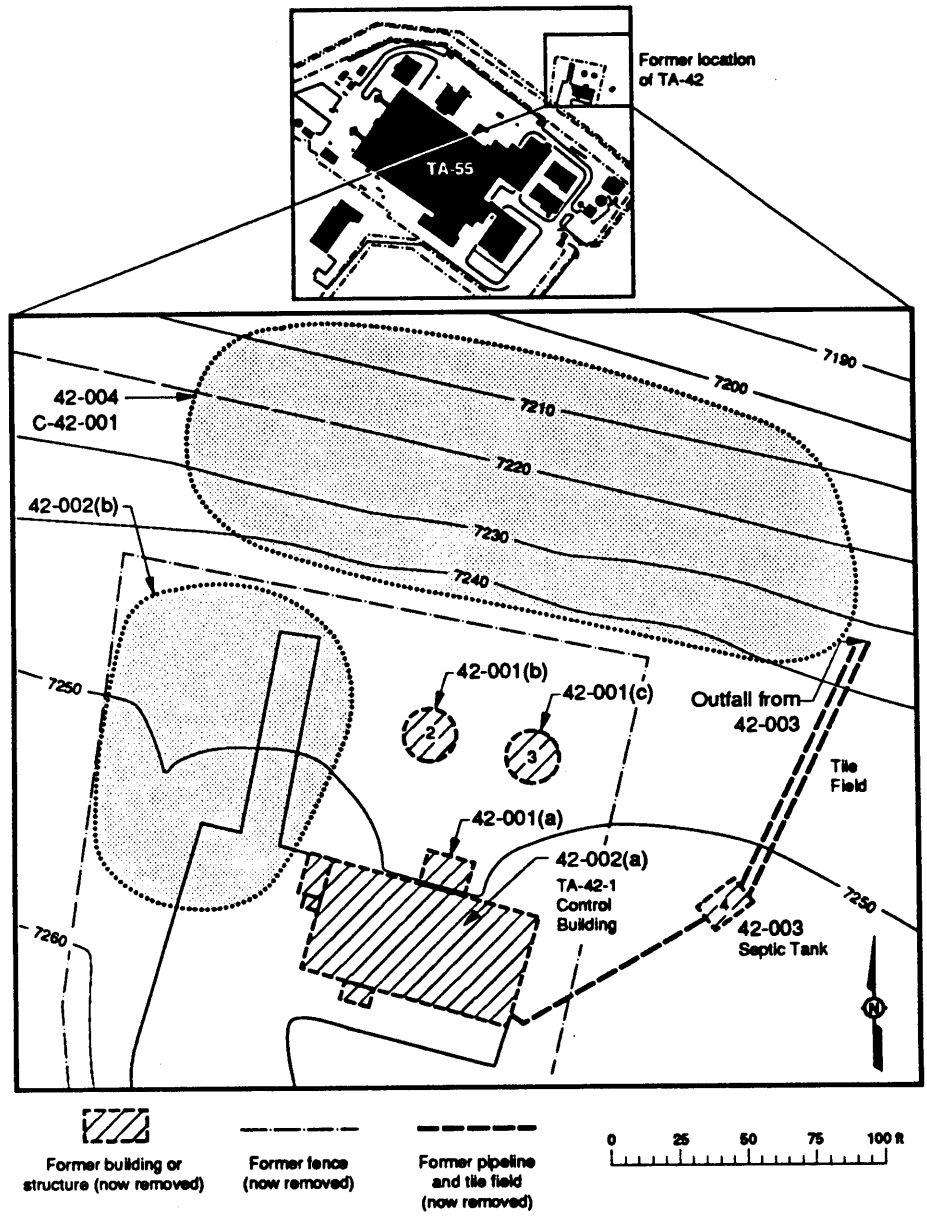


Figure 3-7. Locations of structures and SWMUs at TA-42 (Roy F. Weston, Inc. 1989, 0486).

3.4.1.3 Ownership Profile and Land Uses

DOE owns the property at which TA-42 was located. The area is currently used as a buffer zone for TA-55.

3.4.2 Historical Overview

Former TA-42, the Incinerator Site, was designed to reduce the volume of radionuclide-contaminated waste produced throughout the Laboratory (Emelity et al. 1975, 0282; Harper and Garde 1981, 0457; LANL 1990, 0145). Construction of the site was completed in 1951. At that time, the TA consisted of the structures listed in Table 3-29. TA-42 structures were enclosed within a 5,000-m^2 fenced area (Herceg circa 1971, 04-0099; Harper and Garde 1981, 0457).

The incinerator was intended to burn radionuclide-contaminated wastes generated at the Laboratory. However, because of the poor performance of the incinerator and operational problems associated with the off-gas cleanup system, very little waste was actually incinerated at TA-42. The incinerator operated for little more than one year (1951-1952) (Harper and Garde 1981, 0457).

From 1957 until 1969, the facility was used for storage and decontamination of contaminated equipment (e.g., dry boxes and vehicles). During the summer of 1969, an unsuccessful attempt was made to reactivate the incinerator so it could burn uncontaminated classified wastes (Harper and Garde 1981, 0457). By 1970, operations were discontinued, and all combustibles were removed from the building (DOE 1987, 0264). Because TA-42-1 was contaminated with radioactivity, the facility became a candidate for decommissioning. The residual contamination, the poor physical condition, and the specialized nature of the building structure and equipment made it unattractive for any future beneficial occupancy (Harper and Garde 1981, 0457).

In 1977, the decision was made to decommission the site. In 1978, all structures, debris, and contaminated soils were removed and disposed of at Area G, TA-54. Following removal of contaminated materials, the site was contoured and revegetated (Harper and Garde 1981, 0457).

3.4.2.1 Waste Management Activities

The handling of materials contaminated with radionuclides (plutonium, uranium, tritium, americium, cesium, and others) at TA-42 has been documented (Enders 1965, 04-0067; LASL circa 1977, 0701; Bradshaw 1977, 04-0031; Meyer 1977, 04-0157; Ahlquist 1978, 04-0009). Other potentially hazardous materials that may have been used or handled at the site include grease and oil removed from contaminated equipment, and solvents and acids used to remove grease and oil (LANL 1990, 0145).

The following structures or locations at TA-42 have been identified as SWMUs in the 1990 SWMU report (LANL 1990, 0145):

SWMU No. 42-001 (a-c)	Incinerator Complex
SWMU No. 42-002 (a-b)	Decontamination Facility
SWMU No. 42-003	Septic System
SWMU No. 42-004	Canyon Disposal

These SWMUs are discussed in the following paragraphs. Their locations are shown in Figure 3-7. None of these SWMUs were listed in the HSWA Module VIII (EPA 1990, 0306). One AOC (C-42-001) has been designated at TA-42, but this AOC is the same site as SWMU No. 42-004.

SWMU Nos. 42-001(a-c), Incinerator Complex: An incinerator, SWMU No. 42-001(a), was located adjacent to the north wall of the control building, TA-42-1 (Figure 3-7). The feed port and operational systems for the incinerator were located inside TA-42-1. The incinerator was designed to burn radionuclide-contaminated waste in a cylindrical combustion chamber. Combustion products passed through an off-gas cleanup system before discharged through a stack to the atmosphere. This off-gas cleanup system consisted of a Venturi scrubber, a filter bank, and an ash separator. Several attempts at incinerating low levels of contamination indicated that the facility would require major modifications before it could handle the desired types and

volumes of waste (Harper and Garde 1981, 0457). Problems in the off-gas cleanup system included ice formation in the off-gas filters and the resultant destruction of the filter bank. The incinerator itself was subject to pressure excursions, which led to contamination inside TA-42-1 so extensive that incinerator operators were required to wear full-body protection (Perkins 1976, 0629). Because the facility was constantly beset by such problems, it was shut down in 1952, although sporadic attempts to use the incinerator were made until about 1954 (H-Division 1954, 0488; Harper and Garde 1981, 0457).

Ashes trapped in the off-gas system and incinerator were placed in two holding tanks, TA-42-2 (SWMU No. 42-001[b]) and TA-42-3 (SWMU No. 42-001[c]), which were located immediately north of the incinerator. Each tank had a capacity of 140,000 liters (37,000 gal.) and was connected by underground drain lines to the incinerator (Figure 3-7). When the tanks were decommissioned in 1978, their contents were measured and assayed for plutonium content. One tank (TA-42-2) contained 2,000 liters (473 gal.) of dry sludge with a ^{239}Pu concentration of 130 nCi/g. The other tank (TA-42-3) contained 2,600 liters (615 gal.) of wet sludge with a ^{239}Pu concentration of 1,000 nCi/g. The sludges were removed, mixed with cement, and taken to Area G, TA-54, for storage in accordance with DOE's 20-year retrievable storage criteria. The tanks were excavated and taken to TA-54 for disposal. The drain lines were filled with hot asphalt to contain radioactive contamination (Harper and Garde 1981, 0457). It is not known if the drain lines were removed or left in place (Ahlquist 1987, 04-0017).

SWMU Nos. 42-002(a-b), Decontamination Facility: Between 1956 and 1969, the main floor area of the incinerator/control building, TA-42-1, was used by Group H-1 as an area for storage and decontamination of contaminated equipment (Roy F. Weston, Inc. 1989, 0486). This area is listed as SWMU No. 42-002(a) (LANL 1990, 0145). In the decontamination process, a "vacublaster" was used to remove radionuclides and possibly other contaminants including grease and oil from various laboratory equipment. This process generated wastes probably consisting of fine solid residues and liquids containing radionuclides, and possibly acids and solvents. Waste liquids apparently went to the septic system that served this building (SWMU No. 42-003). It is believed that fine solid residues were bagged and sent to a MDA (Roy F. Weston, Inc. 1989, 0486).

According to a former Laboratory employee (unidentified), objects such as trucks that were too large to take inside TA-42-1 were cleaned at the end of the asphalt driveway located west and north of TA-42-1 (Figure 3-7). This driveway area is designated as SWMU No. 42-002(b) (LANL 1990, 0145). Contaminated liquids from SWMU No. 42-002(b) flowed down the embankment on the northwest side of the parking lot. Contaminated soils in this area were not sampled or removed during the 1978 D&D effort.

SWMU No. 42-003, Septic System: SWMU No. 42-003 is the septic system that served TA-42-1. The septic system, which was installed in 1951 on the northeast side of TA-42-1 (Figure 3-7), included a drain line from TA-42-1, a 565-gal. septic tank (TA-42-4), a filter trench, a tile leach field, and an outfall into Mortandad Canyon (LANL 1990, 0145). The system and associated contaminated soils were removed during the 1978 D&D project (Harper and Garde 1981, 0457).

The septic tank received radioactive liquid wastes from TA-42-1 that contained plutonium, uranium, associated fission products, and tritium. The system probably also received solvents, acids, and greases. Most of these contaminants are believed not to be associated with incinerator operations, but entered the septic system

between 1956 and 1969 when TA-42-1 was used as a decontamination facility (Roy F. Weston, Inc. 1989, 0486). During this time, wastewater containing ^{239}Pu, ^{235}U, tritium, and fission products passed through the septic system and was discharged into Mortandad Canyon (Meyer 1977, 04-0157). Radioactively contaminated liquids were periodically removed from the septic tank and taken to Pit No. 4 on Mesita del Buey (Roy F. Weston, Inc. 1989, 0486). In 1973, the septic tank was observed to contain water and possibly to have overflowed. At that time, the unfiltered slurry in the tank was sampled and found to contain radioactivity levels of 4,116,800-c/m/l gross- alpha, 1,376,000-c/m/l gross-beta, and 39,000-c/m/l gross-gamma (Roy F. Weston, Inc. 1989, 0486).

When TA-42 was decommissioned in 1978, the liquid in the tank was pumped out and treated at the TA-50 wastewater treatment plant. The septic tank was found to contain 150 liters (approximately 35 gal.) of sludge, which contained 365 nCi/g ^{239}Pu. The sludge was solidified by adding cement, and the tank and sludge were taken to Area G in TA-54. Contaminated soils around the tank were found to contain less than 25-pCi/g gross-alpha activity. These contaminated soils were removed and taken to TA-54. The excavated area was then backfilled. Soils in the vicinity of the tile drain field also contained less than 1-nCi/g gross-alpha activity and were removed by backhoe. Four samples were collected from the tile field area greater than 25-pCi/g alpha activity, with the highest concentration measured at 99 pCi/g (Harper and Garde 1981, 0457). Also, three of eight samples collected from a contaminated area beneath the tile drain outfall contained greater than 25-pCi/g gross-alpha activity, with the highest concentrations measured at 418 pCi/g (Harper and Garde 1981, 0457).

SWMU No. 42-004, Canyon Disposal: Some building debris, including pipes, were discarded over the canyon edge north of TA-42. Whether the debris contained hazardous constituents or radionuclide contamination is unknown. Samples taken at this site in January 1991 indicated background levels of gross-alpha, -beta, and -gamma activity. No VOCs, SVOCs, or PCBs were detected. All Toxic Characteristic Leaching Procedure (TCLP) metal concentrations were less than EPA action levels (Fresquez 1991, 04-0075). This canyonside disposal area is also designated as an AOC, C-42-001.

C-42-001, Canyonside Disposal: This AOC is the same as SWMU No. 42-004.

3.4.2.2 Summary of Potential Waste Materials

On the basis of available information (Buckland 1952, 04-0038; Enders 1965, 04-0067; Bradshaw 1977, 04-0031; LASL circa 1977, 0701; Ahlquist 1978, 04-0009; LANL 1990, 0145), waste materials handled at TA-42 included the following materials:

- Americium-241 (^{241}Am)
- Cesium-137 (^{137}Cs)
- Lanthanum-140 (^{140}La)
- Plutonium-238, -239 (^{238}Pu, ^{239}Pu)
- Tritium (^{3}H)

- Uranium-235 (^{235}U)
- Unspecified fission products
- Unspecified acids
- Unspecified organic compounds (e.g., oil, grease, solvents)

3.4.2.3 Past Waste Spills, Releases and Incidents

Documentation of accidental spills or releases at TA-42 has not been found. However, because of the inefficiency of the incinerator (SWMU No. 42-001[a]) and problems with the off-gas cleanup system, radionuclides and possibly other contaminants were released through airborne emissions. During early operations of the incinerator, effluents from the stack were "very high in activity" (H-Division 1954, 0488). No data are available that quantify the radioactivity levels of the stack emissions. Other possible contaminant release sources include the ash holding tanks (SWMU Nos. 42-001[b and c]), the decontamination areas (SWMU Nos. 42-002[a and b]), and the septic system (SWMU No. 42-003).

Some wastes were intentionally released from TA-42. Liquid waste and some ash from the incinerator tank were discharged presumably into Mortandad Canyon in October 1952 (Buckland 1952, 04-0038). The only contaminant discharged was thought to be ^{140}La. The contamination level in the liquid was less than the tolerance level used for disposal of liquid wastes at Ten Site (TA-35); however, the ashes were estimated to contain a total of 100 mCi, approximately 30 mCi greater than discharge tolerance (Buckland 1952, 04-0038). The septic system outfall also discharged liquid wastes to Mortandad Canyon. Samples taken in 1952 in Mortandad Canyon downstream from this outfall showed radioactive contamination in the canyon (Roy F. Weston, Inc. 1989, 0486).

3.4.2.4 Environmental Surveys and D&D Activities

Because of the specialized nature of the incinerator facility and the extensive contamination of the control building (TA-42-1) and other structures at the site, the decision was made in the mid-1970s that TA-42 should be decommissioned and decontaminated. The 1974 LASL Radioactive Waste Management Site Plan and the 1977 Ten-Year Decontamination and Decommissioning Plan list TA-42 as a "Priority 1" (highest priority) D&D facility. The structures at TA-42 were found to be "excess to present needs with no foreseeable use" and "not suitable for decontamination" (Jordan 1975, 04-0104; Bradshaw 1977, 04-0031; LASL circa 1977, 0701).

Preliminary decommissioning in 1975 included the removal of interior walls and equipment from the control building. The plutonium-contaminated incinerator and ash tanks were not included in this effort (Roy F. Weston, Inc. 1989, 0486). In 1977 a decision was made to complete the decommissioning of TA-42. Preliminary contamination surveys with a Laboratory-developed phoswich system indicated detectable surface soil contamination within the fenced area, in the incinerator equipment, in the ash storage tanks, and in the septic tank and tile field effluent line. Gross-alpha activity on the septic tank (TA-42-4) was measured at 2.5×10^6 disintegrations per minute per liter (d/m/l) (LASL 1978, 04-0258). Most of the contamination present, excluding the contents of the ash storage tanks, was

attributed to the decontamination operations that were conducted at TA-42 between 1957 and 1969 (Harper and Garde 1981, 0457).

Decommissioning work began in January 1978 with the removal of the incinerator and associated equipment in the control building. After dismantling and removal of the structure, the drain pipes under the building foundation were filled with hot asphalt to contain the contamination. The gross-alpha activity on accessible portions of the pipes measured 22 d/s/cm^2. Whether the drain lines were removed or left in place is unknown. The uncontaminated foundation was crushed with a crane and steel ball and removed (Harper and Garde 1981, 0457).

The supernatant liquid from the 4,000-liter concrete septic tank was pumped into a tank and transported to the Laboratory's radioactive liquid waste treatment facility (TA-50). The 35 gal. of sludge in the tank, which contained 365 nCi/g ^{239}Pu, was solidified by the addition of cement. An attempt to remove the tank intact failed when the walls collapsed. The remaining rubble was loaded on a dump truck with a backhoe (Harper and Garde 1981, 0457).

Three exploratory holes were bored into the septic tank tile field to establish contamination levels. Levels encountered (<1.0 nCi/g gross-alpha) indicated that the soil was not highly contaminated and could be removed using water for dust control and then using a backhoe (Harper and Garde 1981, 0457). Phoswich surveys indicated general contamination in the immediate area in which the tile field drainpipe surfaced at the edge of Mortandad Canyon. Downward migration of the contamination into the subsoil tuff necessitated excavation of a pit measuring 10 ft wide, 12.5 ft long, and 10 ft deep at the canyon wall. After soil removal operations were completed, the site was monitored for plutonium contamination. The levels encountered were determined to be as low as practicable (ALAP). The site was then contoured to conform with the surrounding terrain, and native grasses were planted (Harper and Garde 1981, 0457).

When the area was believed to have been satisfactorily decontaminated, environmental surveillance technicians sampled for contamination. Final gross-alpha contamination measurements (Harper and Garde 1981, 0457) indicated that

- 60 of 61 soil samples in the former building area (SWMU Nos. 42-001[a], 42-002[a]) contained less than 25-pCi gross-alpha per gram of soil (pCi/g); one sample had a value of 29 pCi/g
- All samples in the septic tank area (SWMU No. 42-003) contained less than 25-pCi/g
- 4 of 17 samples in the tile field were greater than 25 pCi/g, the highest being 99 pCi/g, and
- 5 of 8 samples in the excavation under the tile field-drain outfall were greater than 25 pCi/g with the highest being 418 pCi/g. Also, 17 surface samples were collected from the canyon wall below the tile drain outfall. Of these, 3 samples contained greater than 25 pCi/g gross alpha. Two samples immediately beneath the outfall contained 36 and 40 pCi/g, and another approximately 66 ft below the outfall contained 29 pCi/g.

Because of the generally low contamination levels and the safety hazards associated with further excavation, the Environmental Surveillance Group recommended that TA-42 be considered decontaminated to ALAP on the basis of soil sampling results recorded after the removal of facilities and contaminated soil. Laboratory personnel further recommended that the pit on "the edge of a 20 to 30 degree slope in a rather inaccessible area" remaining at the end of the former septic tank outlet trench be filled to avoid "significant erosion of the fill in the trench" (Crismon 1978, 04-0055). Estimated concentrations of 90 ± 43-pCi/g ^{239}Pu, 5-pCi/g americium, and 2-pCi/g cesium were determined for the sample just below the pit that had 40 pCi of gross-alpha activity. After the concurrence of the Laboratory's Health Division Office and the Los Alamos, New Mexico, Area Office of the DOE that the area was decontaminated to ALAP levels, the area was contoured and revegetated to minimize erosion (Harper and Garde 1981, 0457).

In 1977, soil and sediment samples were collected near the new plutonium facility at TA-55 to document preoperational radiation levels. A soil sample collected just west of the TA-42 fence (Figure 3-7) contained the highest concentration of plutonium (16 pCi/g). The contamination was attributed to operations that generated wastes at TA-42 (LASL circa 1977, 0701).

Soil samples were collected at the site of TA-42 in January 1991 to document soil contamination levels at the site of the proposed Nuclear Safeguard Technology Laboratory near TA-55 (Fresquez 1991, 04-0075). Soil samples collected at the former incinerator site, SWMU No. 42-001(a), revealed background concentrations of gross-alpha, -beta, and -gamma activity. VOCs, SVOCs, and PCBs were not detected in any of these samples. Concentrations of TCLP metals (Ag, As, Ba, Cd, Cr, Hg, Pb, and Se) were all less than EPA guideline limits (Fresquez 1991, 04-0075).

Samples collected at the former locations of the ash holding tanks showed background levels of beta and gamma activity, and concentrations of PCBs and TCLP metals were below EPA guidelines. No VOCs or SVOCs were detected. Alpha activity at the site of tank TA-42-2 (SWMU No. 42-001[b]) ranged from background to <25 pCi/g, or below DOE guideline levels. However, surface soils at the former location of tank TA-42-3 (SWMU No. 42-001[c]) had alpha activity that ranged from 59 to 97 pCi/g, and subsurface samples had alpha activity of >75 pCi/g. These values exceeded the DOE guideline values of 25 pCi/g for surface soils and 75 pCi/g for subsurface soils. Concentrations of specific radionuclides are not yet available (Fresquez 1991, 04-0075).

Soil samples collected from the former site of TA-42-1, the incinerator/control building and indoor decontamination facility, SWMU No. 42-002(a), indicated background concentrations of gross-alpha, -beta, and -gamma activity. No VOCs, SVOCs, or PCBs were detected. Lead was found in one soil sample at 11.4 ppm; this exceeded the EPA guideline of 5 ppm. All other TCLP metal concentrations were below EPA guidelines (Fresquez 1991, 04-0075). Soil samples collected from the former parking lot area, SWMU No. 42-002(b), revealed PCBs at <1 ppm, well below the EPA guideline of 50 ppm, and SVOCs in concentrations two orders of magnitude below EPA action levels. VOCs and gross-beta and -gamma activity were not detected. Soils contained gross-alpha activity at levels between 61 and 130 pCi/g, well above the DOE guideline value of 25 pCi/g. Concentrations of specific radionuclides are not yet available (Fresquez 1991, 04-0075).

Soil samples taken at depths of 10, 15, 20, and 25 ft beneath the former site of the septic tank, SWMU No. 42-003, contained gross-alpha activities of 67, 37, 26, and

18 pCi/g, respectively. These values are below the DOE guideline value of 75 pCi/g for subsurface soils (Fresquez 1991, 04-0075). Gross-beta and -gamma activities were at background for all sample depths. No VOCs or PCBs were detected, however, eight SVOCs were detected at the 15 ft depth. Seven of these SVOCs were polyaromatic hydrocarbons thought to be derived from paving tar or asphalt present in the fill material beneath the septic tank. The other SVOC, bis-2-ethyl-hexylphthalate, was detected at 400 ppb, which is well below EPA guideline levels (Fresquez 1991, 04-0075).

3.4.3 Regulatory Activities

3.4.3.1 Permits

Previous or existing permits associated with TA-42 do not exist.

3.4.3.2 Interim Corrective Measures

The 1988 Inventory of Federal Hazardous Waste Activities forms completed for TA-42 indicate that CERCLA PA/SI corrective actions were completed in October 1987 as part of the Phase I CEARP Investigation (LANL 1988, 04-0125). No additional documentation on corrective actions has been located.

3.5 Description of TA-48, Radiochemistry Site

3.5.1 Site Location and Physical Description

TA-48, the Radiochemistry Site, is located northwest of TA-55, the Plutonium Processing Facility. The site is currently used for chemical and radiochemical analyses, radioactive waste disposal research, and radioisotope production for nuclear medicine. The following subsections provide a detailed description of the site.

3.5.1.1 Geographic Location and Local Area Description

TA-48 is located north of Pajarito Road at an approximate latitude and longitude of 35°52'00" N and 106°18'20" W (USGS 1984, 04-0239). The site is situated on Mesita del Buey (the southern finger of South Mesa) between Mortandad Canyon on the north and Two Mile Canyon on the south. The elevation at TA-48 ranges from approximately 7,100 to 7,320 ft. The site lies within the boundaries of the Laboratory in Los Alamos County.

3.5.1.2 Physical Site Description

TA-48 was established in 1957 and is the site of former and current operational structures built to house radiochemistry and nuclear medicine research work. Activities in the main Radiochemistry Building (TA-48-1), are divided into several different work areas: the alpha wing, the hot cell, and the Nevada Operations Facility. The alpha wing, located in the northeast end of the building, is used for processing

high-level alpha and/or beta-gamma emitters. The hot cell facility, which formerly handled irradiated fuel elements from the Rover Program (Nuclear Rocket Reactor Program), is currently used for radiochemical analyses on spallation products from the Clinton P. Anderson Meson Physics Facility (LAMPF). The Nevada Operations Facility dissolves and performs radiochemical studies on samples retrieved from underground shot cavities at the Nevada Test Site (DOE 1987, 0264). The purpose of the Nevada Operations Facility is to evaluate the performance of nuclear weapon devices tested at the Nevada Test Site.

Table 3-30 provides a description of the structures at TA-48, and their locations are shown in Figure 3-8.

3.5.1.3 Ownership Profile and Land Uses

DOE owns the property that TA-48 is located on, which is currently occupied by the Isotope and Nuclear Chemistry (INC) Division Office and the Isotope Geochemistry (INC-7) and Nuclear and Radiochemistry (INC-11) groups. The facility is used for radiochemistry and nuclear medicine applications (DOE 1987, 0264).

3.5.2 Historical Overview

The Radiochemistry Site was constructed in 1957 for work in radiochemistry. Initially the major work was to study samples from bomb tests; however, that work evolved into other types of studies related to weapon tests, research on long-term studies of radioactive materials in waste disposal sites, basic research in geochemistry and radiochemistry, and production of radioisotopes for nuclear medicine (DOE 1987, 0264). TA-48 facilities also have historically been and are currently used to study nuclear properties of radioactive materials using analytical and physical chemistry. Measurements of radioactive substances are performed, and hot cells are used for remote handling of radioactive materials (LANL 1988, 04-0125).

3.5.2.1 Waste Management Activities

Waste materials leave TA-48-1 by ventilation stacks, a sanitary sewer line, storm sewer lines, industrial waste lines, a tank truck for special burial, and a dumpster (Sattizahn 1971, 04-0181). Nine ventilation stacks for air emissions at TA-48 exist: three stacks carry exhaust from chemical fume hoods; three stacks carry exhaust from combustion boilers; one stack carries filtered exhaust from the alpha wing gloveboxes; one stack carries filtered exhaust from the hot cell addition; and one stack carries exhaust from a welding and degreasing booth in the basement of TA-48-1. A sanitary sewer line transports sanitary liquid waste from TA-48 to the sanitary waste treatment lagoons at TA-35. Storm sewer lines collect rain water for discharge into the surface impoundment east of TA-48-1. An industrial waste line transports liquid chemical waste from TA-48 southeastward approximately 0.5 mi to TA-50. Two holding tanks (one in the basement of the core processing wing and another in the basement of the hot cell wing) are available for holding high-level radioactive liquid wastes for later transfer to TA-50; however, these are no longer used. Contaminated and noncontaminated solid materials leave through appropriate dumpsters for disposal at appropriate solid waste dumps (Sattizahn 1971, 04-0181).

TABLE 3-30

DESCRIPTION OF STRUCTURES AT TA-48

- **TA-48-1 (RC-1), Radiochemistry Laboratory.** Construction was completed by 1957. A high-level chemistry addition (alpha wing) was completed in 1963 (LANL 1984, 04-0117). The facility is surrounded by an 8-ft-high security fence (LASL 1957 04-0236). SWMU Nos. 48-004 and 48-008 are inside TA-48-1, and SWMU Nos. 48-001, 48-002, 48-005, 48-007, and 48-009 are outside, adjacent to TA-48-1.
- **TA-48-2 (RC-2), Guard house.** Located directly west of the main entrance to TA-48-1 (LANL 1983, 04-0110).
- **TA-48-3, Storm drain manhole.** Located west of TA-48-1.
- **TA-48-4, Sanitary sewer manhole.** Located east of TA-48-1.
- **TA-48-5, Sanitary septic tank.** The 12-ft by 7-ft tank wasdecommissioned in 1986. It was located about 300 ft east of TA-48-1 (AEC1967, 04-0008). Part of SWMU No. 48-003.
- **TA-48-6, Sanitary filter bed.** The dimensions of the sand filter bed were approximately 81 ft by 40 ft. The bed was locatedjust east of TA-48-5. The bed was decommissioned in 1986 (AEC 1967, 04-0008). Part of SWMU No. 48-003.
- **TA-48-7, Electrical manhole.** The manhole islocated about 100 ft west of TA-48-1 and about 70 ft directly north of TA-48-2.
- **TA-48-8 (RC-8), General storage building.** This structure houses an isotope separator, machine shop, electronics laboratory, anda storage area all in one large room. It isalso an electromagnet with noncontact cooling water discharging to Outfall 04A126, SWMU No. 48-007(e).
- **TA-48-9, Weighing rack.** Removed in 1981.
- **TA-48-10, Acid manhole.** Location not shown on Structure Location Plan.
- **TA-48-11, Transformer station.** Located west of TA-48-1.
- **TA-48-12, Gas-metering station.** Located just west of the south end of TA-48-1.
- **TA-48-14, Transformer station.** Located west of TA-48-2.
- **TA-48-15 (RC-15), Lawn building.** Located east of TA-48-89.
- **TA-48-17 (RC-17), Assembly and check-out building.** Located against the east wall of TA-48-1 near its south end (LANL 1983, 04-0111).
- **TA-48-18, -19, -20, and -21, Acid manholes.**
- **TA-48-22 and -23, Acid manholes.** Located south and east of TA-48-1.
- **TA-48-26 (RC-26), Storage building.** Located just east of TA-48-1 near its north end. The building is used as office space (LANL 1983, 04-0112).
- **TA-48-27 (RC-27), Office building.** Located adjacent to TA-48-33, north of TA-48-1 (LANL 1983, 04-0113).
- **TA-48-28 (RC-28), Instrument building.** Houses a laser with noncontact cooling water discharged to Outfall 04A152.

TABLE 3-30 (concluded)

DESCRIPTION OF STRUCTURES AT TA-48

- **TA-48-29 (RC-29), Office building.** The transportable was moved from TA-0 and relocated west of TA-48-8 outside the security fence (LANL 1984, 04-0119). Located immediately east of SWMU No. 48-006.
- **TA-48-30 (RC-30), Office trailer.** Moved from TA-0 and relocated outside the security fence west of RC-8 (LANL 1983, 04-0114).
- **TA-48-31 (RC-31), Laboratory and office trailer.** Located west of TA-48-29 outside the security fence.
- **TA-48-32, Septic system.** Located northwest of TA-48-29.
- **TA-48-33 (RC-33), Office building.** Located near the north end of TA-48-1 (LANL 1987, 04-0123).
- **TA-48-34 (RC-34), Office building.** Located west of TA-48-29 outside the security fence.
- **TA-48-35, -36, and -37, Railroad boxcars.** Used forstorage. Located inside the security fence near the southeast corner of TA-48-1.
- **TA-48-38 and -39, Storage sheds.** Located near the northwest corner of TA-48-1.
- **TA-48-40 and -41, Storage sheds.** Located east of TA-48-31.
- **TA-48-45 (RC-45), Laboratory and diagnostics building.** Located east of TA-48-1 near the eastern perimeter of the secure area. Built over SWMU No. 48-003.
- **TA-48-46 (RC-46), Office and laboratory building.** Located west of TA-48-1 and adjoining TA-48-47 (LANL 1990, 04-0130).
- **TA-48-47 (RC-47), Office building.** A 28-ft by 60-ft transportable structure providing office and support facilities to TA-48-46, to which it is joined (LANL 1990, 04-0130).
- **TA-48-56 and -57 (RC-56 and -57), Office buildings.** The 28-ft by 60-ft transportable structures are joined to form an L-shaped office facility located outside the security fence and northwest of the main parking lot (LANL 1990 R5585, 04-0231).
- **TA-48-89, -90, and -91, Storage sheds.** Located east of TA-48-17.
- **TA-48-100, Storage shed.** Located north of TA-48-28.
- **TA-48-101, Storage trailer.** Located west of TA-48-1 near the north end.
- **TA-48-102, and -103, Storage trailers.** Located east of TA-48-1.
- **TA-48-104, -105, and -106, Bottle tanks.** Located across paved area outside east service entrance to TA-48-1.
- **TA-48-111, Transportainer.** Located near the south end of TA-48-1.
- **TA-48-111, Transportainer.** Located near the south end of TA-48-1.
- **TA-48-129, Unmanned guard gate.** Not shown on structure location plans or maps.
- **TA-48-130, Laboratory trailer.** Located east of TA-48-1.

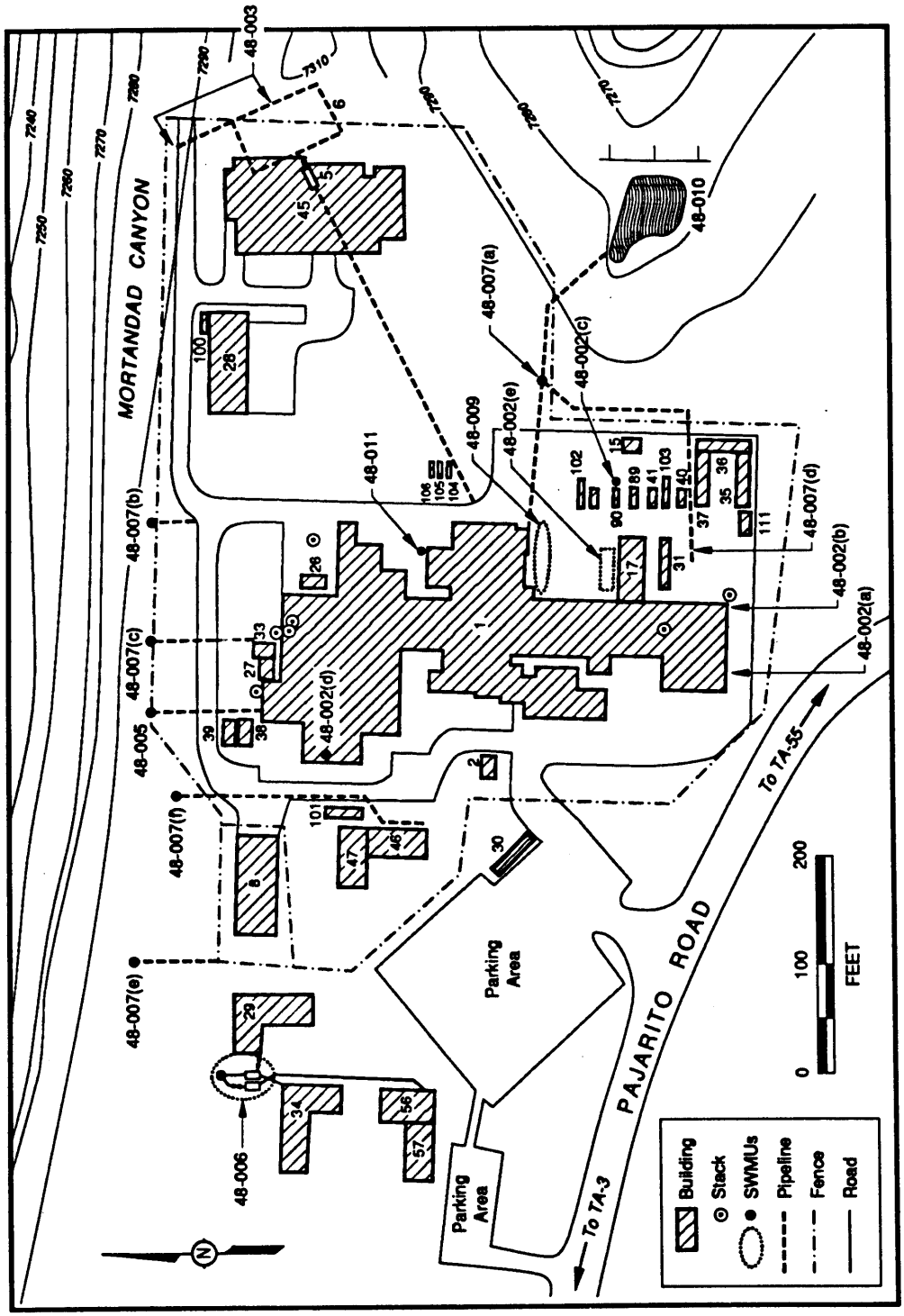


Figure 3-8. Locations of structures and SWMUs at TA-48. SWMU No. 48-001 is surface deposition of airborne releases surrounding TA-48-1 (modified from LANL 1988, 04-0259).

In 1988, the amount of waste generated annually at TA-48 was estimated (Efurd 1988, 04-0058). The estimates were as follows:

- 34 dumpster loads of cardboard boxes containing compactible low-level solid radioactive waste (approximately 4,000 ft^3 before compaction),
- 12 dumpster loads of cardboard boxes containing noncompactible low-level solid radioactive waste generated from general site activities,
- 30 barrels of noncompactible low-level solid radioactive waste generated from hot cell operations,
- 1,000 ft^3 of noncompactible low-level solid radioactive waste generated from periodic site cleanups,
- Less than 10 lb of sludge from the inactive settling tank in the core processing facility,
- Approximately 100 gal. of acid and 10 gal. of bases discharged to the radioactive liquid waste (RLW) line,
- Milligram quantities of transuranic (TRU) wastes transported through the industrial waste line to the treatment plant, and
- 200 to 400 mR of spallation and activation products.

In addition, the estimate was that one 30-gal. barrel of solid TRU waste had been generated in the previous six years, and the amounts of liquid and fission products transported through the industrial waste line to the main liquid treatment plant were not quantified (Efurd 1988, 04-0058). The use of ^{89}Sr, perchloric acid, ^{10}Be, solid TRU wastes, unspecified acids and bases, mixed fission products, spallation and activation products, uranium, plutonium, or Alloy (enriched uranium-235), lead, hydrofluoric acid, ^{60}Co, asbestos, aluminum "rabbit," and welding and silver soldering materials at TA-48 has been documented (Reider 1959, 04-0173; Schulte 1959, 04-0183; Enders 1965, 04-0066; Brazier 1967, 04-0032; Dropesky and Barnes 1970, 04-0056; Sattizahn 1971, 04-0181; Hurdle 1983, 04-0101; Efurd 1988, 04-0058; LANL 1988, 04-0125; LANL 1991, 04-0133).

SWMUs identified at TA-48 in the 1990 SWMU report (LANL 1990, 0145) are listed in Table 3-31.

SWMU No. 48-001, Air Exhaust System: Exhaust hoods have been used in a variety of operations since TA-48 first opened in 1957. Most hoods in the Radiochemistry Laboratory (TA-48-1) are equipped with a water spray that can be used while the hoods are operating. This spray is particularly important when using perchloric acid to prevent a buildup that could react with organics at elevated temperatures to form an explosive. All ducts from the hoods are periodically sprayed with water to prevent corrosion (DOE 1987, 0264). Because perchloric acid causes corrosion of filters, most of the hoods do not have filters (Abney personal communication in Roberson 1991, 04-0175). Hoods have apparently been used without filters since the 1950s for this reason (H-Division 1957 0489; H-Division 1957, 0475). Approximately one-third to one-half of the major acids used (i.e., hydrochloric, hydrofluoric, nitric, and perchloric) are vented to the hoods. Most of the acid is exhausted to the atmosphere

TABLE 3-31

TA-48 SWMUS

SWMU NO.	DESCRIPTION
48-001	Air Exhaust System
48-002(a-e)*	Container Storage Areas
48-003*	Inactive Septic System
48-004(a-d)	Sumps and Tanks
48-005*	Waste Lines
48-006	Active Septic System
48-007(a-f)	Drains and Outfalls
48-008	Leakage from PCB Transformers
48-009	Soil Contamination from Air Compressor Operations
48-010	Surface Impoundment
48-011 (proposed)	Shaft Containing Lead Shield

* SWMU Nos. 48-002(a and b), 48-003, and 48-005 were listed in Table A of the HSWA Module VIII (EPA 1990, 0306).

and some fraction is removed by the water spray (DOE 1987, 0264). Also, none of the hoods in the alpha wing meet the criteria for work with radioactive materials. Radioactive materials are handled in gloveboxes that have individual filters (Abney personal communication in Roberson 1991, 04-0175).

During its first several years of operation, the Venturi air scrubber system, which was installed during the construction of TA-48-1, developed many problems. A 1957 H-Division Progress Report notes that the Venturi scrubber was undergoing repair (H-Division 1957, 0475). The scrubber was to be studied to determine its effectiveness in removing radionuclides from emissions. Attempts to operate the system revealed additional deficiencies (H-Division 1957, 0475). By December 1957, all mechanical defects were corrected, simulated digestions were run, and preliminary air-cleaning efficiency tests were made for the resulting acid atmospheres (H-Division 1957, 0476). By the end of April 1958, more repairs and improvements on the Venturi air-cleaning system were completed in preparation for samples from the "HARDTACK" tests (H-Division 1958, 0490). The ENG-2 Group completed work on modifications to the ventilation system in late 1958 or early 1959. Modifications were made to maintain atmospheric concentrations of radioactive materials at levels less than those specified by the National Committee on Radiation Protection (NCRP) (Schulte 1959, 04-0183). Whether the Venturi system ever worked properly or if it was disconnected and replaced with a new air scrubber is unknown.

Because contaminated air has been vented to the atmosphere without proper filtration during the long operation of this facility, the soil surrounding TA-48-1 has possibly become contaminated. Group HS-5 monitors air emissions from TA-48 stacks monthly (Abney personal communication in Roberson 1991, 04-0175). Tables 3-32, 3-33, and 3-34 provide information on the total amounts of radionuclides (plutonium, uranium, and mixed fission products) released to the atmosphere from TA-48 during the years 1967 through 1970, 1971, and 1974 through 1988. Average daily releases of alpha emitters from TA-48-1 were estimated to be less than 0.1 pCi/m^3; releases for beta emitters ranged from 0.4 to 20 pCi/m^3 (LASL circa 1969, 0702).

The high-efficiency particulate air (HEPA) filter area for the TA-48 exhaust system was monitored for radioactivity levels during a 1988 ER Program reconnaissance survey and was found to be 233 cpm (60 µR/hr) above background (Shafer circa 1989, 04-0187).

SWMU Nos. 48-002(a-e), Container Storage Areas: Five container storage areas at TA-48 were designated as SWMUs (LANL 1990, 0145). A 1991 ER Program site inspection revealed that all but one of these areas have been cleaned up to some extent and are no longer used for storage (Roberson 1991, 04-0175). However, soil contamination may exist at these sites from previous leaks and spills. These former storage areas are discussed in the following text. Figure 3-8 shows the locations of these SWMUs.

TABLE 3-32

TOTAL DISCHARGE OF AIRBORNE RADIOACTIVITY AT TA-48 FOR 1967 THROUGH 1970

Source of Pollutant	Pollutant	1967 (Ci)	1968 (Ci)	1969 (Ci)	1970 (Ci)
Stacks	^{235}U	1.7×10^{-4}	1.3×10^{-4}	6.5×10^{-4}	2.4×10^{-5}
Stacks[a]	FP[b]	1.7×10^{-2}	1.29×10^{-2}	3.9×10^{-3}	1.4×10^{-3}
Stacks[c]	^{239}Pu	1.10×10^{-4}	1.46×10^{-4}	1.26×10^{-4}	3.1×10^{-5}
FE-45, -46[d]	^{239}Pu	—	—	—	2.6×10^{-5}
FE-45, -46[d]	FP[b]	—	—	—	1.6×10^{-3}
FE-51[d]	^{239}Pu	—	—	—	7.2×10^{-9}
FE-51[d]	FP[b]	—	—	—	6.9×10^{-8}

Source: Voelz (1971, 04-0194).
[a]Total discharge from stacks 1, 2, and 3.
[b]Fission products.
[c]Total discharge from stack 2.
[d]New operations in 1970.

TABLE 3-33

AIR EMISSIONS OF RADIONUCLIDES AT TA-48 FOR 1971

Source of Pollutant (Stacks)	Pollutant	Concentration in Air (μCi/ml)	Total Quantity Released During Reporting Period (μCi)
FE-11, -12, -13	^{235}U	8.2×10^{-14}	6
FE-11, -12, -13	FP[a]	2.7×10^{-13}	219
FE-15, -16	^{239}Pu	1.6×10^{-4}	11
FE-15, -16	FP[a]	6.0×10^{-13}	509
FE-37, -38, -29, -40	^{235}U	4.9×10^{-15}	0.4
FE-37, -38, -39, -40	FP[a]	4.1×10^{-14}	4
FE-45	^{239}Pu	1.0×10^{-14}	8
FE-45	FP[a]	1.7×10^{-12}	1,018
FE-51	^{239}Pu	2.6×10^{-15}	0.1
FE-51	FP[a]	2.4×10^{-14}	1

Source: LASL (1972a, 04-0146).
[a]Fission products.

TABLE 3-34

ATMOSPHERIC RELEASES OF RADIONUCLIDES FROM TA-48, 1974 THROUGH 1988

Year	$^{238,239}Pu$ (μCi)	$^{235,238}U$ (μCi)	Mixed Fusion Products	Reference
1988	0.7[a]	0.2	1110	(ESG 1989, 0308)
1987	0.6[a]	1.6	1250	(ESG 1988, 0408)
1986	2.8[a]	0.6	2500	(Purtymun and Maes 1987, 0203)
1985	2.1[a]	1.9	1206.5	(Becker 1986, 0027)
1984	2.6[a]	1.3	1566	(Becker et al. 1985, 0029)
1983	--	0.5	816	(Purtymun et al. 1984, 0210)
1982	9.9	7.3	941	(ESG 1983, 0621)
1981	1.3	2.3	1367	(ESG 1982, 0620)
1980	1.57	0.67	1755	(ESG 1981, 0424)
1979	0.33	6.8	1072	(ESG 1980, 0406)
1978	1.9	11.2	1169	(Hakonson et al. 1979, 0119)
1977	8.4	55	2192	(ESG 1978, 0095)
1976	5.0	112	1231	(ESG 1977, 0618)
1975	12.3	3.9	722	(Apt and Lee 1976, 0617)
1974	23.9	1.3	941	(Apt and Lee 1975, 0616)

[a]Total includes ^{240}Pu for 1983-1988.

- SWMU No. 48-002(a) was a container storage area located on the south end of TA-48-1 (Figure 3-8). An initial field observation report (Perkins 1986, 04-0169) mentioned the presence of about 200 rusty flasks in decayed and broken wooden-frame holders. A follow-up memorandum (Garvey 1986, 04-0087) confirmed the presence of these flasks. Each flask was estimated to hold about 2 quarts (76 lb) of high-purity mercury, which is thought to have been recycled at TA-50-1 by a triple distillation process to remove radionuclides. The flasks were estimated to have been there from between 1976 to 1981 until approximately 1989, at which time the mercury was eventually removed (LANL 1990, 0145). The available documentation contains no indication of any spills or leaks associated with this storage area. The area is no longer used for storage (Roberson 1991, 04-0175).

- SWMU No. 48-002(b) was a container storage area located at one of the loading dock areas on the south side of TA-48-1 (Perkins 1986, 04-0169) (Figure 3-8). The 1986 CEARP field survey noted the presence of labeled and unlabeled drums at the site, and evidence of spills and leaks (Perkins 1986, 04-0169). The contents of the drums was unknown. A November 1988 field survey noted spills at this area, which was apparently from leaky drums. The 1989 Laboratory subcontractor environmental audit noted only one long, unlabeled cylinder (LANL 1990, 0145). All materials were removed from this area before July 1991, and the site is no longer used for storage (Roberson 1991, 04-0175).

- SWMU No. 48-002(c) is a container storage area on asphalt between a metal storage shed (TA-48-91) and the fence on the east side of TA-48-1 (Figure 3-8). Drums, lead pigs, and batteries were stored here from 1988 to 1989. Some drums and cans formerly stored in this area were unlabeled; other drums were labeled as containing chemical waste (unspecified), decontamination waste, and pump oil. The condition of the containers was not mentioned (LANL 1990, 0145), and releases and spills have not been documented at this area. In 1991, the area contained a few batteries and scrap metal. No drums are currently stored at this site (Roberson 1991, 04-0175).

- SWMU No. 48-002(d) is a satellite storage area located on the northwest side of TA-48-1 (Figure 3-8). According to Laboratory personnel, the containers here may store radioactive waste from the TA-48 hot cell (LANL 1990, 0145). In 1991, the area contained two cardboard boxes labeled "hot trash" that were awaiting pickup (Roberson 1991, 04-0175). Releases or spills have not been documented at this area.

- SWMU No. 48-002(e) was a satellite container storage area located on the east side of TA-48-1 (Figure 3-8). This area was listed on the 1988 Laboratory Active Container Storage Database and was used for many years for the storage of solvents

such as cutting oil. All containers and other materials were removed from this area in 1989 or 1990 (Roberson 1991, 04-0175). Releases or spills have not been documented at this area (LANL 1990, 0145); however, rust stains were observed on the pavement on which drums were formerly stored.

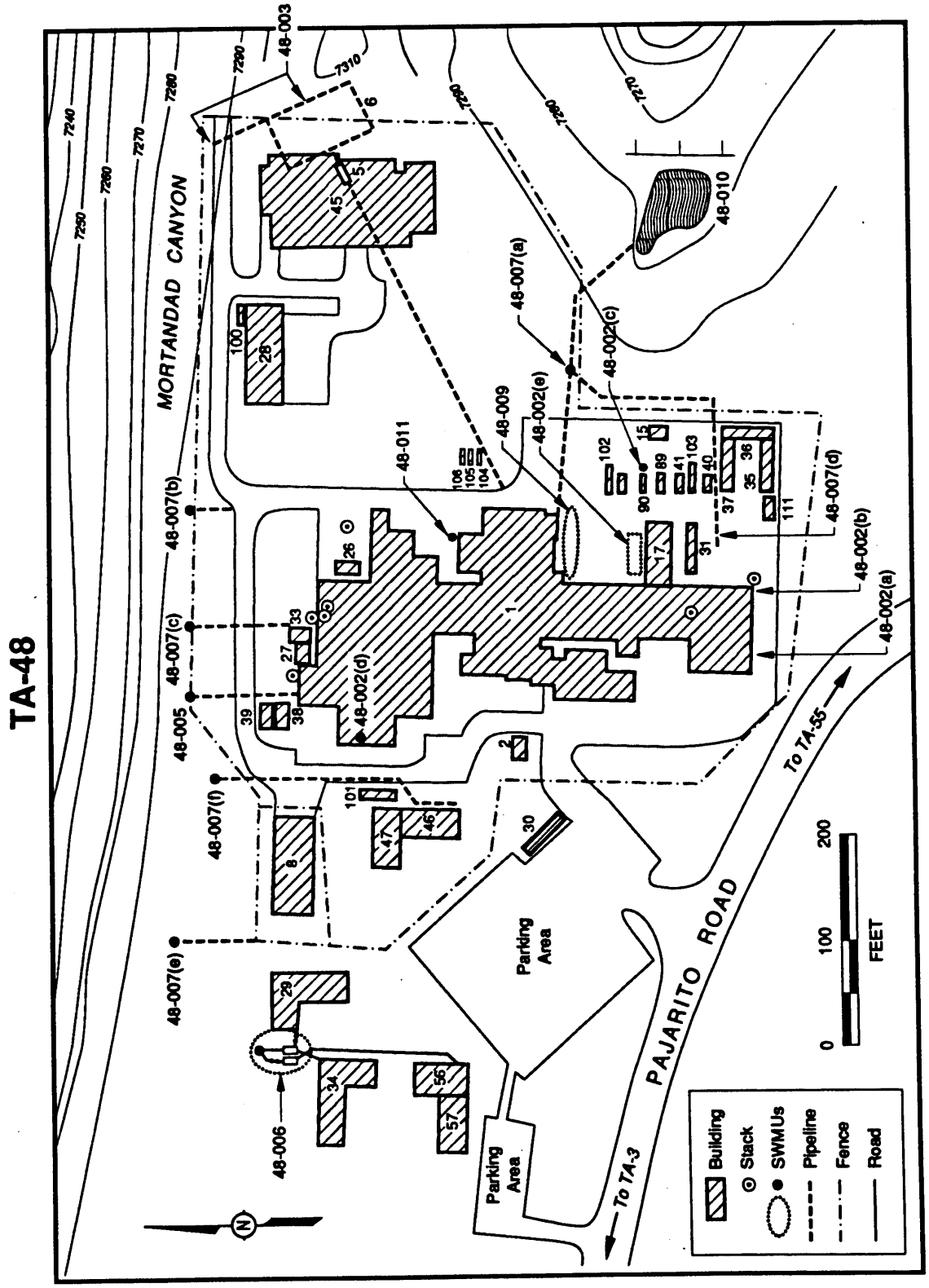


Figure 3-8. Locations of structures and SWMUs at TA-48. SWMU No. 48-001 is surface deposition of airborne releases surrounding TA-48-1 (modified from LANL 1988, 04-0259).

SWMU No. 48-003, Inactive Septic System: SWMU No. 48-003 was a septic system that served TA-48-1 from 1957 until it was abandoned in January 1986 (The Zia Company 1986, 04-0205). This unit consisted of a septic tank (TA-48-5), a filter bed (TA-48-6), and an outfall into Mortandad Canyon (Figure 3-8). Sanitary wastes from TA-48-1 went to the tank, and the decanted liquid went to the filter bed. The tank and the dosing chamber to which it was connected totalled 21 ft 7 in. in length. The dosing chamber was connected to the sand filter bed (which measured 40 ft 7 in. wide by 81 ft 2 in. long) by 20 ft of 6-in. pipe (AEC 1967, 04-0008).

Although the septic system primarily received sanitary waste, the septic tank system is suspected of receiving the discharge of hazardous chemicals and radionuclides. In 1973, an environmental assessment of a project to improve the Laboratory's septic tank systems listed this system as one with a potential for receiving an accidental release of chemicals or radioactivity (LASL 1973, 0493). The report proposed that the existing surface sand filter be renovated to "facilitate the monitoring of an accidental release." Readings taken in a 1988 ER Program site reconnaissance survey measured 14-mR/hr gamma activity 3 ft from the surface near the former site of the filter bed (Shafer 1989, 04-0187). During the same reconnaissance program, the inactive outfall was located to the north of the former location of the filter bed. The outfall had an NPDES Serial No. 08s and EPA ID No. SSS, both of which were delisted and combined with NPDES Serial No. 10s. The waste that was handled by this septic system now discharges to the sanitary lagoons at TA-35. The septic tank and filter bed were decommissioned and removed in 1986, and building TA-48-45 was built over the site (Roberson 1991, 04-0175).

SWMU Nos. 48-004(a-d), Sumps and Tanks: The sumps and tanks at TA-48-1 were operational from the 1950s until the 1970s and were abandoned in place in 1982. Some of the tanks were subsequently removed. SWMU No. 48-004 includes the remaining inactive sumps and tanks that were a part of the acid-neutralization process in TA-48-1 (Table 3-35). Figure 3-9 shows the locations of these SWMUs.

A 1968 memorandum lists three sumps at TA-48 that may contain potentially hazardous materials (Kennedy 1968, 04-0107). The three sumps are not identified but the memorandum mentions the possibility of the tanks overflowing. To prevent the overflow of the tanks, the tanks were equipped with alarms that would be activated when the tanks approached full capacity. Wastes handled in these sumps were either Class B or Class C (Kennedy 1968, 04-0107). An automatic neutralization station added caustics to the acid wastes in these sumps (H-Division 1958, 0479). Each sump was equipped with a dual sump pump for pumping treated liquid waste to TA-50 for further processing. The mud that precipitated in the sumps was drummed and buried in the contaminated solid waste disposal area at TA-54. Acid wastes are now piped to TA-50 without pretreating with caustics.

Releases or spills from these sumps and tanks have not been documented, but some contamination may remain inside the sumps and tanks.

SWMU No. 48-005, Waste Lines: From 1957 to 1965, industrial waste lines were used to transport liquid wastes containing radionuclides and chemicals from TA-48 to a chemical waste treatment plant at TA-45. Starting in 1963, liquid wastes from TA-48 were diverted through new underground pipes to an improved treatment facility at TA-50. By the end of 1967, lines carrying wastes to TA-45 were considered to have been decommissioned (LANL circa 1984, 04-0116; Elder et al. 1986, 0456). Portions of the industrial waste line system that lay outside the TA-48 fence were removed in 1981 and 1984. Portions of the lines that lay inside the security fence were not removed (Elder et al. 1986, 0456). The locations of these lines are shown

TABLE 3-35

SUMPS AND TANKS AT TA-48

SWMU No.	Description	Location
48-004(a)	Two sumps: one is approximately 4 ft by 3 ft by 2 ft deep; and the other is about 6 ft by 6 ft by 5 ft deep.	Below the floor of the shop, Room 50
48-004(b)	Three sets of tanks: one set is located in a pit area in which a sump exists. Waste mud removed from the second set of tanks had radionuclide contamination.	South basement, Room 80
48-004(c)	Two tanks (now removed) that contained sodium hydroxide solutions, and a sump that collected condensate from the caustic tanks.	North basement
48-004(d)	One tank that appears to have never been used.	Below hot cell in the basement

in Figure 3-8. Table 3-36 summarizes the status of industrial waste lines at TA-48. More information on the industrial waste line removal project at TA-48 is provided in Section 3.5.2.4, Environmental Surveys and D&D Activities.

Releases and leaks from these industrial waste lines are not well documented, and the extent of soil contamination associated with these lines is unknown. In March 1982, a break in Line 36 was discovered to be the source of water ponding at the northwest corner of TA-48-1. The break was repaired, and an unspecified amount of contaminated soil was removed (Emelity 1982, 04-0063). No information is available on the levels of activity in this water or in the soil that was removed. Other releases from these lines have not been documented.

No information is available concerning the extent of contaminants released from the Line 37 outfall into Mortandad Canyon.

SWMU No. 48-006, Active Septic System: An active septic system (TA-48-32) located northwest of TA-48-29 (Figure 3-8) is designated as SWMU No. 48-006 (LANL 1990, 0145). The system, which began operation in the mid-1980s, consists of two 1,000-gal. tanks connected in parallel, although a 1983 registration of an unpermitted individual liquid waste system lists this system as one 2,000-gal. tank (LANL 1990, 0145). The overflow from TA-48-32 goes to a seepage pit. Blockage in the line between the tank and the seepage pit was removed in January 1986. Before removal of the blockage, the system required frequent pumping (The Zia Company 1986, 04-0205). The system currently serves approximately 70 people in six transportable office buildings (LANL 1990, 0145). The Waste Stream

Characterization Report covering TA-48-29, -34, -56, and -57 (all located in this vicinity) indicates that only offices, computer rooms, draftsmen's work stations, restrooms, and kitchen/break areas occupy these buildings (LANL 1991, 04-0133). The system is believed to manage only sanitary waste from these buildings. No past or present releases of hazardous chemicals or radionuclides to or from this system are suspected (Roberson 1991,04-0175).

SWMU No. 48-007, Outfalls: TA-48 has six active outfalls permitted under NPDES Permit No. NM0028355 (Table 3-37). All of the outfalls discharge to Mortandad Canyon, north and east of TA-48. Small "wetland" areas have developed at several of these outfalls, particularly at SWMU Nos. 48-007(a and d). Five of these outfalls discharge untreated noncontact cooling water used in heat exchange for equipment

TABLE 3-36

RADIOACTIVE WASTE LINES AT TA-48

Waste Line	Description	Status
Line 34	A 3-in. cast-iron pipe that ran westward from TA-48-1; carried industrial wastes to TA-45 before 1963. Contained up to 1,000-dpm/50-cm^2 alpha activity.	A 200-ft section of Line 34 outside the TA-48 fenced area was removed in 1984. A 100-ft section remains inside the security fence at a depth of approximately 11 ft.
Line 36	A 3-in. cast-iron pipe that runs southward from the north wing of TA-48-1 to Line 34. No activity was detected in Line 36.	A 300-ft section of Line 36 remains inside the security fence at a depth of approximately 11 ft.
Line 37	A 2-in. cast-iron pipe, 56 ft in length, that ran from sumps in the north basement of TA-48-1 northward to the canyon outfall.	Completely removed in 1981.
Line 38	A 3-in. cast-iron pipe that ran southward from TA-48-1 to Line 33.	A 50-ft section inside the security fence remains at a depth of 10 ft.
Line 39	An 8-in. vitrified-clay pipe that ran southeastward along Pajarito Road from MH-RC-10 to MH-1016.	Completely removed in 1981.
Line 40	A 5-in. PVC pipe parallel to Line 39.	Completely removed in 1984.
Line 41	A 1-1/2 in. stainless-steel pipe that ran southeastward from the south end of TA-48-1 to MH-1016.	Completely removed in 1981.

Source: Elder et al. (1986, 0456).

TABLE 3-37

OUTFALLS AT TA-48

SWMU No.	NPDES Permit No.	Waste Source	Outfall Location[a]
48-007(a)	045/046 EPA 03A	TA-48-1	East of TA-48-1
48-007(b)	016 EPA 04A	TA-48-1	Northeast of TA-48-1
48-007(c)	131 EPA 04A	TA-48-1	North of TA-48-1
48-007(d)	153 EPA 04A	TA-48-1	East of TA-48-1
48-007(e)	126 EPA 04A	TA-48-8	Northwest of TA-48-8
48-007(f)	137 EPA 04A	TA-48-46	Northeast of TA-48-46

[a]Outfall locations are shown in Figure 3-8.

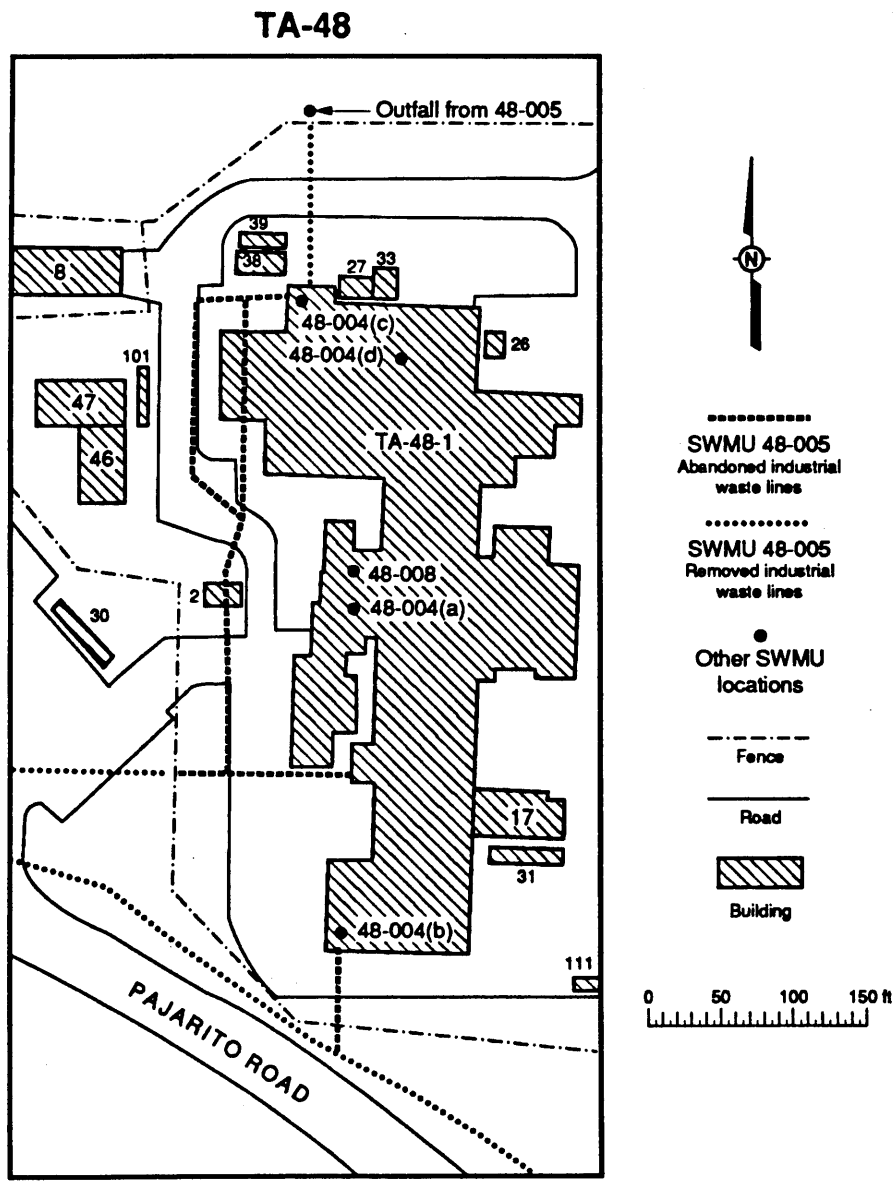


Figure 3-9. Locations of structures and SWMUs at TA-48.

such as vacuum pumps, electromagnets, x-ray machines, and lasers in various TA-48 buildings. Because these are once-through cooling systems, they do not require chemical treatment. One outfall, SWMU No. 48-007(a), discharges treated cooling tower water. The water used for cooling enters the systems as potable water. However, the exact origin of the cooling water for each discharge point in building TA-48-1 is unknown, and results of a dye test conducted in the early 1980s were inconclusive. Because their origin is unknown, leaks may have occurred that could have resulted in contamination of outfalls discharging from this building (SWMU Nos. 48-007[a, b, c, and d]) (DOE 1987, 0264; LANL 1990, 0145).

SWMU No. 48-007(a) discharges up to 750 gph as treated cooling-water blowdown from two cooling towers located on the roof of TA-48-1. These cooling towers receive 1,875 gph of potable water, of which 1,125 gph are lost to evaporation. Because these cooling towers are defined as open systems (open to evaporation loss), the water used in them must be treated to control scale, corrosion, microbiological growth, and algal growth. The following treatment chemicals used are Garratt-Callahan (G.C.) Company products: G.C. Formula 227-L, which inhibits corrosion and scaling, and G.C. Formula 314-T, which acts as a biocide (Radzinski 1991, 04-0171). The exact chemicals used in these formulas are unknown, but some of the water treatment chemicals used at the Laboratory are known to contain mercury and lead (Fresquez 1990, 04-0073). This outfall discharges into the unlined surface impoundment (SWMU No. 48-010) east of TA-48-1.

SWMU No. 48-007(b) discharges up to 420 gph as noncontact cooling water that cools a vacuum pump housed in the northeast corner of TA-48-1. This outfall, which was "grandfathered" in under the NPDES permit, discharges directly into Mortandad Canyon on the north side of TA-48-1 (LANL 1985, 04-0121).

SWMU No. 48-007(c), submitted to the EPA in April 1987 for inclusion under the NPDES permit, discharges up to 110 gph as noncontact cooling water from a vacuum pump cooling system in the basement at the north end of TA-48-1 (LANL 1991c, 04-0261). This outfall discharges into Mortandad Canyon northeast of TA-48-1.

SWMU No. 48-007(d) was listed as unpermitted in the SWMU report, but was submitted to EPA in May 1990 for inclusion under the NPDES permit as Outfall 04A153 (LANL circa 1990, 04-0131). The outfall discharges up to 4,000 gpd of noncontact cooling water used to cool a vacuum pump housed in the south end of TA-48-1. The effluent drains into the surface impoundment/wetlands area (SWMU No. 48-010) east of TA-48-1 (LANL 1990, 0145).

SWMU No. 48-007(e), was submitted to the EPA in May 1985 for inclusion under the NPDES permit, but was dropped from the permit in 1991 (LANL 1991c, 04-0261). The outfall discharged a maximum of 500 gph as noncontact cooling water used to cool an electromagnet in the northwest corner of TA-48-8, the isotope separation building (LANL 1990, 0145). No release history for this outfall exists; however, chemicals including inorganics and solvents such as acetone, alcohol, and benzene are used at TA-48-8 (LANL 1990, 0145). This outfall discharges into Mortandad Canyon northwest of TA-48-1.

SWMU No. 48-007(f), submitted to the EPA in November 1987 for inclusion under the NPDES permit, discharges up to 100 gpd of noncontact cooling water as x-ray cooling load from an office and laboratory building, TA-48-46 (LANL 1990, 0145). Materials used at TA-48-46 and possible releases to Mortandad Canyon from this outfall are unknown (LANL 1990, 0145).

A new outfall that was not addressed in the SWMU report, Outfall 04A152, was submitted to EPA for inclusion under the NPDES permit in May 1990. This outfall discharges a maximum of 11,000 gpd of noncontact cooling water as laser jacket cooling water for the barrel and power supply housed in the instrument building, TA-48-28 (LANL 1991, 04-0133). The outfall discharges into Mortandad Canyon north of TA-48-28. Because this outfall has been permitted under NPDES since its operation began, it is not considered a SWMU.

SWMU No. 48-008, Leakage from PCB Transformers: Two transformers leaking PCB-contaminated oil are located in Room 26, a switchgear room located on the east side of the basement of TA-48-1 (SWMU No. 48-008). The first one (ID No. 5549) was cited as leaking from the top valve in a 1987 memorandum regarding leaking PCB transformers that required daily inspections. The second one (ID No. 5548), located next to No. 5549, began to leak sometime before September 1989. By then, both transformers had produced about 4 gal. of PCB-contaminated oil. The oil in transformer No. 5549 contained 40.3 ppm of PCBs and transformer No. 5548 had 51.9 ppm of PCBs (50 ppm is the EPA action level for PCBs) (LANL 1990, 0145). The oil leaked onto the painted concrete floor in Room 26, but did not flow from the room and was cleaned up. During a 1991 ER Program site visit, Laboratory personnel stated that the transformers had been retrofitted four times, most recently in December 1990, and the transformers no longer use PCB oil (Helmick personal communication in Roberson 1991, 04-0175). No sign of oil leaks was observed on the transformers or the floor during this inspection (Roberson 1991, 04-0175).

SWMU No. 48-009, Soil Contamination from Air Compressor Operations: Two air compressors are located in a caged area on a loading dock east of TA-48-1. Each compressor is approximately 3 ft by 4 ft 6 in. by 3 ft 6 in. and contains 35 gal. of oil. One of the units compresses air for TA-48-1 and the second acts as a backup. Since early 1989, the main air compressor has periodically broken down every 2 to 3 months. When this occurs, about 2 to 3 gal. of crankcase oil sprays onto the ground and the backup compressor is activated. An absorbent clay material placed on the ground to absorb the oil is removed and replaced after each breakdown. SWMU No. 48-009 is a trail of visible oil stains that was observed to extend about 200 ft away from the east loading dock area, across the paved parking lot, and down to a level area that drains into Mortandad Canyon. The spilled oil was sampled in 1989 and does not contain PCBs (LANL 1990, 0145). Stained asphalt was observed below the compressor during an ER Program site visit in July 1991, but the trail of stains extended only about 40 ft. Oil stains did not extend off of the paved area east of TA-48-1 (Roberson 1991, 04-0175).

SWMU No. 48-010, Surface Impoundment: SWMU No. 48-010 is an unlined pond located about 500 ft southeast of TA-48-1 that was excavated into the tuff in 1978. Industrial noncontact cooling water and treated cooling water from cooling towers on the roof of TA-48-1 discharge to Outfall 03A045 (SWMU No. 48-007[a]) and Outfall 04A153 (SWMU No. 48-007[d]), which drain into this impoundment. The pond discharges eastward into a side canyon that is a tributary to Mortandad Canyon. A large wetlands area has developed around this pond. The extent of contamination in the pond has not been characterized.

SWMU No. 48-011 (proposed), Shaft Containing Lead Shield: In 1976 or 1977, a shaft 65 ft deep and 3 ft in diameter was drilled into the tuff on the east side of TA-48-1 (Figure 3-8). A stainless-steel cylinder 2 ft in diameter by 3 ft high filled with an estimated 3,000 lb of "clean, poured lead" and containing a NaI detector was to be lowered into this shaft for use in radiation-counting experiments. When the cylinder was being lowered into the shaft, the cable broke and the cylinder fell to the bottom.

Attempts at removing the cylinder failed, and it has been abandoned at the bottom of the shaft (Butler 1991, 04-0214).

This site has not been listed as a SWMU or AOC but is currently undergoing formal ER Program consideration for inclusion on the list. The shaft is being addressed in this Work Plan. The steel cylinder may have ruptured during this incident, and lead may have been released into the environment. The shaft provides a conduit for rainwater to enter the site and come in contact with the lead. Lead is the only suspected contaminant at this site.

3.5.2.2 Summary of Potential Waste Materials

Based on available information, potential waste materials handled at TA-48 include the following:

- Perchloric acid
- Beryllium-10 (^{10}Be)
- Solid transuranic wastes
- Unspecified acids
- Unspecified bases
- Mixed fission products
- Spallation and activation products
- Uranium
- Plutonium
- Strontium-89 (^{89}Sr)
- Lead
- Hydrofluoric acid
- Cobalt-60 (^{60}Co)
- Asbestos
- Welding and silver soldering materials
- Aluminum "rabbit"
- G.C. Formula 227-L (corrosion and scale inhibitor)
- G.C. Formula 314-T (biocide)
- Mercury

3.5.2.3 Past Waste Spills, Releases, and Incidents

Normal or routine releases of solid, liquid, and atmospheric effluents from TA-48 are discussed in Section 3.5.2.1, Waste Management Activities. Atmospheric releases from TA-48-1 were discussed as SWMU No. 48-001. Accidental spills or releases documented in Laboratory reports and memoranda are discussed in the following text.

In March 1982, a broken radioactive waste force main over a leaking water main was determined to be the cause of water ponding at the northwest corner of TA-48-1. The break and leaks were repaired, and contaminated soil was removed (Emelity 1982, 04-0063). This release is associated with SWMU No. 48-005. Information on the extent of contamination from this incident is not available. The sources of the radioactive waste were connected to the new collection system so that the radioactive waste main could be drained and abandoned (Emelity 1982, 04-0064). The daylight discharge that receives storm run-off from TA-48-1 may have been contaminated from this incident (Emelity 1982, 04-0063).

3.5.2.4 Environmental Surveys and D&D Activities

Because TA-48 is an active laboratory area, few D&D activities have been carried out. SWMUs affected by D&D activities are SWMU No. 48-003 (the former septic system was removed in 1986) and SWMU No. 48-005 (portions of the industrial waste line system were removed in 1981 and 1984). More information on the D&D of the waste lines is provided in the following text.

The 1977 Laboratory Ten-Year D&D Plan discusses radioactive contamination (plutonium, uranium, and fission products) associated with an underground industrial waste line that runs from a TA-48-1 manhole to ULR-149 (LASL 1977, 0469; Bradshaw 1977, 04-0031). This line and others outside the TA-48 security fence were eventually removed in 1981 and 1984. These lines had been used to pipe radioactive liquid waste to the treatment facility at TA-45 before 1963 and had been abandoned since that time because of the opening of an improved liquid waste treatment facility at TA-50 (LANL circa 1984, 04-0116).

A major project to remove unused and contaminated sections of the industrial waste line system at TA-48 began in September 1981 and ended, because of a lack of funds, in December 1981 (McAtee 1981, 04-0155; Hohner 1981, 04-0100; Harper 1981, 04-0094; Harper 1981, 04-0095). The following sections of the system connected with TA-48 were removed in 1981: 335 ft of Line 32 running from manhole ULR-149 eastward; 150 ft of Line 35 running from manhole ULR-149 eastward; 56 ft of Line 37 running from the north end of TA-48 northward to a canyon outfall; 505 ft of Line 39 running between manholes TA-48-10 and ULR-1016; and 630 ft of Line 41 running from the south side of TA-48 southeastward. Line 42 had been removed in 1976 and 1977 when TA-55 was under construction (Elder et al. 1986, 0456). Radioactive contamination levels up to 800,000-dpm/50-cm^2 alpha activity were detected during line removal operations (Harper 1981, 04-0094). The locations at which high radioactivity was detected are not identified in this memorandum.

Additional decommissioning in the TA-48 area was not done until 1984 when the following industrial waste line segments were removed: 290 ft of Line 33 from its junction with Line 31 near TA-48 to its junction with Line 40 at manhole TA-48-10; 459 ft of Line 40 running parallel to Line 39 between manholes TA-48-10 and

ULR-1016; 200 ft of Line 34 from TA-48-1 to its junction with Line 33; 6 ft of Line 38 from TA-48-1 to manhole TA-48-10; and 1,762 ft of Line 43 from manhole ULR-1016 to the east side of Pecos Drive (Elder et al. 1986, 0456). Contamination levels up to 80,000 dpm/100 cm^2 were detected during this phase of line removal (Cox 1984, 04-0045). As before, the locations at which activity was detected are not given in the reports.

By September 1986, the following segments of the lines remained in place: 100 ft of Line 34; 330 ft of Line 36; and 50 ft of Line 38. These line sections were all inside the security fence at TA-48 and were left in place because of the low levels of contamination and because they were situated under a guard station, roads and sidewalks, and various utilities (Cox 1985, 04-0053). A survey of Line 34 measured less than 1,000-dpm/50-cm^2 alpha activity. Line 36 showed no activity, and Line 38 was not surveyed for radioactivity (Elder et al. 1986, 0456).

During 1988 ER Program reconnaissance surveys, gamma-ray count data measured using a Ludlum Model 19 counter determined background radioactivity in the TA-48 environs to be 20 µR/hr. Waste barrels at TA-48 measured less than average background for beta-gamma activity. The HEPA filter area associated with the air exhaust system (SWMU No. 48-001) at TA-48-1 measured 233 cpm (60 µR/hr) greater than background beta-gamma activity. The former sand filter bed area at TA-48-6 (SWMU No. 48-003) measured 103 cpm greater than background at the surface (Shafer circa 1989, 04-0187; LANL 1988, 04-0126; LANL 1988, 04-0127). Measurements from the parking lot on the east side of TA-48-1 were less than background, but the radioactive waste dumpsters in the east parking lot measured from 100 to 450 µR/hr greater than background and 80 µR/hr greater than background at 10 ft. The fission product area inside TA-48-1 measured 400 µR/hr greater than background. The entire hot cell area exceeded the "action level," which is not specified in the notes (Shafer circa 1989, 04-0187; LANL 1988, 04-0128).

In April 1991, five surface and five subsurface soil samples were collected north of TA-48-8 as part of an ER Program Interim Action (ERIA) reconnaissance survey at the site of a proposed building, the Weapons Isotope Separator Facility (Fresquez 1991, 04-0079). Surface samples were defined in the memorandum as samples taken between 0 and 4.8 ft in depth, and subsurface samples were defined as samples collected from greater than 4.8 ft in depth (Fresquez 1991, 04-0078). The exact depths from which these samples were taken is not provided. The samples were taken in the vicinity of three SWMUs: No. 48-001, potential soil contamination from improperly filtered atmospheric emissions; No. 48-005, buried industrial waste Line 36, and associated soil contamination from lines 36 and 37 (removed); and No. 48-007(e), a cooling water outfall northwest of TA-48-8.

Levels of gross-alpha, -beta, and -gamma activity were at background for all samples collected. No PCBs or SVOCs were detected in any of the samples. All samples revealed concentrations of TCLP metals (Ag, As, Ba, Cd, Cr, Hg, Pb, and Se) to be less than EPA guideline levels. Trace amounts of three VOCs, p-isopropyltoluene (p-Cymene), isopropylbenzene (cumene), and trichlorotrifluoroethane (Freon), were detected at less than 52 ppb. EPA action level concentrations are not listed for these VOCs (Fresquez 1991, 04-0079).

In January 1991, five surface and five subsurface soil samples were collected from the site of a proposed parking lot immediately east of the security fence on the east side of TA-48 (Figure 3-8). The samples were "systematically collected over the entire area;" however, the exact locations from which samples were taken are not provided (Fresquez 1990, 04-0073; Fresquez 1991, 04-0077). Two additional

surface soil samples were collected from a channel that diverts surface run-off along the northern edge of the proposed parking lot into the surface impoundment east of TA-48 (SWMU No. 48-010).

The proposed parking lot area was suspected of being contaminated by fallout from improperly filtered air emissions (SWMU No. 48-001), and run-off from container storage areas on the south and east sides of TA-48-1 (SWMU Nos. 48-002[a, b, c, and e]). Soil in the run-off channel was reportedly stained by oil spilled from a leaking air compressor (SWMU No. 48-009).

Gross-beta and -gamma activity in all surface and subsurface samples was at background levels. However, gross-alpha activity ranged from background to 45 pCi/g for surface soil samples and from background to 65 pCi/g for subsurface samples. Alpha activity was below the DOE guideline value of 75 pCi/g for subsurface samples, but surface soil samples from the western and northwestern half of the proposed parking area exceeded the DOE guideline level of >25 + 18 pCi/g for surface alpha activity (Fresquez 1991, 04-0077).

No VOCs were detected in any of the samples, and most samples did not contain detectable levels of SVOCs. Di-n-butyl-phthalate (an SVOC plasticizer) was detected in two samples at 1 ppm, far less than the EPA guideline level of 8,000 ppm. The only PCBs detected, mixed arochlors at less than 0.61 ppm, were also well below EPA action levels. TCLP metals were all at concentrations less than EPA regulatory guidelines (Fresquez 1991, 04-0077).

In summary, the samples collected in 1991 from the site of the proposed parking area east of TA-48-1, and from the site of the proposed Weapons Isotope Separator Facility north of TA-48-8 indicated "no organic, inorganic, or radiological constituents in concentrations high enough to pose a health hazard" (Fresquez 1991, 04-0077; Fresquez 1991, 04-0079). Gross-alpha activity in the northwestern and western half of the proposed parking area is the only constituent that exceeded DOE guideline levels.

3.5.3 Regulatory Activities

3.5.3.1 Permits

Seven outfalls are permitted under NPDES at TA-48, as listed in Table 3-37 and discussed in Section 3.5.2.1, Waste Management Activities.

3.5.3.2 Interim Corrective Measures

The 1988 Inventory of Federal Hazardous Waste Activities forms completed for TA-48 indicate that CERCLA PA/SI corrective actions were completed in October 1987 as part of the CEARP Phase I Investigation.

3.6 Description of TA-52, Reactor Development Site

3.6.1 Site Location and Physical Description

TA-52, which is located southeast of TA-35, houses the operations of the Safety Assessment, Safety Code Development, and Reactor Design and Analysis groups. The site was also the location of the Ultra-High- Temperature Reactor Experiment (UHTREX) until its removal in 1990. TA-52 occupies the central portion of former TA-4. The following subsections provide a detailed description of the site.

3.6.1.1 Geographic Location and Local Area Description

TA-52 is located on Mesita del Buey on the south side of Puye Road approximately 2,000 ft east of the intersection with Pajarito Road. The facility is located at an approximate latitude and longitude of 35°51'35" N and 106°17'20" W, respectively (USGS 1984,04-0239). The area lies between elevations of 7,140 and 7,200 ft, and is bounded on the north by Ten Site Canyon (a tributary of Mortandad Canyon) and on the south by Canada Del Buey. TA-52 lies within the boundaries of the Laboratory and Los Alamos County.

3.6.1.2 Physical Site Description

TA-52 was built in the mid-1960s to house the UHTREX reactor. The reactor was shut down in February 1970 (LANL 1989, 0459). Since then, the site has housed offices and laboratories used by the Energy Division (Q-Division) and its successor, the Nuclear Technology and Engineering Division (N-Division), and a classified document disposal operation (LANL 1989, 0459).

Three principal structures exist at TA-52. The UHTREX Building (TA-52-1), which housed the reactor, consists of the reactor containment area and areas outside the main containment area, which include the ground-floor level, the operations level, and a basement (Balo and Warren 1982, 0457). This building currently houses the N-Division offices and laboratories. The second main building at TA-52 is the Mechanical Assembly Building (TA-52-11), which houses the document-shredding facility (LANL 1990, 0145). TA-52-33 is the Weapons Support Office Facility, which is used for R-Division research and support. Other buildings at TA-52 are used primarily for office space.

Other structures at TA-52 include the Waste Neutralization and Pumping Facility, TA-52-2, in which acid wastes from UHTREX were treated; the filter pit, TA-52-14, in which the helium reactor coolant, possibly contaminated with fission products, was passed through a subgrade bank of HEPA and charcoal filters; and the Heat Dump Building and Pad, TA-52-15 and -16, respectively, in which coils and fans for cooling of the helium reactor coolant were contained (Ahlquist 1985, 04-0016; LANL 1989, 0459). Figure 3-10 shows locations of the structures within TA-52, and Table 3-38 contains detailed descriptions of these structures.

3.6.1.3 Ownership Profile and Land Uses

DOE owns TA-52, and Laboratory personnel use the space for offices.

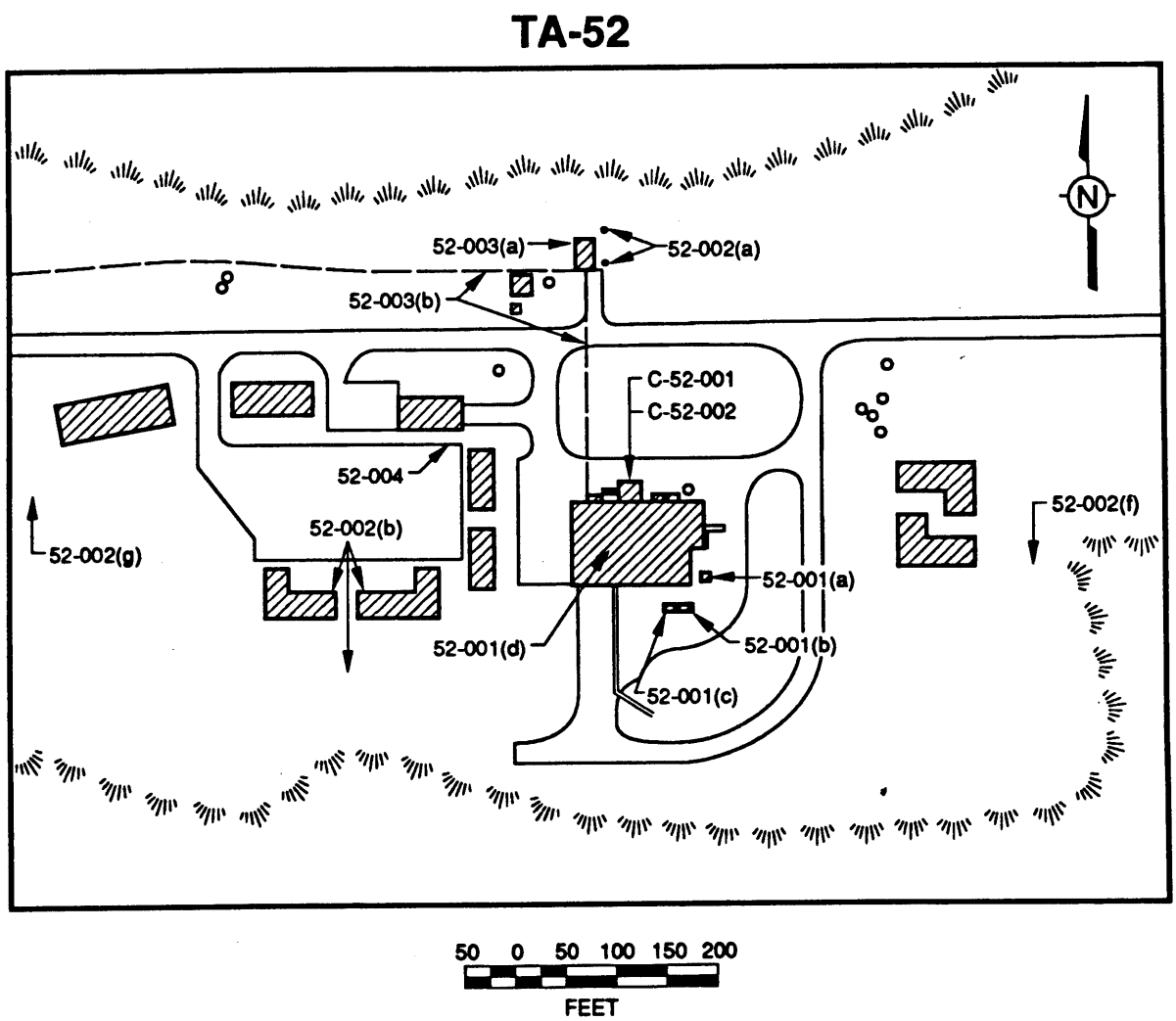


Figure 3-10. Locations of structures and SWMUs at TA-52 (LANL 1983, 04-0244).

TABLE 3-38

DESCRIPTIONS OF STRUCTURES AT TA-52

- **TA-52-1, UHTREX Building.** Composite rectangular building with dimensions 132 ft by 85 ft. Completed February 3, 1965. Formerly housed the UHTREX reactor and associated equipment (SWMU No. 52-001[d]). Now used by N-Division as office and laboratory space (DOE 1987, 0264).
- **TA-52-2, Waste Neutralization and Pumping Facility.** Completed February 3, 1965. Used for the treatment of UHTREX liquid wastes. Designated as SWMU No. 52-003. Removed in 1989.
- **TA-52-3, Septic tank.** Completed February 3, 1965. Designated as SWMU No. 52-002(a).
- **TA-52-4, Distribution box.** Served septic tank TA-52-3, SWMU No. 52-002(a). Completed February 3, 1965.
- **TA-52-5, Electric manhole.** Installed February 3, 1965.
- **TA-52-6, Water valve manhole.** Installed February 3, 1965.
- **TA-52-7, Exhaust stack.** 100 ft high. Completed February 3, 1965. Removed in 1989.
- **TA-52-8, Retaining wall.** Completed February 3, 1965.
- **TA-52-9, Substation.** Completed February 3, 1965. Contains two pad-mounted transformers.
- **TA-51-10, Office building.** Relocated to TA-3-204.
- **TA-52-11, Mechanical Assembly Building.** Completed February 5, 1965. Contains classified-document-shredding facility (hammer mill). SWMU No. 52-004 is an inactive outfall from the Mechanical Assembly Building.
- **TA-52-12, Fuel tank.** Installed February 5, 1965.
- **TA-52-13, Switchgear station.** Completed December 29, 1964.
- **TA-52-14, Filter pit.** Completed February 5, 1965. Consisted of HEPA and charcoal filter banks in a subsurface pit. Designated as SWMU No. 52-001(a). Removed in 1989.
- **TA-52-15, Heat Dump Building.** Completed February 5, 1965. Used for cooling reactor coolant. Designated as SWMU No. 52-001(b). Removed in 1989.
- **TA-52-16, Heat Dump Pad.** Completed February 5, 1965. Associated with TA-52-15. Designated as SWMU No. 52-001(c). Removed in 1989.
- **TA-52-17, Manifold.** Steel-grating walkway. Completed February 5, 1965. Removed in 1989.
- **TA-52-18, Telephone manhole.** Completed February 5, 1965.
- **TA-52-19, Electrical manhole.** Completed February 5, 1965.
- **TA-52-20, Telephone manhole.** Completed February 5, 1965.
- **TA-52-21, Electrical manhole.** Completed February 5, 1965.

TABLE 3-38 Continued

DESCRIPTIONS OF STRUCTURES AT TA-52

- **TA-52-22 through -26, Test wells.** Drilled in 1964 and 1965 as Gas Injection Study Test Wells. TA-52-22 is a 295 ft-deep, 4-in.-diameter open hole. TA-52-23 is 99 ft deep, 3 in. in diameter with 6-in. casing. TA-52-24, -25, and -26 are 97 ft deep, 5 in. in diameter with steel casing.
- **TA-52-27, Graphite building.** Moved to TA-52 in January 1965 for use as a construction shack. Transferred to The Zia Company in 1967.
- **TA-52-28, Office trailer.** Moved to TA-52 from TA-35 on June 16, 1967.
- **TA-52-29, Gas-metering station.**
- **TA-52-30, Office trailer.** Relocated from TA-35-79.
- **TA-52-31, Transform station.** Removed in 1977.
- **TA-52-32, Electrical manhole.** Completed September 4, 1975. 90 ft south of TA-52-13.
- **TA-52-33, Weapons Support Office Facility.** Completed March 22, 1977. 134 ft by 40 ft, 3-stories tall, located west of TA-52-1. Used by R-Division.
- **TA-52-34, Septic tank.** Designated as SWMU No. 52-002(b). Consists of two 2,000-gal.-capacity septic tanks that drain to a seepage pit.
- **TA-52-35, and -36, Transportable office buildings.** 24-ft by 60-ft trailers. Located east of TA-52-1.
- **TA-52-41 through -45, Transportable office buildings.**
- **TA-52-46, and -47, Septic tanks.** 500-gal. tanks planned for installation in 1984; possibly never installed.
- **TA-52-48, Metal building.** 40-ft by 100-ft corrugated-metal building at entrance to TA-52.
- **TA-52-49, Septic tank.** 1,000-gal. tank, now TA-63-12. Designated as SWMU Nos. 52-002(e) and 63-001(a).
- **TA-52-50, Seepage pit.** Associated with TA-52-49, now TA-63-12. Designated as SWMU Nos. 52-002(e) and 63-001(a).
- **TA-52-52, Transportable office.** Located at intersection of Puye and Pajarito roads. Installed 1984. Now in TA-63.
- **TA-52-53, Guard station.** Installed 1984. Now located in TA-63.
- **TA-52-64, Transportable office.** Located south of TA-52-35, and -36.
- **TA-52-65, Guard station.** 5-ft by 9-ft structure adjacent to TA-52-64. Installed in 1985.
- **TA-52-72, Office trailer.** Installed in 1986.
- **TA-52-73 through -83, Electrical manholes.** Installed 1986.

3.6.2 Historical Overview

TA-52 was built on the central portion of former TA-4. The site was established in the mid-1960s to house the UHTREX facility, which was an experimental fission reactor fueled by graphite roads loaded with triply-coated, 93% enriched uranium beads (Ahlquist 1985, 04-0016). The reactor was helium-cooled, graphite-moderated, and designed to operate at an outlet gas temperature of 2,400°F (DOE 1987, 0264; LANL 1989, 0459). UHTREX was intended for the advancement of high-temperature, gas-cooled reactor technology and research and development of new fuels. Plans to operate UHTREX with uranium-thorium fuel elements and other fuels with high yield of fission products did not materialize (LANL 1989, 0459). This unit was actively used for reactor experiments from 1965 to 1968 (LANL 1990, 0145). Criticality was attained in August 1967 and the reactor operated for about one year, achieving the desired 2,400°F temperature, and reaching peak power at about 3 MW (Regan 1967, 0462; Ahlquist 1985, 04-0016). In 1970, the reactor was shut down, and the fuel was removed and taken to TA-3. The graphite liner of the reactor vessel, which in 1977 reportedly still contained an undetermined quantity of fuel fragments and a ^{239}Pu source, was also later removed (DOE 1987, 0264; LANL 1990, 0145). Since then, the UHTREX facility has been used by Q-Division and its successor, the N-Division for office and laboratory space. The site also houses a classified document-shredding and disposal facility.

The western portion of former TA-4 was incorporated into TA-52 in the 1980s, and then was redesignated as TA-63 in 1989.

3.6.2.1 Waste Management Activities

The reactor experiment at TA-52 lasted only one year after criticality was attained. Radioactive and mixed wastes were possibly released to the environment while the reactor was in operation. Wastes currently managed at this facility are limited to sanitary liquid wastes from several septic systems and solid nonhazardous wastes from the document shredder. Table 3-39 lists the SWMUs that were designated at TA-52 in the 1990 SWMU report (LANL 1990, 0145).

TABLE 3-39

TA-52 SWMUs

SWMU No.	Description
SWMU No. 52-001(a-d)*	UHTREX Equipment
SWMU No. 52-002(a-g)*	Active Septic Systems
SWMU No. 52-003(a-b)	Waste Treatment Facility
SWMU No. 52-004	Inactive Outfall

*SWMU Nos. 52-001(a-d) and 52-002(a-f) were listed in the HSWA Module VIII (EPA 1990, 0306). In addition to these SWMUs, two AOCs, C-52-001 and C-52-002, have been designated at TA-52.

SWMU Nos. 52-001(a-d), UHTREX Equipment: This SWMU consists of equipment that was associated with the operation of the UHTREX reactor. Structures included in this SWMU are listed in Table 3-40. The locations of these structures are shown in Figure 3-10.

TABLE 3-40

UHTREX EQUIPMENT

SWMU No.	Structure No.	Description	Location
52-001(a)	TA-52-14	Filter Pit	In ground immediately east of TA-52-1
52-001(b)	TA-52-15	Heat Dump Building	Near SE corner of TA-52-1
52-001(c)	TA-52-16	Heat Dump Pad	Immediately west of Heat Dump Building, SE corner of TA-52-1
52-001(d)	TA-52-1	Sump Pump Room, Hot Cells, Duct Work	Inside the UHTREX Building, TA-52-1

The filter pit and the Heat Dump Building and Pad (SWMU Nos. 52-001[a-c]) were removed in 1989 during the D&D of the UHTREX facility. Reactor support equipment inside TA-52-1 (SWMU No. 52-001[d]) was removed and decontaminated in 1990 (Salazar and Elder 1991, 0623).

SWMU No. 52-001(a), the filter pit, was a below-grade pit that contained a bank of four HEPA and four charcoal filters. The primary helium coolant from the UHTREX reactor was circulated through these filters to remove fission product particulates that may have leaked into the coolant from the reactor vessel. Filtered coolant was either recirculated back through the reactor, or exhausted out stack TA-52-7 during shut-down periods (Salazar and Elder 1991, 0623). The extent of contamination associated with the filters or the filter pit is unknown. A 1971 memorandum mentions that a filter was removed from TA-52 for disposal at TA-54. The filter did not contain ^{235}U, but was contaminated with mixed fission products (unspecified) and ^{60}Co from induced activity. Radiation on the filter when it was removed in January 1970 was 23 R/hr at contact. Eighteen months later radiation levels from the filter were 18 mR/hr at a distance of 3 ft (Buckland 1971, 04-0033). It is not known if this level of contamination was typical of the filters, or if this filter had been contaminated by an anomalous release or leak of fission products to the reactor coolant.

In 1989, all filters and frames were removed from the filter pit, which was then decontaminated to the DOE surface residual guidelines for radioactivity, backfilled with clean soil, and covered with asphalt. The concrete pit shell was left in the ground, and no soil was removed from beneath the pit (Elder 1991, 04-0218).

SWMU No. 52-001(b), the Heat Dump Building, and SWMU No. 52-001(c), the Heat Dump Pad, were the sites of fans and coils that were used to cool the secondary reactor coolant. Reports indicate no leakage from the primary coolant system to the secondary system (Ahlquist 1985, 04-0016). Releases of contaminants to the environment from the Heat Dump Building or Pad have not been recorded. The filter

pit, Heat Dump Building, and Heat Dump Pad were screened for radiation during the 1988 UHTREX radiological characterization and were found not to exceed background levels (LANL 1990, 0145). The heat dump area was surveyed again in 1989 by Group HSE-7 and radiation levels were found to exceed the background level.

In 1989, the metal Heat Dump Building was removed, the concrete pit beneath it was surveyed to verify that no above-background radioactivity existed, and then the pit was backfilled with clean soil. The area was covered with asphalt. The concrete pit remains in the ground. The Heat Dump Pad was completely removed and the area was paved with asphalt (Elder 1991, 04-0218). Soil samples were collected at the excavation site to demonstrate that residual soil contamination guidelines for radionuclides (developed by RESRAD modeling) were not exceeded (Salazar and Elder 1991, 0623).

In addition to the reactor vessel, numerous large pieces of equipment such as heat exchangers, gas cleanup systems, pumps, and filters were located in TA-52-1 (LANL 1990, 0145). SWMU No. 52-001(d) includes the sump pump room, ducts, and hot cells located within the UHTREX Building (TA-52-1). The sump pump, located in Room 303, probably received some contaminated wastes. Hot cells were located in rooms 104, 211, 212, and 213 (LANL 1989, 0459). An inactive outfall associated with TA-52-1 exists, but its exact location is uncertain. It is believed to have discharged noncontact cooling water (LANL 1990, 0145). The operation of the UHTREX reactor has no documented releases of contaminants to the environment. However, some contamination within the system in TA-52-1 existed. Some residual fuel fragments were believed to remain in the reactor vessel, and some fuel elements were reportedly broken during fuel-handling problems, possibly introducing contamination to the system (Ahlquist 1985, 04-0016).

SWMU Nos. 52-002(a-g), Active Septic Systems: Several active septic systems are present at TA-52. Information on these systems is provided in Table 3-41 and in the following text.

SWMU No. 52-002(a) is the original septic system for the UHTREX facility. The 2,580-gal. septic tank (TA-52-3) and the associated distribution box (TA-52-4) were installed in 1965 (LASL no date, 0402). The system is located north of TA-52-1, approximately 30 ft north of Puye Road and 10 ft east of TA-52-2, the Waste Neutralization and Pumping Facility (SWMU No. 52-003). Overflow from the tank goes to a tile drain field trench 300 ft in length that tuns east and west near the Ten Site Canyon edge (LASL 1968, 04-0241). The tank must be pumped regularly because the leach field is saturated (The Zia Company 1986, 04-0205) However, the tile drain field is still used (Smithour 1992, 04-0224). Tank TA-52-3 currently receives only sanitary waste, but solvents, chemicals, and radionuclides may have been introduced to the system from the UHTREX facility in the past.

The other septic systems at TA-52 have been installed since 1983 and serve only offices. Most likely these systems have not received hazardous or radioactive constituents (Smithour 1992, 04-0223). Radiation screening measurements performed in 1988 for the ER Program in the areas of SWMUs Nos. 52-002(a, b, and f) did not exceed background levels. SWMU No. 52-002(b) is a composite system that includes four tanks: TA-52-97, TA-52-98, and two adjacent tanks designated collectively as TA-52-34 (Figure 3-10). Tanks TA-52-97 and -98 serve office trailers TA-52-45 and -44, respectively. Overflow from these tanks goes to the tanks at TA-52-34, and drains to a seepage pit located at the south edge of the mesa near the north wall of Cañada del Buey. All these tanks are routinely pumped (Smithour 1991, 04-0222).

TABLE 3-41

SEPTIC SYSTEMS AT TA-52

SWMU No.	Structure No.	Structures Served	Location	Period of Use
52-002(a)	TA-52-3, -4	TA-52-1	North side of Puye Road	1965-Present
52-002(b)	TA-52-34(a) TA-52-34(b) TA-52-97 TA-52-98	TA-52-44, TA-52-45 Possibly other transportables	South edge of Mesa, south of TA-52-1	1983-Present
52-002(c,d)	TA-52-46, -47	Unknown[a]	Unknown[a]	Unknown[a]
52-002(e)[b]	TA-52-49, -50	TA-63-1	TA-63	1984-Present
52-004(f)	TA-52-99	TA-52-35, -36	East of TA-52-1	1983-Present
52-002(g)	TA-52-95	New office trailers west of TA-52-33	SW of TA-52-33	1989-Present

Source: 1990 SWMU report (LANL 1990, 0145).
[a]Existence of these tanks has not been confirmed.
[b]This septic system is now within TA-63 boundaries and is designated as SWMU No. 63-001(a).

Although tanks TA-52-46 and -47 were designated in the SWMU report as SWMU Nos. 52-002(c) and 52-002(d), respectively, their existence has not been confirmed. Recent engineering drawings do not show locations for these septic tanks, and neither Group ENG-7 nor Jo Controls World Services Inc. (JCI) have any information on the tanks (Madrid 1991, 04-0225; Smithour 1991, 04-0222). The tanks were probably planned but never installed.

SWMU No. 52-002(e) consists of a septic tank, TA-52-49, and a seepage pit, TA-52-50. This septic system was installed in 1984 in the western portion of TA-52, but now occurs within the boundaries of TA-63 and serves buildings at TA-63. The system was also designated as SWMU No. 63-001(a). This system will be treated as a TA-63 SWMU throughout the remainder of this Work Plan.

SWMU No. 52-002(f) consists of a 2,500-gal. tank (TA-52-99) and seepage pit located at the east end of TA-52 near Cañada del Buey (Figure 3-10). The system serves transportable offices TA-52-35 and -36, and is regularly pumped (Smithour 1991, 04-0222). SWMU No. 52-002(g), TA-52-95, is a 3,000-gal. holding tank installed in 1989 or 1990 to serve new transportable offices located west of TA-52-33. The tank is located to the southwest of TA-52-33 (Figure 3-10).

SWMU No. 52-003, Waste Treatment Facility: Building TA-52-2, the Waste Neutralization and Pumping Facility for liquid wastes from the UHTREX facility, has been designated as SWMU No. 52-003(a). The structure was located approximately 200 ft north of TA-52-1, on the north side of Puye Road (Figure 3-10). The building consisted of two stories, a basement and a ground-level floor (LASL 1968, 04-0242). The basement foundation was approximately 10 ft below ground level. The entire facility was removed in 1989 during the UHTREX D&D Project (Salazar and Elder 1991, 0623). The system was designed for caustic pretreatment of UHTREX wastes before they were piped to TA-50. The treatment facility included several tanks. Two 5,000-gal. concrete waste holding tanks were located on the north side of TA-52-2. These holding tanks were recessed into the ground at basement level (LASL 1968, 04-0242). Also, two tanks existed in the basement of TA-52-2. The size and purpose of one of these concrete tanks is unknown; the other tank was a mixing basin of less than 50-gal. capacity that was used to neutralize caustics. A 150-gal. tank on the first floor stored sodium hydroxide. Potential waste materials handled at TA-52-2 include radionuclides, acids, and other chemicals that are suspected to have been in the liquid wastes from the UHTREX reactor operations (LANL 1990, 0145).

When the facility was decontaminated and removed in 1989, all tanks were removed and the structure was demolished and excavated. Soils beneath the structure foundation were excavated to solid tuff, and the area was backfilled, graded, and revegetated (Salazar and Elder 1991, 0623). Soil samples were collected to demonstrate that residual soil contamination guidelines for radionuclides were not exceeded (Salazar and Elder 1991, 0623). Whether these samples were analyzed for nonradiological contaminants is unknown.

Liquid wastes entered and were discharged from this facility through 3-in. cast-iron industrial waste lines (SWMU No. 52-003[b]). Line 66 ran northward and transported wastes from TA-52-1 to TA-52-2. Line 65 ran west along the canyon edge behind the north fence line of MDA-C and transported wastes from TA-52-2 to TA-50 (Emelity et al. 1975, 0282; Salazar and Elder 1991, 0623) (Figure 3-10). The activity level of wastes pumped through the pumping station in 1969 and 1970 was found to be 3,000 dpm/l for alpha emissions, 13,000 dpm/l for beta emissions, and 207,000 dpm/l for gamma emissions (Elder 1988, 04-0059). Soils along the trace of the waste lines were sampled in 1988 by Group HSE-8 for radioactivity. Of 173 soil samples collected along waste lines 65 and 66 between TA-52-1 and TA-50, none showed detectable beta activity, and gamma activities were below 3 pCi/g (Salazar and Elder 1991, 0623). Twelve samples had alpha activity that exceeded the limit set by Group HSE-8 of 25 pCi/g. Of these, the maximum value was 126 pCi/g and the average was 67 pCi/g. None of these samples contained activity that exceeded the value of 267 pCi/g for residual soil radioactivity, as determined by site-specific RESRAD modeling. Soil samples from the waste lines that were analyzed for metals in 1988 found that concentrations of several metals (Ba, Cr, Mg, Ni, V, and Zn) were greater than background levels for areas near TA-52-2. However, all metals except vanadium were determined to be within background ranges for other nearby areas (Soholt 1988, 04-0189). The waste lines were removed in the fall of 1989 (Salazar and Elder 1991, 0623).

Engineering drawings for the installation of TA-52-2 indicate a short section of line (Line 66A) running northward from TA-52-2 to an outfall in Ten Site Canyon (LASL 1968, 04-0242). Exploratory excavations performed in 1989 during the removal of TA-52-2 did not reveal the pipe. Also, the sump in TA-52-2 that was supposed to feed Line 66A did not exist (Salazar and Elder 1991, 0623). Therefore, the canyon outfall and Line 66A were probably never installed.

SWMU No. 52-004, Inactive Outfall: SWMU No. 52-004 is an inactive outfall near the southeast corner of TA-52-11, the Mechanical Assembly Building (Figure 3-10). The Safety Assessment Group, Q-6, reportedly used TA-52-11 for wind-tunnel experiments in which water was run over simulated fuel rods and discharged as noncontact cooling water to this outfall (DOE 1987, 0264). This inactive discharge point has NPDES Outfall No. 112EPA04A. The extent of contamination associated with the operations in the Mechanical Assembly Building, if any, is unknown. Radioactive measurements taken in the area of TA-52-11 during 1988 ER Program site reconnaissance did not exceed background levels (LANL 1990, 0145). Mason and Hanger (the Laboratory security force) had a hammer mill/incinerator installed in this building sometime in late 1970 to destroy classified documents and film (LANL 1990, 0145). The residue from the destroyed documents goes to dumpsters and is then transported to TA-54 (DOE 1987, 0264). The building no longer has any liquid effluent.

C-52-001 and C-52-002, Potential Release Sites: Potential soil contamination may be associated with Substation TA-52-9. Oil stains were observed on the pad containing two transformers (Serial Nos. E-688470B and L-688470A). No active leaks were observed during an inspection on September 21, 1985 (LANL 1990, 0145).

3.6.2.2 Summary of Potential Waste Material

A summary of waste material that could have been generated at TA-52 is as follows:

- Filters contaminated with ^{60}Co and other ^{235}U fission products
- Uranium-235 (^{235}U) and fission products
- Possible solvents and chemicals from the UHTREX facility

3.6.2.3 Past Waste Spills, Releases, and Incidents

No waste spills have been reported at TA-52; however, atmospheric releases did occur from the stack (TA-52-7) because of UHTREX operations in 1969 and 1970. Filtered helium coolant was discharged through the stack during periods when the reactor was shut down. In 1969, the fission products released had an average concentration of 4.7×10^{-10} µCi/ml and a total discharge of 130 Ci (Chelius 1970, 04-0041). In 1970, fission products released had an average concentration of 4.9×10^{-12} µCi/mL and a total discharge of 2.4×10^{-4} Ci (Voelz 1971, 04-0194).

3.6.2.4 Environmental Surveys and D&D Activities

Although use of the UHTREX reactor was discontinued in 1970 and several portions of the UHTREX facility (e.g., the reactor vessel and hot cells in [TA-52-1], the filter pit [TA-52-14], and exhaust stack [TA-52-7]) were known to be radioactively contaminated, funding to decommission the facility was not made available until many years later (Koenig 1988, 04-0109). D&D of the UHTREX facility was proposed in the LASL Ten-Year Decontamination and Decommissioning Site Plan (LASL 1977, 0649). This proposal pointed out that decontamination of the UHTREX Building, TA-52-1, would provide almost 10,000 ft^2 of usable floor space for future

occupants. However, D&D of UHTREX was ranked a moderate priority—8 out of 17 Laboratory facilities for which decommissioning was proposed (LASL 1977, 0649). The moderate risk level was because radiation fields in accessible areas of the building were "manageable (10-20 mR/hr)" (LANL 1988, 0483).

In September 1988, a plan to decommission and decontaminate the UHTREX facility was proposed (Koenig 1988, 04-0109). The plan included the removal of several outdoor structures that were associated with UHTREX operations, as well as reactor-related equipment that remained inside TA-52-1. Two of the outdoor structures, the filter pit (TA-52-14; SWMU No. 52-001[a]) and the emissions stack (TA-52-7), were known to be "contaminated beyond residual radioactivity guidelines" (Koenig 1988, 04-0109) (Note: These guideline levels were not provided.) Removal of several structures not contaminated above these guideline levels—the Waste Neutralization and Pumping Facility (TA-52-2; SWMU No. 52-003), industrial waste lines 65 and 66 (SWMU No. 52-003[b]), and the Heat Dump Building and Pad (TA-52-15 and -16; SWMU Nos. 52-001[b and c])—was also proposed because these structures offered no beneficial use and presented operation, safety, and environment liabilities.

By September 1989, the following outdoor structures had been removed (Shafer circa 1989, 04-0187):

- Waste Neutralization and Pumping Facility, TA-52-2 (SWMU No. 52-003[a])
- Industrial waste lines 65 and 66 (SWMU No. 52-003[b])
- Filter pit, TA-52-14 (SWMU No. 52-001[a])
- Heat Dump Building, TA-52-15 (SWMU No. 52-001[b])
- Heat Dump Pad, TA-52-16 (SWMU No. 52-001[c])

Other structures removed included the exhaust stack (TA-52-7), two block sheds, and a concrete dock (TA-52-17). Areas in which excavation was required were backfilled with soil and paved with asphalt (Salazar and Elder 1991, 0623).

D&D activities inside TA-52-1 (SWMU No. 52-001[d]) included the following (LANL 1988, 0483; Salazar and Elder 1991, 0623):

- Removal of lead shielding bricks in rooms 104, 215, 216, 307, 310, 401, and the heat dump
- Removal of loose contamination in rooms 310, 401, 402, and possibly others
- Removal of reactor support systems in rooms 101, 102, 103, 105, 107, 202, 214, 215, 303, 304, 305, and 306
- Removal of asbestos insulation in rooms 216, 307, 310, the heat dump, and others
- Decommissioning of hot cell areas (rooms 104, 211, 212, and 213)

- Removal of reactor auxiliary systems in rooms 106, 216, 307, 308, 401, 402, and 403
- Removal of reactor vessel and associated components (primary cooling-loop pipes, heat exchanger, and recuperator) from Rooms 217, 309, and 310
- Certification that residual contamination of walls, floors, and other accessible surfaces is less than guidelines

According to Laboratory personnel, D&D of TA-52 was completed in October 1990. The only part that is still radioactively contaminated is the area in which the reactor was actually housed. This is a small area, 4 ft high, that personnel will not use (Hanson 1991, 04-0092).

3.6.3 Regulatory Activities

3.6.3.1 Permits

No previous or existing permits are associated with TA-52.

3.6.3.2 Interim Corrective Measures

D&D of UHTREX-associated equipment was accomplished between 1988 and 1990. No other known interim corrective measures have been undertaken at TA-52.

3.7 Description of TA-55, Plutonium Processing Facility

3.7.1 Site Location and Physical Description

TA-55 was established for the operation of a Plutonium Processing Facility in 1973. Principal operations conducted at TA-55 include fabrication of plutonium metal components, plutonium processing, and basic research on TRU materials. TA-55 also includes the location of former TA-42. The following subsections provide a detailed description of the site.

3.7.1.1 Geographic Location and Local Area Description

TA-55 is located on Pecos Drive north of Pajarito Road at an approximate latitude and longitude of 35°51'50" N and 106°17'07" W, respectively (USGS 1984, 04-0239). The 21-acre site is located on a finger mesa between a branch of Mortandad Canyon on the north and Two Mile Canyon on the south. The surface of the mesa is relatively flat, sloping toward the northeast, away from the Jemez Mountains, with drainage into a small canyon that joins Mortandad Canyon. TA-55 is bounded on the south by the north wall of Two Mile Canyon. The elevation at TA-55 ranges from approximately 7,100 to 7,300 ft. The site lies within the boundaries of the Laboratory in Los Alamos (LANL 1990, 0145; ESG 1978, 0095).

3.7.1.2 Physical Site Description

Construction of TA-55, the Plutonium Processing Facility, was initiated in 1973 to replace the plutonium processing operations at TA-21. Today, TA-55 houses a group of structures inside a security fence. The largest structure is the Plutonium Building, TA-55-4. Associated with TA-55-4 are several support and storage buildings including TA-55-1, the Administration Building; TA-55-2, support offices; TA-55-3, the support building, which houses offices, shops, and "cold" (nonradiological) laboratories (DOE 1987, 0264). Table 3-42 provides a complete listing of TA-55 structures. The locations of these structures are found on Figure 3-11.

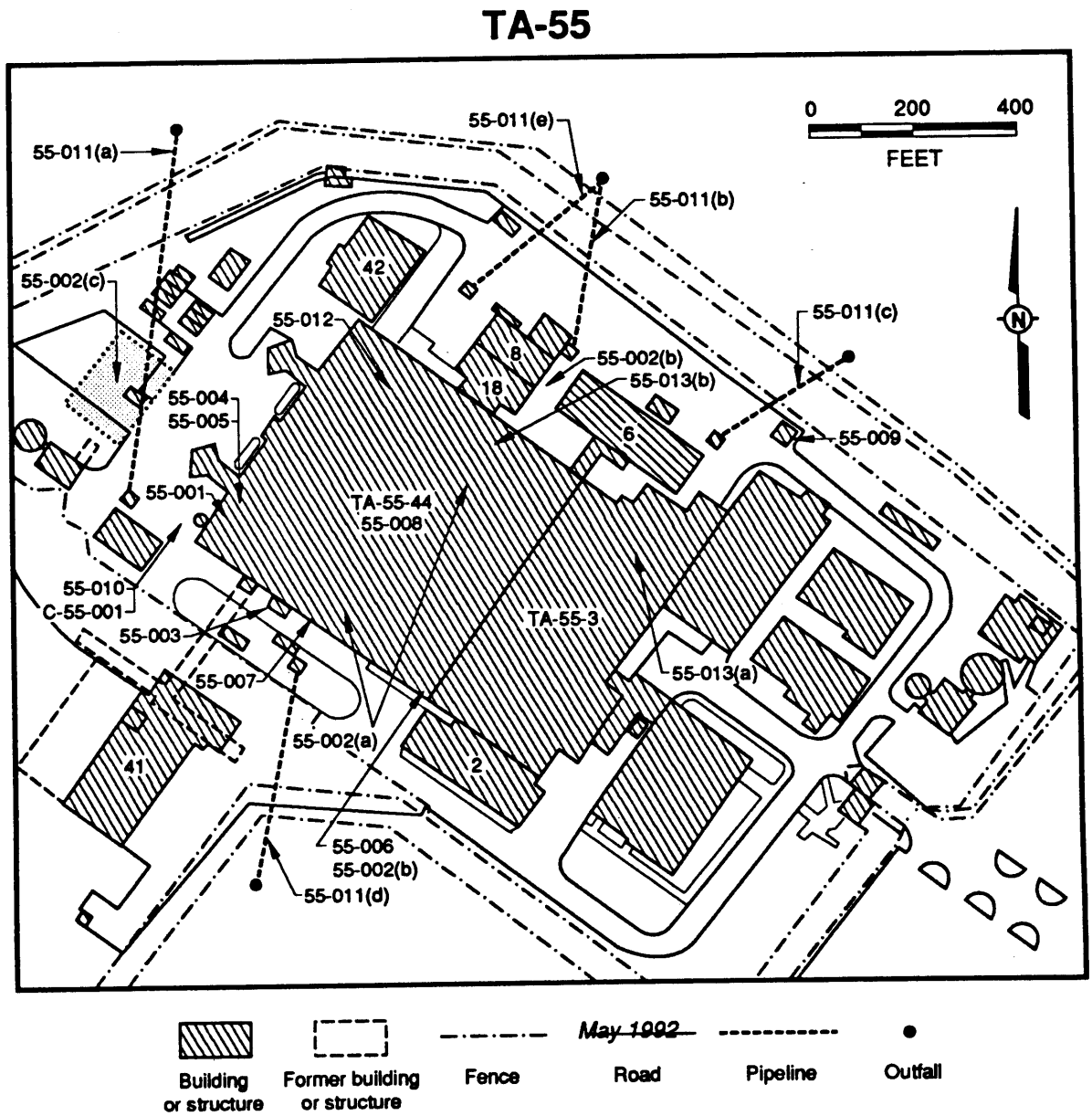


Figure 3-11. Locations of structures and SWMUs at TA-55.

TABLE 3-42

DESCRIPTION OF STRUCTURES AT TA-55

- **TA-55-1 (PF-1), Administration building.**
- **TA-55-2 (PF-2), Support office building.** Contains offices, an analysis laboratory, and mechanical equipment rooms. Radioactive materials are handled only in the analysis laboratory (Room 124B).
- **TA-55-3 (PF-3), Support building.** Contains change rooms, offices, laboratories for nonradiological research, darkrooms, a machine shop, and mechanical equipment rooms. SWMU No. 55-013(a) is in Room 186 of this building.
- **TA-55-4 (PF-4), Plutonium Building.** This is the primary site for plutonium processing, fabrication, and research. SWMU Nos. 55-001, 55-002(a), 55-004, 55-005, 55-006, 55-007, 55-008, 55-012, and 55-103(b) are located inside this building (see Figure 3-10).
- **TA-55-5 (PF-5), Warehouse.**
- **TA-55-6 (PF-6), Utility Building.** A cooling tower is associated with TA-55-6. Blowdown from the boilers goes to the sanitary sewer system.
- **TA-55-7 (PF-7), Calcium building.**
- **TA-55-8 (PF-8), Generator building.**
- **TA-55-9 (PF-9), Guard station.**
- **TA-55-10 and -11, Pump houses.** These structures are used for emergency fire response.
- **TA-55-12, -13, and -14, Water tanks.** TA-55-12 and TA-55-14 are used as sources of fire-fighting water. TA-55-13 provides potable water.
- **TA-55-15, -16, and -17, Diesel tanks.** TA-55-15 and TA-55-16 are 300-gal.-capacity steel tanks, installed in approximately 1978, used to store fuel for fire-protection system pumps (Martz 1986, 04-0152; Roy F. Weston, Inc. 1989, 0486). TA-55-17 is a 3,000-gal.-capacity steel tank, installed in approximately 1988, used to store fuel for the standby diesel generator in TA-55-8.
- **TA-55-18, Canopy.** A vehicle passageway for trucks carrying TRU materials into or out of TA-55-4.
- **TA-55-19, Compressed gas trailer station.**
- **TA-55-20 (PF-20), Covered passageway.**
- **TA-55-21, Utility tunnel.**
- **TA-55-22 (PF-22), Vehicle monitoring station.**
- **TA-55-27, Flag pole.**
- **TA-55-28 (PF-28), Nuclear materials building.**
- **TA-55-41 (PF-41), Nuclear materials storage building.** Most of this structure is underground.

TABLE 3-42

DESCRIPTION OF STRUCTURES AT TA-55

- **TA-55-1 (PF-1), Administration building.**
- **TA-55-2 (PF-2), Support office building.** Contains offices, an analysis laboratory, and mechanical equipment rooms. Radioactive materials are handled only in the analysis laboratory (Room 124B).
- **TA-55-3 (PF-3), Support building.** Contains change rooms, offices, laboratories for nonradiological research, darkrooms, a machine shop, and mechanical equipment rooms. SWMU No. 55-013(a) is in Room 186 of this building.
- **TA-55-4 (PF-4), Plutonium Building.** This is the primary site for plutonium processing, fabrication, and research. SWMU Nos. 55-001, 55-002(a), 55-004, 55-005, 55-006, 55-007, 55-008, 55-012, and 55-103(b) are located inside this building (see Figure 3-10).
- **TA-55-5 (PF-5), Warehouse.**
- **TA-55-6 (PF-6), Utility Building.** A cooling tower is associated with TA-55-6. Blowdown from the boilers goes to the sanitary sewer system.
- **TA-55-7 (PF-7), Calcium building.**
- **TA-55-8 (PF-8), Generator building.**
- **TA-55-9 (PF-9), Guard station.**
- **TA-55-10 and -11, Pump houses.** These structures are used for emergency fire response.
- **TA-55-12, -13, and -14, Water tanks.** TA-55-12 and TA-55-14 are used as sources of fire-fighting water. TA-55-13 provides potable water.
- **TA-55-15, -16, and -17, Diesel tanks.** TA-55-15 and TA-55-16 are 300-gal.-capacity steel tanks, installed in approximately 1978, used to store fuel for fire-protection system pumps (Martz 1986, 04-0152; Roy F. Weston, Inc. 1989, 0486). TA-55-17 is a 3,000-gal.-capacity steel tank, installed in approximately 1988, used to store fuel for the standby diesel generator in TA-55-8.
- **TA-55-18, Canopy.** A vehicle passageway for trucks carrying TRU materials into or out of TA-55-4.
- **TA-55-19, Compressed gas trailer station.**
- **TA-55-20 (PF-20), Covered passageway.**
- **TA-55-21, Utility tunnel.**
- **TA-55-22 (PF-22), Vehicle monitoring station.**
- **TA-55-27, Flag pole.**
- **TA-55-28 (PF-28), Nuclear materials building.**
- **TA-55-41 (PF-41), Nuclear materials storage building.** Most of this structure is underground.

3.7.1.3 Ownership Profile and Land Uses

TA-55 is located on DOE property and is the site of plutonium metal components fabrication and plutonium processing, including scrap recovery and purification to pure metal, and research in plutonium metallurgy. Although the facility was originally designed only as a research and development facility, it has been needed in recent years for backup production of purified plutonium to supplement the Rocky Flats Plant (DOE 1988, 0614).

3.7.2 Historical Overview

The Plutonium Processing Facility at TA-55 was constructed in the 1970s to provide more advanced equipment and a safer working environment than was possible at TA-21. The site was first occupied in 1977, and by January 1978 operations at TA-55 had replaced the plutonium processing facilities at TA-21 (Roy F. Weston, Inc. 1989, 0486). The following is an overview of activities and a description of SWMUs at TA-55.

3.7.2.1 Waste Management Activities

The following activities are conducted at TA-55: preparation of ultra-pure plutonium metal, alloys, and compounds; large-scale preparation of certain specific alloys; metal machining and fabrication to form these materials into specific shapes; determination of high-temperature thermodynamic and physical properties of plutonium; reclamation of plutonium scrap; production of ^{238}Pu heat sources; fabrication of plutonium-uranium fuels for breeder reactors; and research and development of isotope separation programs (Roy F. Weston, Inc. 1989, 0486).

Plutonium machining and recovery operations are performed in sealed gloveboxes under inert or dry atmospheric conditions and under negative pressure so that in the event a leak developed, air would flow from the room into the glovebox. In this way, contamination would remain inside the glovebox and would not be spread into the room (Foxx personal communication in Roberson 1991, 04-0211). Exhaust from ventilations of gloveboxes and facility rooms is filtered through banks of HEPA filters and continuously monitored before being discharged to the atmosphere (DOE 1987, 0264).

Liquid wastes generated at TA-55 are primarily from two sources: the plutonium scrap recovery/purification operations and the sanitary waste wywtems. Significant amounts of liquid wastes are generated from glovebox cooling water. Liquids from the recovery/purification operations are distilled in an evaporator to reduce volume and as part of the extraction process for recoverable plutonium. The distillate is piped to the liquid waste treatment system at TA-50 for processing. Sanitary wastes, which may contain small amounts of radionuclides from the showers at TA-55-4, are piped to the lagoons at TA-35 (DOE 1987, 0264).

Evaporator bottoms, spent analytical solutions, acidic aqueous waste, salts, and solid particulates generated at TA-55 from recovery processes and other research and development activities are mixed with cement in 55-gal. drums and transported to TA-54 for storage. Miscellaneous solid wastes (e.g., Kimwipes®, gloves, etc.) discarded from the Plutonium Processing Facility are segregated by radionuclide

content before storage or disposal at TA-54. Office trash is sent to the county landfill (DOR 1987, 0264).

Twenty SWMUs have been identified at TA-55. These SWMUs are listed in Table 3-43. Locations of the SWMUs are shown on Figure 3-11. None of these SWMUs were listed in the HSWA Module VIII (EPA 1990, 0306).

One AOC, C-55-001, has also been designated at TA-55, but this AOC is the same site at SWMU No. 55-010.

TABLE 3-43

TA-55 SWMUs

SWMU No.	Description
55-001	Cementing Process
55-002(a-c)	Radioactive Waste Container Storage Areas
55-003	Containment Area
55-004	Evaporator
55-005	Filtration Unit
55-006	Glass Breaker
55-007	Thermal Treatmrnt Units
55-008	Sumps and Tanks
55-009	Monitoring Sump
55-010	Solvent Spill
55-011(a-e)	Drains and Outfalls
55-012	Inactive Hazardous Waste Container Storage Area
55-013(a-b)	Hazardous Waste Container Storage Areas

SWMU No. 55-001, Cementing Process: The cementing process, SWMU No. 55-001, is performed inside a series of negative-pressure gloveboxes in Room 401 in the southwest corner of the Plutonium Building (TA-55-4) (Figure 3-11). The cementing process is a RCRA interim status treatment for mixed waste. Various types of TRU and TRU-mixed waste generated from plutonium recovery processes are immobilized using cement in lead-shielded drums. Liquid wastes which are cemented consist of TRU material containing acidic wastes from plutonium recovery, organic liquids, and other liquids (LANL 1990, 0145). Bagged solid wastes placed in the cement slurry include hydroxide cake, nonrecoverable incinerator ash, plastic, acidic filtrate salts, pyrochemical salts, and other TRU-containing particulate solids (LANL 1990, 0145). Oils contaminated with TRU material are placed in cement with an emulsifier (LANL 1990, 0145). The solid salt wastes that precipitate from the evaporation process typically contain about 1 g of ^{239}Pu per kg of solid

waste, which would contain about 0.07 Ci radioactivity if the plutonium was high-grade (Foxx personal communication in Roberson 1991, 04-0211). To lower the acidity of the waste mixtures, caustics are added during the cementing process. Most cemented mixtures have a pH of approximately 4.0 (Foxx personal communication in Roberson 1991, 04-0211). Cement is added to the drums through a hopper that feeds from a cement silo (TA-55-53) located near the southwest corner of the building. The drummed cement-mixed waste paste is then transported to TA-54 for storage pending permanent emplacement in the Waste Isolation Pilot Project (WIPP) (LANL 1990, 0145).

The gloveboxes in which the cementing process is conducted are designed to contain spills. No releases of contaminants from the cementing process have been documented (Foxx personal communication in Roberson 1991, 04-0211).

SWMU Nos. 55-002(a-c), Radioactive Waste Container Storage Areas: TA-55-4, the Plutonium Building, contains several areas in which radioactively contaminated waste is stored (SWMU No. 55-002[a]). Vacuum-pump waste oil is stored in 55-gal. drums at a designated satellite storage area in Room 425. The waste oil may be mixed with vermiculite and contains less than 100 nCi/g per gram of TRU or may consist entirely of oil contaminated with various radionuclides. A glovebox in Room 124 contains fuel pellets that may be recycled, and a pellet grinder contaminated with ^{235}U and ^{239}Pu from a special uranium oxide development project conducted at the Hanford Facility in 1988. Neither the pellets nor the pellet grinder are considered waste but are placed in the glovebox for safe storage (Foxx personal communication in Roberson 1991, 04-0211). Low-level waste is stored in the basement (B38) before Multiple Energy Gamma Assay Spectrometer (MEGAS) surveying. If the waste has a radioactivity count greater than 5 mR/hr, it is sent to Room 432 for repackaging.

Waste with a count less than 5 mR/hr is packaged in cardboard boxes and placed in dempster dumpsters (SWMU No. 55-002[b]) located northeast of the Plutonium Building and adjacent to TA-55-8 and TA-55-18. The waste in B38, Room 432, and in the dempster dumpsters consists primarily of rags, plastic, paper, glassware, packaging material, and metal scraps contaminated with various radionuclides (LANL 1990, 0145). B38 is part of an area that is RCRA interim status storage for TRU mixed waste. The dumpsters are used strictly for packaged, low-level, radioactively contaminated solid waste. No liquids or mixed wastes enter the dumpsters. Releases of radionuclides or hazardous wastes from the dumpsters have not been documented (Foxx personal communication in Roberson 1991, 04-0211).

The corridor in the basement also contains several areas designated for temporary storage of radioactively contaminated waste, and areas that are RCRA interim status storage areas for mixed waste. Waste is typically contained in lead-shielded drums or cardboard boxes. These areas are marked off with pylons and chains or tape. Two of the areas contain 55-gal. drums of low-level mixed liquid waste. Another area was used for storage of cardboard boxes containing low-level contaminated trash. Yet another area was provided for temporary storage of oversized contaminated solid wastes, such as pipes and equipment. Releases of radionuclides or chemicals from these storage areas are unknown. Although the storage drums are lead-shielded, the areas are not shielded, and might present a radioactivity hazard. Radioactivity at these areas is monitored. These materials are all staged and awaiting transport to TA-54 (Foxx personal communication in Roberson 1991, 04-0211).

An outdoor waste container storage area (asphalt pad) is located on the west side of TA-55-4 (Figure 3-11). This area was not identified as a SWMU in the SWMU report, but it is an area in which radioactive and mixed wastes are managed. It is a

interm status storage area for mixed waste. RCRA interimThis area is currently under consideration for inclusion on the SWMU list and is referred to as SWMU No. 55-002(c) in this report. The site is used for temporary storage of wooden crates that contain low-level and TRU waste awaiting transport by truck to TA-54. Plastic vessels containing unidentified liquid wastes are also stored here. Releases of contaminants at this site have not been documented but the potential for releases exists.

SWMU No. 55-003, Containment Area: SWMU No. 55-003 (structure TA-55-127) is the nitric acid tank and the surrounding secondary containment area located on the south side of the Plutonium Building (Figure 3-11). The aboveground tank holds 6,100 gal. of high-quality nitric acid that is used for several dissolution processes in TA-55-4; the acid is a product, not waste (Foxx personal communication in Roberson 1991, 04-0211). The containment area almost completely encloses the tank (except for the top) and could easily hold the entire contents of the tank. The containment structure consists of 10-in.-thick concrete floor and walls that extend approximately 3.5 ft aboveground, and glass windows that extend approximately another 4.5 ft upward. The structure is provided with a vacuum pump for removal of rainwater.

Spills have not occurred since the containment berm was constructed; however, a nitric acid spill occurred from this tank before the berm was built. Approximately 500 liters (132 gal.) of HNO_3 was spilled onto the asphalt and was contained by the parking lot curb. The acid did not reach the storm sewer and was not released to surrounding soils (Foxx personal communication in Roberson 1991, 04-0211).

SWMU No. 55-004, Evaporator: The thermosyphon evaporator, SWMU No. 55-004, is located adjacent to the cementing process in Room 401 in the Plutonium Building (TA-55-4) (Figure 3-11). The evaporator system is a part of a recovery process for plutonium dissolved off scrap or from impure oxides. The evaporation process reduces the volume of liquid waste by removing water. Radionuclides, heavy metals, and other solutes are concentrated in the "bottoms" that precipitate during the process. Liquid wastes are circulated and distilled in the evaporator in 600- to 700-liter batches. The liquid distillate, which is composed primarily of acidic aqueous solution and small quantities of plutonium and other heavy metals such as uranium, lead, iron, chromium, and nickel, is sampled for ^{239}Pu and ^{241}Am content. If plutonium or americium content is greater than a certain level, the liquid is recirculated through the evaporator. If the radionuclide content exceeds the discard limit the distillate goes to a filtration unit (SWMU No. 55-005) for additional recovery. The precipitate, which consists of $NaNO_3$ and other nitrate salts, typically contains more than 100 nCi/g TRU content. These salts go to cooling trays and then are passed through the filtration process, in which all recoverable plutonium is extracted. After recovery, the salt precipitate is stored in the filtration glovebox. This salt is potentially mixed waste; thus the glovebox is a RCRA interim status storage area for mixed waste.

The evaporator is part of a closed-loop process and does not release contaminants to the environment. Should contamination of the cooling water occur, the water would be distilled in the evaporator (LANL 1990, 0145). Releases of radionuclides or hazardous chemicals from the evaporator have not been documented.

SWMU No. 55-005, Filtration Unit: SWMU No. 55-005 is a closed-loop filtration system closely associated with, and adjacent to, the evaporator (SWMU No. 55-004) and the cementing process (SWMU No. 55-001) in Room 401 of the Plutonium Building (TA-55-4) (Figure 3-11). The filtration unit removes radionuclides from TRU-contaminated acidic liquids and precipitates from the evaporator (SWMU No. 55-

TABLE 3-43

TA-55 SWMUs

SWMU No.	Description
55-001	Cementing Process
55-002 (a-c)	Radioactive Waste Container Storage Areas
55-003	Containment Area
55-004	Evaporator
55-005	Filtration Unit
55-006	Glass Breaker
55-007	Thermal Combustion Units
55-008	Sumps and Tanks
55-009	Monitoring Sump
55-010	Solvent Spill
55-011 (a-e)	Drains and Outfalls
55-012	Inactive Hazardous Waste Container Storage Area
55-013 (a-b)	Hazardous Waste Container Storage Areas

004). After filtration, liquids with plutonium and americium content below the discard limit go to TA-50 for treatment. The solids removed during filtration are subjected to a plutonium recovery process. Solids are fixed in cement in the adjacent cement processing area (SWMU No. 55-001) when TRU content less than a certain level is achieved, and from there are taken to TA-54 for disposal (LANL 1990, 0145).

Like the evaporator and cement process, the filtration unit operates in a sealed, negative-pressure glovebox designed to contain spills. Releases of radionuclides or hazardous chemicals from the filtration unit to the environment have not been documented (Foxx personal communication in Roberson 1991, 04-0211).

SWMU No. 55-006, Glass Breaker: The glass breaker located in a glovebox in Room 133 of the Plutonium Building (TA-55-4) is SWMU No. 55-006. The glass breaker is intended to break glassware that may have been contaminated with mixed waste. The glass breaker had not beenused as of January 1991, pending startup of a new conveyer system and new assay capabilities (Kaal 1991, 04-0105). The glass breaker does not release radionuclides or hazardous chemicals to the environment.

SWMU No. 55-007, Thermal treatment Units: Two thermal treatment units (SWMU No. 55-007) are located in Room 420 of the Plutonium Building (TA-55-4) (Figure 3-11). The units were formerly used to incinerate small quantities of rags, with potentially recoverable radionuclides, to ash. After that, a different technology was developed in which the waste was treated with heat, in the presence of argon gas, to reduce the waste to ash without flame (Foxx personal communication in Roberson 1991, 04-0211). Two types of thermal treatment were used: one for nitrocellulose rags and one for plasticized rags. After thermal treatment, the ashes were sent through a leaching system to recover radionuclides if the TRU content was high or sent to the cement plant if the TRU content was low. The gases released from the

units were passed through a liquid (NaOH) scrubbing solution to remove radionuclides before passing into the glovebox ventilation system, which is equipped with HEPA filters (Foxx personal communication in Roberson 1991, 04-0211). The scrubber solution was sent to TA-50 for treatment (LANL 1990, 0145).

SWMU No. 55-008, Sumps and Tanks: SWMU No. 55-008 includes the sumps, tanks, and pumps located in the basement of the Plutonium Building (TA-55-4). Six 3-ft by 3-ft by 3-ft-deep sumps/pumps receive spills and the mop water in the building; four 8-in.-diameter by 4-ft-long condensate tank pumps receive condensate from cooling coils; and eight 8-in.-diameter by 4-ft-long blowdown tanks receive condensate from cooling coils. The liquids discharged to these units have in the past contained small amounts of mixed waste constituents (LANL 1990, 0145; Foxx personal communication in Roberson 1991, 04-0211). All of these units are connected by direct pipeline to the Liquid Waste Treatment Facility at TA-50, and do not release wastewater to the environment. The sumps may be slightly contaminated from radionuclides that previously entered the sump system. Whether contaminants have entered the environment directly from these units is unknown.

SWMU No. 55-009, Sump: A monitoring sump (TA-55-71) located outside near the TA-55 security fence northeast of the Utility Building (TA-55-6) is SWMU No. 55-009 (Figure 3-11). The sump was used to monitor sanitary waste liquids produced at TA-55 for radionuclides before discharge to the TA-35 sewage treatment lagoons. Significant levels of radionuclides were never detected, but the waste liquids may have contained small quantities of chemicals and solvents. The concrete pit measures about 7 ft by 7 ft by 5 ft 5 in. deep and is connected to the Plutonium Building by a 6-in. vitrified clay pipe approximately 250 ft long. The sump is connected to the TA-35 sewage treatment lagoons by approximately 4,000 ft of 8-in.-diameter vitrified clay pipe. Because radionuclides were never detected by the monitoring sump during several years of use, the sump is no longer used and has been abandoned in place (Foxx personal communication in Roberson 1991, 04-0211).

SWMU No. 55-010, Solvent Spill: A solvent spill, SWMU No. 55-010, was discovered at the southwest side of the Plutonium Building (TA-55-4), immediately beneath the cement silo (TA-55-53) that serves the cement process (SWMU No. 55-001) (Figure 3-11). During drilling for the installation of the cement silo in 1984, core samples were taken next to Room 401 approximately 6 to 8 ft from the basement wall. Analysis of the core samples showed a large quantity of methyl ethyl ketone (MEK), along with toluene and methyl isobutyl ketone (MIBK) in smaller quantities, at a depth of 18-ft-below present grade (Foxx personal communication in Roberson 1991, 04-0211). The Health and Environmental Chemistry Group, EM-9, analyzed some samples from the borings and found the samples to contain plasite paint, an organic solvent-based epoxy paint (LANL 1990, 0145). The contamination was determined to be the result of an accidental spill by the painting contractors during construction of the Plutonium Building (Schmidt 1984, 04-0182). The contaminated soil was covered with additional clean soil and asphalt in 1978 (Roy F. Weston, Inc. 1989, 0486).

SWMU Nos. 55-011(a-e), Drains and Outfalls: The storm drainage system for TA-55 consists of catch basins equipped with storm drains that discharge to outfalls. The catch basins, storm drains, and outfalls that serve TA-55 are listed in Table 3-44. Their locations are shown in Figure 3-11.

The storm drains manage storm water collected from TA-55-4 and may contain very low levels of TRU radionuclides, solvents, or metals that may have settled on the TA-

TABLE 3-44

TA-55 OUTFALLS

SWMU No.	Structure No.	Water Source	Outfall
55-011(a)	TA-55-79	NW side of TA-55-4	Mortandad Canyon
55-011(b)	TA-55-82	NE side of TA-55-4	Mortandad Canyon
55-011(c)	TA-55-83	NE side of TA-55-4	Mortandad Canyon
55-011(d)	TA-55-78	SW side of TA-55-4	Two Mile Canyon
55-011(e)	TA-55-81	NE side of TA-55-4	Mortandad Canyon

55 facility roof or parking area from air emissions. Contaminants may be concentrated in the catch basins or at the outfall discharge points (LANL 1990, 0145).

SWMU No. 55-012, Inactive Hazardous Waste Container Storage Area: A bottle of waste acid containing heavy metals, SWMU No. 55-012, was stored on a shelf in Room 503 in the Plutonium Building. The jar contained about 100 ml of waste nitric acid containing nonradioactive heavy metals generated during reagent preparation for plutonium analysis. The storage site was inactive in January 1990 (LANL 1990, 0145). The jar had been disposed of before a November 1990 ER Program site visit.

SWMU Nos. 55-013(a-b), Hazardous Waste Container Storage Areas: SWMU No. 55-013 includes two active hazardous waste storage areas at TA-55 (Figure 3-11). The fume hood (SWMU No. 55-013[a]) in Room 186 in the northeast quadrant of TA-55-3 is a satellite facility used to store acetone, trichlorethylene, tetrahydrofuran, pyridine, toluene, ethanol, Freon-113, diethyl ether, pentane, dichloromethane, solvent-contaminated hydrolysis products of alkali, diatomaceous earth (celite), metals, hydrides, and molecular sieves. In Room 208 of TA-55-4, hood XB-206 (SWMU No. 55-013[b]), in the southeast corner of the room, is a satellite facility and stores tetrahydrofuran, pyridine, and dimethoxyethane (ethylene, hexane, glycol, dimethyl ether). Both storage rooms are regularly inspected (LANL 1990, 0145). No releases to the environment from these areas have been documented, except for the filtered air emissions from the hoods.

C-55-001, MEK/Solvent Spill: This AOC is the same as SWMU No. 55-010.

3.7.2.2 Summary of Potential Waste Materials

Available information suggests that waste materials potentially handled at TA-55 include the following:

- Plutonium-238, -239, -240, -242 (^{238}Pu, ^{239}Pu, ^{240}Pu, ^{242}Pu)
- Organic chemicals (i.e., acetone, trichloroethylene, pyridine, ethanol, Freon-113, diethyl ether, pentane, dibromomethane, tetrahydrofuran, dimethoxyethane, MEK, MIBK, toluene)
- Fission products (e.g., ^{137}Cs, ^{129}I, ^{90}Sr)
- Heavy metals (i.e., lead, iron, chromium, nickel)
- Americium-241 (^{241}Am)

- Uranium-235 (^{235}U)
- Acidic aqueous solutions
- Vacuum-pump waste oils
- Miscellaneous contaminated solid wastes (i.e., rags, plastic, paper, glassware, packaging material, and metal scraps)

3.7.2.3 Past Waste Spills, Releases, and Incidents

Because this is a relatively new site at the Laboratory, modern facilities and better documentation have resulted in fewer contamination incidents than have occurred at older TAs (Roy F. Weston, Inc. 1989, 0486). Potential spills, releases, and incidents at TA-55 that have been documented in Laboratory memoranda are discussed in the following text.

In October 1984, MEK, toluene, and MIBK were detected at approximately 18-ft-below present grade in core samples collected during drilling conducted 6 to 8 ft from the basement wall on the southwest side of TA-55-4. This spill has been designated as SWMU No. 35-010 (LANL 1990, 0145). An investigation concluded that a painting contractor contaminated the area in 1976. The contaminated soil was covered with asphalt in 1978 (Schmidt 1984, 04-0182). Releases of radionuclides to the atmosphere for the years 1978 through 1988 are summarized in Table 3-45.

TABLE 3-45

ATMOSPHERIC RELEASES OF RADIONUCLIDES FROM TA-55, 1978 THROUGH 1988

Year	^{238,239}Pu (μCi)	^{3}H (Ci)	Reference
1988	15.3[a]	314	(ESG 1989, 0308)
1987	0.2[a]	85.4	(ESG 1988, 0408)
1986	0.2[a]	—	(Purtymun and Maes 1985, 0203)
1985	1.1[a]	—	(Becker 1984, 0027)
1984	1.0[a]	152	(Becker 1985, 0029)
1983	1.1[a]	44	(Purtymun et al. 1982, 0210)
1982	2.6	19	(ESG 1983, 0621)
1981	0.1	—	(ESG 1982, 0620)
1980	0.3	—	(ESG 1981, 0424)
1979	0.1	—	(ESG 1980, 0406)
1978	0.4	—	(Hakonson 1979, 0119)

[a]Total includes ^{240}Pu for 1983-1988.

3.7.2.4 Environmental Surveys and D&D Activities

As part of the preoperational environmental survey for the new Plutonium Processing Facility at TA-55, soil and sediment samples from natural drainages were collected before processing of plutonium at the plant began. Eight soil samples and nine sediment samples (four interior drains, five exterior drains) were collected by taking five plugs using standard environmental samplers (7.6 cm diameter, 4.5 cm length). All but one of the samples analyzed for plutonium were within the range of naturally expected background or worldwide fallout. One soil sample taken from location 6 just west of the TA-42 fence contained a higher concentration of ^{238}Pu and ^{239}Pu (16 pCi/g) compared to the other samples. This plutonium was attributed to incineration or decontamination activities at TA-42 (ESG 1978,0095).

In August 1984, during the Laboratory Radioactive Liquid Waste Lines Removal Project, a 4-ft section of Line 43 was left in place at Station 2+80 south of TA-55, at a depth of 4 ft. Line 43 was an 8-in. cast-iron pipe encased in concrete that ran to TA-50 along Pajarito Road on the south side of TA-55. The abandoned section was under gas and water mains. A decision was made that removing the section would jeopardize the integrity of the water main. The section of Line 43 left in place was decontaminated and the ends were sealed with concrete. Before decontamination, alpha surveys detected contamination levels up to 40,000 dpm/100 cm^2 by swipe. After decontamination, levels were reduced to 4,000 dpm/100 cm^2, as indicated by direct measurement, and no detectable contamination by swipe (Cox 1984, 04-0046). In April 1985, approximately 55 ft of Line 43 was removed, bringing the total of Line 43 removed to that date to 1,762 ft. Up to 120,000 dpm/100 cm^2 was detected inside the pipe (Cox 1985, 04-0054).

During 1984 to 1985, a preoperational survey was conducted in outfall areas at TA-55 (Roy F. Weston, Inc. 1989, 0486). Composite soil samples were collected for each outfall and analyzed for PCBs, some organics, metals, and radioactive contaminants. None of these constituents were detected in the outfalls around TA-55 (Roy F. Weston, Inc. 1989, 0486).

The 1987 Laboratory Environmental Surveillance Report noted that the ^{239}Pu and ^{240}Pu concentrations of 0.2 µCi at two stations near TA-55 were greater than background (ESG 1988, 0408). Annual thermoluminescent dosimeter measurements for TA-55 in 1987 were 106 mrem for the Plutonium Facility South, 117 mrem for the Plutonium Facility West, and 188 mrem for the Plutonium Facility North (ESG 1988, 0408).

3.7.3 Regulatory Activities

3.7.3.1 Permits

In January 1991, the Laboratory submitted a RCRA Part A permit application for mixed waste, which included a number of mixed waste treatment and storage units at TA-55. These units qualify for interim status under section 3005(e) of RCRA and must be operated in compliance with interim status standards until a permit is issued. The following storage areas at TA-55 are interim status mixed waste storage areas:

SWMU No.	
55-004	Container storage area for evaporator salt precipitate (glovebox)
—	Container storage area in basement vault
—	3 container storage areas for TRU mixed waste in base ment
—	Container storage area for low-level mixed waste in base ment
—	Container storage for oversized mixed waste in basement
55-002(c) (proposed)	Outside container storage pad
55-004, 55-001	13 storage tanks for evaporator buttons solution

The following units are interim status mixed waste treatment processes at TA-55:

SWMU No.	
55-001	Cementing process
—	Oxygen sparging furnace for pyrophoric salts

As indicated, only a few of these treatment and storage units have been identified as SWMUs.

3.7.3.2 Interim Corrective Measures

The 1988 Inventory of Federal Hazardous Waste Activities forms completed for TA-55 indicate that CERCLA PA/SI corrective actions were completed in October 1987 as part of the CEARP Investigation (LANL 1988, 04-0125). No additional documentation on corrective actions has been located.

3.8 Description of TA-63, Satellite Service Area

3.8.1 Site Location and Physical Description

TA-63, which houses a Laboratory engineering section office and several supporting office trailers, was created from the western portion of TA-52 when the Laboratory redefined the TA boundaries in 1989. The following subsections provide a detailed description of the site.

3.8.1.1 Geographic Location and Local Area Description

TA-63 is located on the north side of Puye Road, approximately 250 ft east of the intersection of Pajarito and Puye roads. The site is situated south of TA-35 on Mesita del Buey at an approximate latitude and longitude of 35°51'35" N and 106°17'35" W, respectively (USGS 1984,04-0239). The elevation at TA-63 is about 7,220 ft. The site is bounded on the north by Ten Site Canyon (a tributary of Mortandad Canyon) and on the south by Pajarito Canyon. TA-63 lies within the boundaries of the Laboratory in Los Alamos County.

3.8.1.2 Physical Site Description

TA-63 was established in 1989 during the Laboratory's redefinition of TAs areas. TA-63 is currently used as a satellite service and maintenance area for the Field Operations Group (ENG-5), and Johnson Controls World Services Inc. (JCI), the Laboratory's maintenance contractor. The site presently contains nine structures and two active septic systems. Table 3-46 contains a description of structures at TA-63, and Figure 3-12 shows the approximate location of these structures.

TABLE 3-46

DESCRIPTION OF STRUCTURES AT TA-63

- **TA-63-1, Offices and crafts shops.** This building is a single-story structure that houses offices, an electronics shop, and a machine shop. Formerly designated as TA-0-155.
- **TA-63-2, Crafts shop and office.** TA-63-2 is a trailer being used as the electrical shop and an office.
- **TA-63-3, Crafts shop and office.** A single-story concrete-block structure that houses carpentry, welding, plumbing and paint shops, and two offices.
- **TA-63-4, Offices.** A modular building used for offices.
- **TA-63-5, Offices.** This is a trailer divided into three offices.
- **TA-63-6, Offices.** This is a trailer divided into three offices.
- **TA-63-8 and 10, Storage sheds.** Frame and plywood storage sheds for equipment and materials.
- **TA-63-11, Storage.** Metal storage shed for equipment and materials.
- **TA-63-12, Septic system.** Consists of a 1,000-gal. septic tank and the associated seepage pit. This system is SWMU No. 63-001(a) and is also designated SWMU No. 52-002(e). The tank was formerly designated TA-52-49, and the seepage pit was designated TA-52-50. The system receives sanitary waste water from TA-63-3 and TA-63-4.
- **TA-63-14, Septic system.** Consists of 920-gal. septic tank and associated seepage pit. Designated SWMU No. 63-001(b). The tank had former structure number ULR-154, and the seepage pit had number ULR-462. Receives sanitary waste water from offices and crafts shops in TA-63-1. May have received potentially hazardous wastes from the maintenance shop that formerly occupied TA-63-1.

3.8.1.3 Ownership Profile and Land Uses

DOE owns the TA-63 property, and Group ENG-5 and JCI currently use the facility for satellite service and maintenance operations.

3.8.2 Historical Overview

The area now designated as TA-63 has undergone several technical area redesignations. In the 1950s, the area was part of TA-4 (LASL 1955,0243). The area was then part of TA-0 for some time in the 1960s and 1970s. In the mid-1970s, Group ENG-5 had a maintenance shop on the site in building TA-0-155 (now TA-63-1). In 1983 nine structures on the site had TA-0 building designations (LANL 1983,04-0244). The site has also been defined as a portion of TA-52. The dates of the redesignations from TA-4 to TA-0 and from TA-0 to TA-52 are unknown. The western portion of TA-52 was redesignated TA-63 in 1989 (LANL 1990, 0145).

3.8.2.1 Waste Management Activities

Throughout its history, the area has been occupied by only office trailers, storage sheds, and maintenance shops (LANL 1991, 04-0262). Two septic tanks (both still active) have served the occupants of these structures. These septic systems currently receive only sanitary waste. Laboratories have not occupied the site, and radioactive materials have not been managed. Hazardous substances used in the shops are believed to be limited to paints, solvents, oily rags, and batteries. These wastes are taken to a satellite storage area within a fenced area east of the TA-63 parking area for temporary storage (Figure 3-12). From there, the wastes are taken to Disposal Area L at TA-54 for burial (LANL 1991, 04-0133).

SWMU No. 63-001, Septic Systems: Two active septic systems are listed as SWMUs at TA-63. The locations of these systems are shown in Figure 3-12. SWMU No. 63-001(a) is a 1000-gal. septic tank (TA-63-12) and its associated seepage pit and drain line. The seepage pit is 4 ft in diameter and 50 ft deep (Smithour 1992, 04-0223). The system serves approximately 20 to 30 people (LANL 1990, 0145). It is believed that this system serves buildings TA-63-3, -4, -5, and -6. The tank and seepage pit in this system were formerly designated as TA-52-49 and TA-52-50, respectively. In the 1988 SWMU report, this system was listed as SWMU Nos. 52-002(f and g) (Internatinal Technology Corporation 1988, 0329). The system was listed on the HSWA Module VIII as SWMU No. 52-002(f and g) (EPA 1990, 0306). In the 1990 SWMU report, the designation for this SWMU was changed to SWMU No. 63-001(a) (LANL 1990, 0145). Note that this system is also listed as SWMU No. 52-002(e) (LANL 1990, 0145). The SWMU report states that this system may have in the past received hazardous or radioactive wastes from the UHTREX facility (TA-52-1) (LANL 1990, 0145). However, this is considered highly unlikely because this system is located a considerable distance away from the UHTREX facility and has never been connected by waste lines to the UHTREX facility.

SWMU No. 63-001(b) is a 920-gal. septic tank (TA-63-14) and its associated drain lines and seepage pit. This seepage pit is 4 ft in diameter and 50 ft deep (Smithour 1992, 04-0223). The tank and seepage pit in this system were formerly designated as TA-52-154 (ULR-154) and TA-0-462 (ULR-462), respectively. This septic system was listed as SWMU No. 52-002(k) in the 1988 SWMU report and in the HSWA

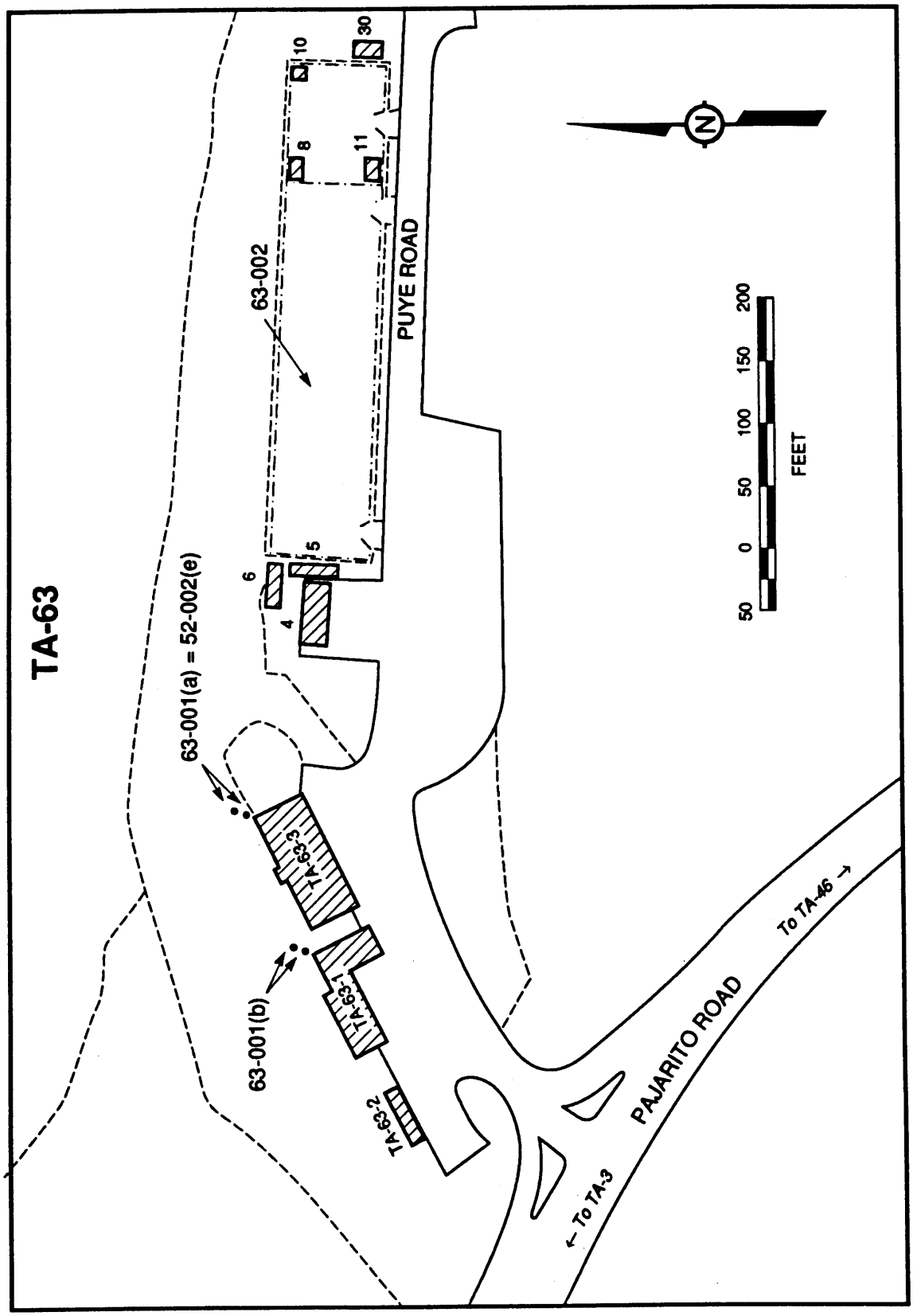


Figure 3-12. Locations of structures and SWMUs at TA-63 (LANL 1991, 04-0262).

Module VIII (International Technology Corporation 1988, 0329; EPA 1990, 0306). The SWMU designation was changed to SWMU No. 63-001(b) in the 1990 SWMU report (LANL 1990, 0145). This system currently serves approximately 30 to 40 people in building TA-63-1 (LANL 1990, 0145). This system currently receives only sanitary waste; however, solvents and other chemicals may have been discharged into this system in previous years when this building (formerly TA-0-155) was used as a maintenance shop by Group ENG-5 (LANL 1990, 0145).

Both of the septic systems are currently active, and no plans exist to discontinue use of the systems (Smithour 1992, 04-0223).

SWMU No. 63-002, Container Storage Area (proposed): Potentially hazardous wastes generated at TA-63 are temporarily stored in a rectangular fenced area east of the north parking lot (Figure 3-14). Wastes including paint, solvents, oily rags, and batteries are reportedly stored in this uncovered, unpaved area. During a 1991 ER Program site inspection, several drums were observed on wooden pallets in this area, including one drum with a bulging top labeled "MEK" (methyl ethyl ketone). Some materials are stored on a 4-ft^2 bermed asphalt pad (Roberson 1991, 04-0229). This site was not included in the 1990 SWMU report, but is currently in the process of inclusion on the SWMU list.

Releases of hazardous materials have not been documented at this storage area, but the potential for a release exists, with little or no means of containment.

3.8.2.2 Summary of Potential Waste Materials

The following materials are potential waste materials from past or current operations at TA-63 (LANL 1991, 04-0133):

- Used batteries
- Paints, paint thinner, and other solvents, including methyl ethyl ketone (MEK)
- Other unspecified chemicals

3.8.2.3 Past Waste Spills, Releases and Incidents

No documentation of spills, releases, or incidents at TA-63 has been found.

3.8.2.4 Environmental Surveys and D&D Activities

No environmental surveys or D&D have been conducted at TA-63 because no laboratory operations are conducted there.

3.8.3 Regulatory Activities

3.8.3.1 Permits

Septic system TA-63-14 is registered as an Unpermitted Individual Liquid Waste System with NMED Registration Number LA-09 (LANL 1990, 0145).

3.8.3.2 Interim Corrective Measures

No known corrective measures have been implemented for TA-63.

3.9 Description of TA-66, ATAC Facility

3.9.1 Site Location and Physical Description

TA-66 was established in 1989 when the Laboratory redefined the TA boundaries. The site is occupied by the Advanced Technology Assessment Center (ATAC), which is operated by the Laboratory's ATAC Program office for the US Department of Defense (DoD) (Wolfsburg 1991,04-0246). TA-66 also serves as a buffer zone for the Laboratory. The following subsections provide a detailed description of the site.

3.9.1.1 Geographic Location and Local Area Description

TA-66 is located on Mesita del Buey, south of Pajarito Road adjacent to the north rim of Two Mile Canyon, a tributary of Pajarito Canyon. The site is situated at an approximate latitude and longitude of 35°51'22" N, 106°17'37" W, respectively (USGS 1984 04-0239). The elevation at TA-66 is approximately 7,180 ft and lies within Laboratory boundaries in Los Alamos County.

3.9.1.2 Physical Site Description

TA-66 has one structure, TA-66-1, which is used as an office building by the Laboratory's ATAC program office (LANL 1990, 0145; Wolfsburg 1991, 04-0246). This office building is served by a septic system, which operates under NMED Registration Permit No. SF-880258. The septic system consists of a 2,000-gal. tank (TA-66-3), which drains to a 4-ft-diameter seepage pit (TA-66-4) (LANL 1991, 04-0133). The septic system was installed when the office building was constructed in 1989 and currently serves approximately 25 people (Wolfsburg 1991,04-0246). Table 3-47 provides a description of these structures.

TABLE 3-47

DESCRIPTION OF STRUCTURES AT TA-66

- TA-66-1, Office building. Constructed in 1989, the building is currently being used for offices by Laboratory personnel.
- TA-66-3, -4, Septic tank and seepage pit. Septic system used for sanitary waste disposal from TA-66-1. NMED Registration Permit No. SF-880285.

3.9.1.3 Ownership Profile and Land Uses

DOE owns TA-66 property, and DoD uses the site for an office building for Laboratory personnel. TA-66 also serves as a buffer zone for the Laboratory.

3.9. Historical Overview

TA-66 was established in 1989 when the Laboratory redefined the TA boundaries. The ATAC has been the sole occupant of TA-66 since the TA was defined.

3.9.2.1 Waste Management Activities

Because the site has not been used for any laboratory operations, no SWMUs are listed for TA-66. Hazardous materials have not been handled and are not currently used at TA-66 (Wolfsburg 1991,04-0246).

3.9.2.2 Summary of Potential Waste Materials

Available information indicates that potential waste materials handled at TA-66 are limited to sanitary wastewater.

3.9.2.3 Past Waste Spills, Releases, and Incidents

No spills, releases, or incidents have occurred at TA-66.

3.9.2.4 Environmental Surveys and D&D Activities

In March 1991, a RCRA waste characterization survey was performed. No hazardous wastes or unusual occurrences were noted during the survey (LANL 1991, 04-0133).

3.9.3 Regulatory Activities

3.9.3.1 Permits

The only known permit is the NMED Registration Permit No. SF-880258 for the active septic system (LANL 1991, 04-0133).

3.9.3.2 Interim Corrective Measures

No known interim corrective measures have been or are presently being implemented at TA-66.

REFERENCES

Aeby, J. W., October 28, 1952. "Monitoring in Canyon Mortandad," Los Alamos Scientific Laboratory Memorandum to Dean Meyer (H-1) from Jack Aeby (H-1), Los Alamos, New Mexico. (Aeby 1952, 04-0002)

Aeby, J. W., August 12, 1954. "Contaminated Water Dumped into Canyon Mortandad since 9-1-51," Los Alamos Scientific Laboratory Memorandum to Dean Meyer from Jack Aeby, Los Alamos, New Mexico. (Aeby 1954, 04-0003)

Aeby, J. W., January 31, 1955. "Ten-Site Monitoring — Week Ending January 23, 1955," Los Alamos Scientific Laboratory Memorandum to Dean Meyer (H-1) from Jack Aeby (H-1), Los Alamos, New Mexico. (Aeby 1955, 04-0004)

Aeby, J. W., September 6, 1955. "Ten-Site Monitoring Week Ending 9-2-55," Los Alamos Scientific Laboratory Memorandum to Dean Meyer (H-1) from Jack Aeby (H-1), Los Alamos, New Mexico. (Aeby 1955, 04-0005)

Aeby, J. W., and T. Garcia, May 28, 1954. "More Digging in Canyon Mortandad," Los Alamos Scientific Laboratory Memorandum to Dean Meyer from Jack Aeby and Tony Garcia, Los Alamos, New Mexico. (Aeby and Garcia 1954, 04-0006)

AEC (US Atomic Energy Commission), February 21, 1957. Drawing No. LA-AX-C-7.1, Sheet 29 of 93, Los Alamos, New Mexico. (AEC 1957, 04-0007)

AEC (US Atomic Energy Commission), 1967. Drawing No. LA-AX-C7.1, Sheet 29 of 93, Los Alamos, New Mexico. (AEC 1967, 04-0008)

Ahlquist, A. J., May 9, 1978. "Final Soil Sampling at TA-42," Los Alamos Scientific Laboratory Memorandum to Ray Garde (H-1) from A. John Ahlquist (H-8), Los Alamos, New Mexico. (Ahlquist 1978, 04-0009)

Ahlquist, A. J., November 14, 1983. "Conversations with Roger Rasmussen; 11/7/83," Los Alamos National Laboratory Memorandum to File from A. John Ahlquist (HSE-8), Los Alamos, New Mexico. (Ahlquist 1983, 04-0011)

Ahlquist, A. J., June 21, 1985. "Note to File," Los Alamos National Laboratory Memorandum to File from A. John Ahlquist, Los Alamos, New Mexico. (Ahlquist 1985, 04-0014)

Ahlquist, A. J., June 25, 1985. "Structure Removal," Los Alamos National Laboratory Memorandum HSE 8-85-727 from A. J. Ahlquist to J. B. Montoya, Los Alamos, New Mexico. (Ahlquist 1985, 04-0015)

Ahlquist, A. J., October 10, 1985. "Phone Conversation with John Elder," Los Alamos National Laboratory Letter to File from A. J. Ahlquist, Los Alamos, New Mexico. (Ahlquist 1985, 04-0016)

Ahlquist, A. J., August 12, 1987. "CEARP Report—Comments," Los Alamos National Laboratory Memorandum to Doris B. Garvey (ECMO) from A. John Ahlquist, Los Alamos, New Mexico. (Ahlquist 1987, 04-0017)

Ahlquist, A. J., R. W. Ferenbaugh, and L. S. Fritz, February 8, 1985. "Interview with Eric L. Peterson, 2/8/85," Los Alamos National Laboratory Memorandum to File from

A. J. Ahlquist, R. W. Ferenbaugh, and L. S. Fritz, Los Alamos, New Mexico. (Ahlquist et al. 1985, 04-0019)

Ahlquist, A. J., R. W. Ferenbaugh, and L. S. Fritz, February 13, 1985. "Interview with Robert S. Fitzhugh, 2/13/85," Los Alamos National Laboratory Memorandum to File from A. J. Ahlquist, R. W. Ferenbaugh, and L. S. Fritz, Los Alamos, New Mexico. (Ahlquist et al. 1985, 04-0020)

Apt, K. E., and V. J. Lee (Comps.), May 1975. "Environmental Surveillance at Los Alamos During 1975," Los Alamos Scientific Laboratory Report LA-5977-MS, Los Alamos, New Mexico. (Apt and Lee 1975, 0616)

Apt, K. E., and V. J. Lee (Comps.), April 1976. "Environmental Surveillance at Los Alamos During 1975," Los Alamos Scientific Laboratory Report LA-6321-MS, Los Alamos, New Mexico. (Apt and Lee 1975, 0617)

Atencio, W., September 5, 1985. "Incident Report," Los Alamos National Laboratory Memorandum to Leroy Garcia (HSE-5) from Walter Atencio (HSE-5), Los Alamos, New Mexico. (Atencio 1985, 04-0021)

Bacastow, J., January 29, 1974. "Open Pits at TA-5 (Beta Site)," Los Alamos Scientific Laboratory Memorandum to Q-Division Files (Q-23) from Jack Bacastow (Safety Engineer), Los Alamos, New Mexico. (Bacastow 1974, 04-0022)

Bailey, M. G., December 3, 1986. "Oil Spill at TA-35, Antares Building," Pan Am World Services, Inc., Memorandum to Joe J. Lopez (Manager PHSE) from Michael G. Bailey (PENV), Los Alamos, New Mexico. (Bailey 1986, 04-0023)

Balo, K. A. and J. L. Warren, December 1982. "Waste Management Site Plan," Los Alamos National Laboratory Report LA-UR-82-3666, Los Alamos, New Mexico. (Balo and Warren 1982, 0457)

Becker, N. M., 1986. "Environmental Surveillance at Los Alamos During 1985," Los Alamos National Laboratory Report LA-10721-ENV, Los Alamos, New Mexico. (Becker 1986, 0027)

Becker, N. M., W, D. Purtymun, and M. Maes, 1985. "Environmental Surveillance at Los Alamos During 1984," Los Alamos National Laboratory Report LA-10421-ENV, Los Alamos, New Mexico. (Becker et al. 1985, 0029)

Blackwell, C. D., July 27, 1959. "Radiation Health Clearance — Building Beta-4, TA-5," Los Alamos Scientific Laboratory Memorandum to S. E. Russo (Eng-3) from C. D. Blackwell (H-1), Los Alamos, New Mexico. (Blackwell 1959, 04-0025)

Blackwell, C. D., October 6, 1959. "Radiation Survey: Buildings TA-5-1 and TA-5-6," Los Alamos Scientific Laboratory Memorandum to S. E. Russo (ENG-3) from Charles D. Blackwell (H-1), Los Alamos, New Mexico. (Blackwell 1959, 04-0026)

Blackwell, C. D., November 10, 1959. "Radioactive Contamination Survey — Beta Site, TA-5," Los Alamos Scientific Laboratory Memorandum from Charles D. Blackwell (H-1), Los Alamos, New Mexico. (Blackwell 1959, 04-0027)

Blackwell, C. D., June 10, 1976. "Radiation Contamination Survey of Structures at TA-5," Los Alamos Scientific Laboratory Memorandum to J. B. Montoya (ENG-3) from C. D. Blackwell (H-1), Los Alamos, New Mexico. (Blackwell 1976, 04-0028)

Bohn, R., October 24, 1986. "Oil Spill at TA-35 TSL-128," Los Alamos Scientific Laboratory Memorandum to Distribution from Roy Bohn (HSE-8), Los Alamos, New Mexico. (Bohn 1986, 04-0030)

Bradshaw, R., March 9, 1977. "Ten-Year Decontamination and Decommissioning Plan, ES3843-0," Los Alamos Scientific Laboratory Memorandum to Distribution from R. Bradshaw, Los Alamos, New Mexico. (Bradshaw 1977, 04-0031)

Brazier, E. L., October 16, 1967. "Radiochemistry Laboratory Core Processing Facility, RC-1, TA-48, Contract No. AT(2-1)-1898-Exhaust Duct Sealing," Los Alamos Scientific Laboratory Memorandum ENG-1-3220 to G. F. Hilton (LAAO) from E. L. Brazier (ENG-1), Los Alamos, New Mexico. (Brazier 1967, 04-0032)

Buckland, C.W., November 1, 1952. "Dumping Liquid Waste from the Incinerator Site TA-42," Los Alamos Scientific Laboratory Memorandum to Roy G. Merryman (ENG-4) from Carl W. Buckland (H-1), Los Alamos, New Mexico. (Buckland 1952, 04-0038)

Buckland, C. D., November 3, 1952. "Effect of Rainfall on the Activity in Mortandad Canyon," Los Alamos Scientific Laboratory Memorandum to Distribution from Carl Buckland (H-1), Los Alamos, New Mexico. (Buckland 1952, 04-0035)

Buckland, C. W., February 19, 1953. "I. Additional Monitoring Responsibilities at Ten-Site, II. Need for a New Dumping Tolerance for Storage Tanks at Ten-Site," Los Alamos Scientific Laboratory Memorandum to Dean Meyer (H-1) from Carl Buckland (H-1), Los Alamos, New Mexico. (Buckland 1953, 04-0037)

Buckland, C., September 25, 1959. "Release for Re-Assignment TA-5-1 and TA-5-6," Los Alamos Scientific Laboratory Memorandum to John Sizer (ENG-3) from C. Buckland (H-1), Los Alamos, New Mexico. (Buckland 1959, 04-0033)

Butler, G. W., September 20, 1991. "NaI (Tl) Detector and Lead Shield in 65-foot Deep Shaft at TA-48," Los Alamos National Memorandum INC-11:91:M493MW to Kim Thomas (INC-11) from Gil Butler, Los Alamos, New Mexico. (Butler 1991, 04-0214)

Carmichael, J., September 20, 1991. "Report for an Environmental Restoration Interim Action Reconnaissance Survey at the Former Underground Storage Tank Site TA-35-188," Los Alamos National Laboratory Memorandum EM-8:91-298 to Robert Gonzales (EM-13) from Jeff Carmichael (EM-8), Los Alamos, New Mexico. (Carmichael 1991, 04-0215)

Chelius, L. G., April 10, 1970. "Radioactive Effluents and Releases," Los Alamos Scientific Laboratory Memorandum to H. Jack Blackwell (LAAO) from Leo G. Chelius (H-1), Los Alamos, New Mexico. (Chelius 1970, 04-0041)
Christenson, C. W., February 29, 1956. "Progress Report, January 21, 1956 – February 20, 1956," Los Alamos Scientific Laboratory Memorandum to T. L. Shipman (H-Division) from C. W. Christenson (H-7), Los Alamos, New Mexico. (Christenson 1956, 04-0042)

Christenson, C. W., September 27, 1956. Los Alamos Scientific Laboratory Memorandum to T. L. Shipman form C. W. Christenson, Los Alamos, New Mexico. (Christenson 1956, 04-0043)

Christenson, C. W., December 10, 1957. "Liquid Waste Treatment at TA-35," Los Alamos Scientific Laboratory Memorandum to Dean Meyer (H-1) from C. W. Christenson (H-7), Los Alamos, New Mexico. (Christenson 1957, 04-0216)

Christenson, C.W., March 25, 1958. Los Alamos Scientific Laboratory Memorandum to T.L.Shipman from C.W. Christenson, Los Alamos, New Mexico. (Christenson 1958, 04-0044)

Clark, R. A., compiler, April 1960. "Los Alamos Power Experiment No. II: LAPRE II," Los Alamos Scientific Laboratory Report LA-2465, Los Alamos, New Mexico. (Clark 1960, 04-0217)

Cox, J., February 14, 1984. "Contaminated Line Removal Project: Report for the Month of January 1984," Los Alamos National Laboratory Memorandum HSE-7-84-75 to Jim Allen (ENG-DO) from Jim Cox (HSE-1), Los Alamos, New Mexico. (Cox 1984, 04-0045)

Cox, J., August 28, 1984. "A Section of Line 43 Remaining South of Building TA-55," Los Alamos National Laboratory Memorandum HSE-1-SS-14 to Ray Garde (HSE-1) from Jim Cox (HSE-1), Los Alamos, New Mexico. (Cox 1984, 04-0046)

Cox, J., January 10, 1985. "Contaminated Line Removal Project Report for the Month of December 1984," Los Alamos National Laboratory Memorandum HSE-1-SS-2 to Jim Allen (ENG-DO) from Jim Cox (HSE-1), Los Alamos, New Mexico. (Cox 1985, 04-0047)

Cox, J., January 28, 1985. "Contaminated Soil and Concrete Left of the Excavation of MH-TLS-12 and Line 90A, Work Package II.5, TA-35," Los Alamos Scientific Laboratory Memorandum HSE-1-SS-5 to Allen Valentine (Radiation Protection Group Leader) from Jim Cox (HSE-1), Los Alamos, New Mexico. (Cox 1985, 04-0048)

Cox, J., February 13, 1985. "Contaminated Line Removal Line Project Report for Month of January 1985," Los Alamos National Laboratory Memorandum HSE-1-SS-11 to Jim Allen (ENG-DO) from Jim Cox (HSE-1), Los Alamos, New Mexico. (Cox 1985, 04-0049)

Cox, J., February 26, 1985. "Contaminated Soil Left at Excavation of TSL-10, Work Package II.5, TA-35," Los Alamos National Laboratory Memorandum HSE-1-SS-14 to Allen Valentine (Radiation Protection Group Leader) from Jim Cox (HSE-1), Los Alamos, New Mexico. (Cox 1985, 04-0050)

Cox, J., March 14, 1985. "Contaminated Line Removal Project Report for Month of February 1985," Los Alamos National Laboratory Memorandum HSE-1-JC-19 to Jim Allen (ENG-DO) from Jim Cox (HSE-1), Los Alamos, New Mexico. (Cox 1985, 04-0051)

Cox, J., April 17, 1985. "Contaminated Soil Left at Excavation of Lines 90, 90B, 91, and 92," Los Alamos National Laboratory Memorandum HSE-1-JC-33 to Allen Valentine (Radiation Protection Group Leader) from Jim Cox (HSE-1), Los Alamos, New Mexico. (Cox 1985, 04-0052)

Cox, J., April 25, 1985. "Sections of 34, 36, and 38 Remaining at TA-48," Los Alamos National Laboratory Memorandum HSE-1-JC-34 to Allen M. Valentine (Radiation Protection Group Leader) from Jim Cox (HSE-1), Los Alamos, New Mexico. (Cox 1985, 04-0053)

Cox, J., May 8, 1985. "Contaminated Line Removal Project: Report for April 1985," "Los Alamos National Laboratory Memorandum HSE-1-JC-40 to Jim Allen (ENG-DO) from Jim Cox (HSE-1), Los Alamos, New Mexico. (Cox 1985, 04-0054)

Crismon, W. H., Jr., July 12, 1978. "Decontamination — TA-42," Letter to Harry S. Jordan, Assistant Division Leader for Operations, H-Division, from William H. Crisman, Jr. (Chief, Technical Programs, AEC), Los Alamos, New Mexico. (Crismon 1978, 04-0055)

Daniels, J. D., January 10, 1968. "Tech Area Septic Tank Survey—Findings and Corrective Action Being Taken, "The Zia Company Memorandum ZU-7969 to files from Joe Daniels, Los Alamos, New Mexico. (Daniels 1968,0613)

DOE (US Department of Energy) April 27, 1987. DOE Environmental Problem 19, Los Alamos, New Mexico. (DOE 1987, 04-0251)

DOE (US Department of Energy) April 27, 1987. DOE Environmental Problem 21, Los Alamos, New Mexico. (DOE 1987, 04-0253)

DOE (US Department of Energy) April 27, 1987. DOE Environmental Problem 16, Los Alamos, New Mexico. (DOE 1987, 04-0252)

DOE (US Department of Energy) April 29, 1987. DOE Environmental Problem 24, Los Alamos, New Mexico. (DOE 1987, 04-0257)

DOE (US Department of Energy) April 30, 1987. DOE Environmental Problem 25, Los Alamos, New Mexico. (DOE 1987, 04-0256)

DOE (US Department of Energy), October 1987. "Phase I: Installation Assessment, Los Alamos National Laboratory," Volumes 1 and 2, (draft), Comprehensive Environmental Assessment and Response Program, Albuquerque Operations Office, Albuquerque, New Mexico. (DOE 1987, 0264)

DOE (US Department of Energy), September 1988. "Remedial Investigation Plan, Los Alamos National Laboratory, Task 6, Technical Areas 35, 42, 48, 55 Synopsis," Los Alamos National Laboratory Report (Working Draft), Los Alamos, New Mexico. (DOE 1988,0614)

DOE (US Department of Energy), September 1988. "Remedial Investigation Plan, Los Alamos National Laboratory, Technical Areas 4, 5, 35, 52, Task 7, Sampling Plan," Department of Energy Report (Working Draft), Albuquerque, New Mexico. (DOE 1988, 0491)

Dropesky, B. J., and J. W. Barnes, January 27, 1970. "Preparation of Be Targets," Los Alamos Scientific Laboratory Memorandum to G. A. Cowan from B. J. Dropesky, and J. W. Barnes, Los Alamos, New Mexico. (Dropesky and Barnes 1970, 04-0056)

Efurd, D. W., May 16, 1988. "Estimates on Waste Generated from TA-48," Los Alamos National Laboratory Memorandum INC-11-88-271 to R. Lotspeich (A-4) from D. W. Efurd (INC-11), Los Alamos, New Mexico. (Efurd 1988, 04-0058)

Elder, J., November 21, 1988. Letter to Michelle Landis from John Elder, Los Alamos National Laboratory, Los Alamos, New Mexico. (Elder 1988, 04-0059)

Elder, J., October 30, 1991. "TA-52 Facilities Decommissioned in UHTREX D&D Project: Remove From SWMU and RPIS Lists," Los Alamos National Laboratory Memorandum HS-3-FSA:91-206 to Joe Wanda Cramer (EES-13) from John Elder (HS-3), Los Alamos, New Mexico. (Elder 1991, 04-0218)

Elder, J. C., E. J. Cox, D. P. Hohner, and A. M. Valentine, September 1986. "Radioactive Liquid Waste Lines Removal Project at Los Alamos (1981–1986)," Los Alamos National Laboratory Report LA-10821-MS, Los Alamos, New Mexico. (Elder et al. 1986, 0456)

Emelity, L. A., January 15, 1958. "TA-35, Ten Site Waste Treatment Plant," Los Alamos Scientific Laboratory Report (Draft), Los Alamos, New Mexico. (Emelity 1958, 04-0060)

Emelity, L. A., April 15, 1958. "History of Ten Site Plant," Los Alamos Scientific Laboratory Report, Los Alamos, New Mexico. (Emelity 1958, 04-0205)

Emelity, L. A., December 1, 1975. "Report of the Liquid Waste Study Group," Los Alamos Scientific Laboratory Memorandum to G. L. Voelz (H-Division) from L. A. Emelity (H-7), Los Alamos, New Mexico. (Emelity 1975, 04-0061)

Emelity, L. A., August 16, 1979. "Decontamination/Decommissioning, TA-35, Los Alamos National Laboratory Memorandum to T. K. Keenan (H-7) from L. A. Emelity (H-7)," Los Alamos, New Mexico. (Emelity 1979, 04-0062)

Emelity, L. A., April 19, 1982. "Monthly Achievement Report for April 1982," Los Alamos National Laboratory Memorandum H-7-82-149 to Jesse Aragon (H-DO) from L. A. Emelity (H-7), Los Alamos, New Mexico. (Emelity 1982, 04-0063)

Emelity, L. A., July 15, 1982. "Significant Events, FY1980, 1981, and 1982," Los Alamos National Laboratory Memorandum H-7-82-252 to Jesse Aragon (H-DO) from L. A. Emelity (H-7), Los Alamos, New Mexico. (Emelity 1982, 04-0064)

Emelity, L. A., J. R. Buchholz, M. Muller, A. Valentine, W. Goldsmith, and L. Bordvin, January 1975. "A Survey of Liquid Waste Management Problems at the LASL," Los Alamos Scientific Laboratory Report, Los Alamos, New Mexico. (Emelity et al. 1975, 0282)

Enders, J., March 22, 1965. "Material Deposited in Disposal Well #88 since 8/17/64," Los Alamos Scientific Laboratory Memorandum to Dean Meyer (H-1) from John Enders (H-1), Los Alamos, New Mexico. (Enders 1965, 04-0066)

Enders, J., March 30, 1965. "Request for Additional Pit Space and Disposal Wells," Los Alamos Scientific Laboratory Memorandum to Charles Reynolds (Eng-4) from John Enders (H-1), Los Alamos, New Mexico. (Enders 1965, 04-0067)

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)

ESG (Environmental Studies Group), April 1977. "Environmental Surveillance at Los Alamos During 1976," Los Alamos Scientific Laboratory Report LA-6801-MS, Los Alamos, New Mexico. (ESG 1977, 0618)

ESG (Environmental Studies Group), April 1978. "Environmental Surveillance at Los Alamos During 1977," Los Alamos Scientific Laboratory Report LA-7263-MS, Los Alamos, New Mexico. (ESG 1978, 0095)

ESG (Environmental Surveillance Group), April 1980. "Environmental Surveillance at Los Alamos During 1979," Los Alamos Scientific Laboratory Report LA-8200-ENV, Los Alamos, New Mexico. (ESG 1980, 0406)

ESG (Environmental Surveillance Group), April 1981. "Environmental Surveillance at Los Alamos During 1980," Los Alamos National Laboratory Report LA-8810-ENV, Los Alamos, New Mexico. (ESG 1981, 0424)

ESG (Environmental Surveillance Group), April 1982. "Environmental Surveillance at Los Alamos During 1981," Los Alamos National Laboratory Report LA-9349-ENV, Los Alamos, New Mexico. (ESG 1982, 0620)

ESG (Environmental Surveillance Group), April 1983. "Environmental Surveillance at Los Alamos During 1982," Los Alamos National Laboratory Report LA-9762-ENV, Los Alamos, New Mexico. (ESG 1983, 0621)

ESG (Environmental Surveillance Group), October 16, 1984. "Site Characterization Technical Plans for the Los Alamos National Laboratory," Los Alamos National Laboratory Report, Los Alamos, New Mexico. (ESG 1984, 0622)

ESG (Environmental Surveillance Group), May 1988. "Environmental Surveillance at Los Alamos During 1987," Los Alamos National Laboratory Report LA-11306-ENV, Los Alamos, New Mexico. (ESG 1988, 0408)

ESG (Environmental Surveillance Group), June 1989. "Environmental Surveillance at Los Alamos During 1988," Los Alamos National Laboratory Report LA-11628-ENV, Los Alamos, New Mexico. (ESG 1989, 0308)

Fowler, E. B., November 28, 1973. "Radioactive Liquid Wastes, Environmental Data," Los Alamos Scientific Laboratory Memorandum EBF-H7-463 to R. Schreiber from Eric Fowler (H-7), Los Alamos, New Mexico. (Fowler 1973, 04-0069)

Fresquez, P., October 31, 1990. "An Environmental Restoration Interim Action (ERIA) Reconnaissance Survey of a Proposed Parking Lot Just East of TA-48-1," Los Alamos National Laboratory Memorandum HSE-8:90-1107 to John Krueger (HSE-13) from Phil Fresquez (HSE-8), Los Alamos, New Mexico. (Fresquez 1990, 04-0073)

Fresquez, P., November 27, 1990. "Final Closure Verification Sampling of Two Former Waste Oil Surface Impoundments (TSL-85 and -125) Located at TA-35," Los Alamos National Laboratory Memorandum HSE-8:90-1220 to John Krueger (HSE-13) from Phil Fresquez (HSE-8), Los Alamos, New Mexico. (Fresquez 1990, 04-0074)

Fresquez, P., March 1, 1991. "Results of an Environmental Restoration Environmental Action (ERIA) Reconnaissance Survey at the Site of the Proposed Nuclear Safeguard Technology Laboratory (NSTL) Near TA-55," Los Alamos National Laboratory Memorandum HSE-8:91-340 to Henry Nunes (EES-13) from Phil Fresquez (HSE-8), Los Alamos, New Mexico. (Fresquez 1991, 04-0075)

Fresquez, P., March 6, 1991. "Results of an Environmental Restoration Verification Survey of a Former Waste Oil Surface Impoundment (TSL-125) at TA-35," Los Alamos National Laboratory Memorandum HSE-8:91-352 to John Krueger (HSE-13) from Phil Fresquez (HSE-8), Los Alamos, New Mexico. (Fresquez 1991, 04-0076)

Fresquez, P., March 12, 1991. "Results of an Environmental Restoration Interim Action (ERIA) Reconnaissance Survey of a Proposed Parking Lot East of TA-48," Los Alamos National Laboratory Memorandum HSE-8:91-376 to Henry Nunes (HSE-13) from Phil Fresquez (HSE-8), Los Alamos, New Mexico. (Fresquez 1991, 04-0077)

Fresquez, P., April 1, 1991. "An Environmental Restoration Interim Action (ERIA) Reconnaissance Survey at the Site of the Weapons Isotope Separator Facility at TA-48," Los Alamos National Laboratory Memorandum HSE-8:91-507 to Henry Nunes (HSE-13) from Phil Fresquez (HSE-8), Los Alamos, New Mexico. (Fresquez 1991, 04-0078)

Fresquez, P., April 11, 1991. "Results of an Environmental Restoration Interim Action (ERIA) Reconnaissance Survey Over Areas Where Wastewater Collection Lines are Planned to be Installed en Route to the New Sanitary Wastewater Systems Consolidation (SWSC) Treatment Plan at TA-46," Los Alamos National Laboratory Memorandum HSE-8:91-597 to Henry Nunes (HSE-13) from Phil Fresquez (HSE-8), Los Alamos, New Mexico. (Fresquez 1991, 04-0232)

Fresquez, P., May 31, 1991. "Results of an Environmental Restoration Interim Action (ERIA) Reconnaissance Survey at the Site of the Weapons Isotope Separator Facility at TA-48," Los Alamos National Laboratory Memorandum HSE-8:91-900 to Robert Gonzales (HSE-13) from Phil Fresquez (HSE-8), Los Alamos, New Mexico. (Fresquez 1991, 04-0079)

Fresquez, P., June 17, 1991. "An Environmental Restoration Interim Action (ERIA) Reconnaissance Survey at the Site of the Los Alamos Power Reactor Experiment No. 2 (LAPRE II) Reactor Vessel and Fuel Reservoir Removal Project at TA-35," Los Alamos National Laboratory Memorandum HSE-8:91-1037 to Robert Gonzales (HSE-13) from Phil Fresquez (HSE-8), Los Alamos, New Mexico. (Fresquez 1991, 04-0080)

Fresquez, P., July 9, 1991. "Results of an Environmental Restoration Verification Survey of a Former Waste Oil Surface Impoundment (TSL-85) at TA-35," Los Alamos National Laboratory Memorandum HSE-8:91-1181 to John Krueger (HSE-13) from Phil Fresquez (HSE-8), Los Alamos, New Mexico. (Fresquez 1991, 04-0081)

Garcia, T. M., May 20, 1968. "Ten Site Monitoring - Week Ending 5-10-68," Los Alamos Scientific Laboratory Memorandum to Dean Meyer (H-1) from T. M. Garcia (H-1), Los Alamos, New Mexico. (Garcia 1968, 04-0084)

Garde, R., March 25, 1976. "TA-35-2 Tritium Facility," Los Alamos Scientific Laboratory Memorandum to John Farr (CMB-3) from Ray Garde (H-1), Los Alamos, New Mexico. (Garde 1976, 04-0085)

Garde, R., January 20, 1978. "DOE National D&D Planning Program Survey for Contaminated Facility Data," Los Alamos Scientific Laboratory, Los Alamos, New Mexico. (Garde 1978, 04-0086)

Garvey, D. B., August 29, 1986. Los Alamos National Laboratory Memorandum 53201555570FV12 to Distribution from Doris B. Garvey, Los Alamos, New Mexico. (Garvey 1986, 04-0087)

Gonzales, R., April 25, 1991. "Lab Job No. 10724-35, D&D of Separator Pit," Los Alamos National Laboratory Memorandum to Distribution from Robert Gonzales, Los Alamos, New Mexico. (Gonzales 1991, 04-0088)

Gonzales, R., April 29, 1991. "Work Order No. 6575723, Remove Old Buried Reactor Vessel," Los Alamos National Laboratory Memorandum to Distribution from Robert Gonzales, Los Alamos, New Mexico. (Gonzales 1991, 04-0089)

Graf, J. M., and H. H. Howard, March 28, 1978. "Residual Radioactivity Associated with the LAPRE II Fuel Reservoir and Reactor Vessel," Los Alamos Scientific Laboratory Memorandum to Ray Garde from J. M. Graf and H. H. Howard, Los Alamos, New Mexico. (Graf and Howard 1978, 04-0090)

Hakonson, T. E., G. C. White, E. S. Gladney, and M. Dreseer, April 1978. "Environmental Surveillance at Los Alamos Scientific Laboratory During 1978," Los Alamos Scientific Laboratory Report LA-7800-ENV, Los Alamos, New Mexico. (Hakonson et al. 1979, 0119)

Hansen, W. R., August 10, 1984. "Site Characterization Priority Listing," Los Alamos Scientific Laboratory Memorandum HSE-8:84-660 to Jesse Aragon (HSE Division Leader) from Wayne Hansen (H-1), Los Alamos, New Mexico. (Hansen 1984, 04-0091)

Hanson, J., June 21, 1991. Telephone communication between B. Hooker and J. Hanson, International Technology (IT) Corporation telephone Log, Los Alamos, New Mexico. (Hanson 1991, 04-0092)

Harper, J., November 9, 1981. "October Status Report of the Removal Project," Los Alamos National Laboratory Memorandum H-7-81-575 to H. S. Jordan (H-DO) from J. Harper (H-7), Los Alamos, New Mexico. (Harper 1981, 04-0094)

Harper, J., December 2, 1981. "Project Activity During November 1981," Los Alamos National Laboratory Memorandum H7-81-627 to H. S. Jordan from J. R. Harper (H-7), Los Alamos, New Mexico. (Harper 1981, 04-0095)

Harper, J. R., July 9, 1979. "Activities June 11 — June 29, 1979," Los Alamos Scientific Laboratory Memorandum to N131 File from Johnny Harper, Los Alamos, New Mexico. (Harper 1979, 04-0096)

Harper, J. R., August 10, 1979. "N131 Activities July 1 — July 31, 1979," Los Alamos Scientific Laboratory Memorandum to Ray Garde (H-1) from Johnny Harper (H-1), Los Alamos, New Mexico. (Harper 1979, 04-0097)

Harper, J. R., and R. Garde, November 1981. "The Decommissioning of the TA-42 Plutonium Contaminated Incinerator Facility," Los Alamos National Laboratory Report LA-9077-MS, Los Alamos, New Mexico. (Harper and Garde 1981, 0457)

Harper, J. R., and R. Garde, November 1981. "The Decommissioning of a Tritium Contaminated Laboratory," Los Alamos National Laboratory Report LA-9056-MS, Los Alamos, New Mexico. (Harper and Garde 1981, 0458)

Harper, J. R., and R. Garde, November 1981. "Decommissioning of the Los Alamos Molten Plutonium Reactor Experiment (LAMPRE-I)," Los Alamos National Laboratory Report LA-9052-MS, Los Alamos, New Mexico. (Harper and Garde 1981, 0467)

H-7, February 1957. "Group H-7 Annual Report," Los Alamos Scientific Laboratory, Los Alamos, New Mexico (H-7 1957, 0700)

H-Division, June 1953. "H-Division Progress Report May 20 – June 20, 1953," Los Alamos Scientific Laboratory Report, Los Alamos, New Mexico. (H-Division 1953, 0466)

H-Division, January 1954. "H-Division Progress Report; December 20, 1953 - January 20, 1954", Los Alamos Scientific Laboratory report, Los Alamos, New Mexico. (H-Division 1954, 0488)

H-Division, March 1955. "H-Division Progress Report February 20 – March 20, 1955," Los Alamos Scientific Laboratory Report, Los Alamos, New Mexico. (H-Division 1955, 0477)

H-Division, May 1955. "H-Division Progress Report April 20 – May 20, 1955," Los Alamos Scientific Laboratory Report, Los Alamos, New Mexico. (H-Division 1955, 0482)

H-Division, July 1955. "H-Division Progress Report June 20 – July 20, 1955," Los Alamos Scientific Laboratory Report, Los Alamos, New Mexico. (H-Division 1955, 0625))

H-Division, August 1955. "H-Division Progress Report July 20 – August 20, 1955," Los Alamos Scientific Laboratory Report, Los Alamos, New Mexico. (H-Division 1955, 0467)

H-Division, February 1956. "H-Division, Report January – February 20, 1956," Los Alamos Scientific Laboratory Report, Los Alamos, New Mexico. (H-Division 1956, 0468)

H-Division, March 1956. "H-Division Progress Report February 20 – March 20, 1956," Los Alamos Scientific Laboratory Report, Los Alamos, New Mexico. (H-Division 1956, 0469)

H-Division, September 1956. "H-Division Progress Report August 20 – September 20, 1956", Los Alamos Scientific Laboratory Report, Los Alamos, New Mexico. (H-Division 1956, 0471)

H-Division, October 1956. "H-Division Progress Report September 20 – October 10, 1956," Los Alamos Scientific Laboratory Report, Los Alamos, New Mexico. (H-Division 1956, 0472)

H-Division, November 1956. "H-Division Progress Report October 20 – November 20, 1956," Los Alamos Scientific Laboratory Report, Los Alamos, New Mexico. (H-Division 1956, 0473)

H-Division, January 1957. "H-Division Progress Report December 20, 1956 – January 20, 1957", Los Alamos Scientific Laboratory Report, Los Alamos, New Mexico. (H-Division 1957, 0474)

H-Division, September 19, 1957. "H-Division Progress Report August 20 – September 20, 1957," Los Alamos Scientific Laboratory Report, Los Alamos, New Mexico. (H-Division 1957, 0489)

H-Division, October 1957. "H-Division Progress Report September 20 – October 20, 1957," Los Alamos Scientific Laboratory Report, Los Alamos, New Mexico. (H-Division 1957, 0475)

H-Division, November 1957. "H-Division Progress Report October 20 – November 20, 1957," Los Alamos Scientific Laboratory Report, Los Alamos, New Mexico. (H-Division 1957, ____)

H-Division, December 1957. "H-Division Progress Report November 20 – December 20, 1957," Los Alamos Scientific Laboratory Report, Los Alamos, New Mexico. (H-Division 1957, 0476)

H-Division, January 1958. "H-Division Progress Report December 20, 1957 – January 20, 1958," Los Alamos Scientific Laboratory Report, Los Alamos, New Mexico. (H-Division 1958, 0478)

H-Division, April 1958. "H-Division Progress Report March 20 – April 20, 1958," Los Alamos Scientific Laboratory Report, Los Alamos, New Mexico. (H-Division 1958, 0490)

H-Division, May 1958. "H-Division Progress Report April 20 – May 20, 1958," Los Alamos Scientific Laboratory Report, Los Alamos, New Mexico. (H-Division 1958, 0479)

H-Division, February 1959. "H-Division Progress Report January 20 – February 20", Los Alamos Scientific Laboratory Report, Los Alamos, New Mexico. (H-Division 1959, 0480)

H-Division, January 1960. "H-Division Progress Report December 20, 1959 – January 20, 1960," Los Alamos Scientific Laboratory Report, Los Alamos, New Mexico. (H-Division 1958, 0481)

Herceg, E., circa 1971. "A Survey of the Nature and Effectiveness of LASL Boundaries," Los Alamos Scientific Laboratory Report, Los Alamos, New Mexico. (Herceg circa 1971, 04-0099)

Herceg, W. E. (Comp.), March 1973. "Environmental Monitoring in the Vicinity of the Los Alamos Scientific Laboratory Calendar Year 1972," Los Alamos Scientific Laboratory Report LA-5184, Los Alamos, New Mexico. (Herceg 1973, 0440)

Hohner, D., October 1981. Zia Work Order #6-5752-03 for Removal of Contaminated Waste Lines, Los Alamos, New Mexico. (Hohner 1981, 04-0100)

Hurdle, R. C., December 22, 1983. "Asbestos Insulation Usage at Los Alamos National Laboratory," Los Alamos National Laboratory Memorandum HSE-5:83-1084 to Jesse Aragon (HSE-DO) from R. C. Hurdle (HSE-5), Los Alamos, New Mexico. (Hurdle 1983, 04-0101)

Hyatt, E. C., July 16, 1959. "Survey of Abandoned Structures," Los Alamos Scientific Laboratory Memorandum to S. E. Russo (ENG-3) from E. C. Hyatt (Industrial Hygiene), Los Alamos, New Mexico. (Hyatt 1959, 04-0102)

Hyatt, E. C., July 28, 1959. "Survey of Abandoned Structures," Los Alamos Scientific Laboratory Memorandum to S. E. Russo (Eng-3) from E. C. Hyatt (Industrial Hygiene), Los Alamos, New Mexico. (Hyatt 1959, 04-0103)

International Technology Corporation, December 1988. "Solid Waste Management Units Report, Los Alamos National Laboratory, Los Alamos, New Mexico," Volumes I-IVprepared by International Technology Corporation, Project No. 301215.02.01, Los Alamos, New Mexico. (International Technology Corporation 1988, 0329)

International Technology Corporation, September 27, 1991. "UST Integrity Testing, Los Alamos National Laboratory, September 1991," Los Alamos, New Mexico. (International Technology Corporation 1991, 0648)

Jordan, H. S., February 21, 1975. "Disposal of LASL Water Boiler Reactor," Los Alamos Scientific Laboratory Memorandum to C. I. Browne (ADA) from H. S. Jordan (H-DO), Los Alamos, New Mexico. (Jordon, 1975, 04-0104)

Kaal, K., July 23, 1991. Notes recorded during site inspection of TA-55 on International Technology (IT) Corporation Field Activity Daily Log, Los Alamos, New Mexico. (Kaal 1991, 04-0105)

Keenan, T. K., September 10, 1975. "Releases of Effluents to Ten Site Canyon," Los Alamos Scientific Laboratory Memorandum to LaMar Johnson (H-8) from T. K. Keenan (H-7), Los Alamos, New Mexico. (Keenan 1975, 04-0106)

Kennedy, W. R., February 8, 1968. "Prevention, Control, and Abatement of Water Pollution by Federal Activities—Storage of Hazardous Materials," Los Alamos Scientific Laboratory Memorandum to Herman Roser (LAAO) from William Kennedy (H-6), Los Alamos, New Mexico. (Kennedy 1968, 04-0107)

Koenig, R. A., September 15, 1988. "UHTREX Project Plan," Los Alamos National Laboratory Memorandum HSE 7-88-407 to C. Garcia from R. A. Koenig, Los Alamos, New Mexico. (Koenig 1988, 04-0109)

LANL (Los Alamos National Laboratory), circa 1981. "Annual Report FY 1980, Surplus LASL Facility Description," Los Alamos, New Mexico. (LANL circa1981, 04-0209)

LANL (Los Alamos National Laboratory), 1983. Engineering Drawing ENG-R3188, Los Alamos, New Mexico. (LANL 1983, 04-0110)

LANL (Los Alamos National Laboratory), 1983. Engineering Drawing ENG-R5212, Los Alamos,New Mexico. (LANL 1983, 04-0244)

LANL (Los Alamos National Laboratory), 1983. Engineering Drawing ENG-R5272, Los Alamos, New Mexico. (LANL circa 1983, 04-0112)

LANL (Los Alamos National Laboratory), 1983. Engineering Drawing ENG-R5304, Los Alamos, New Mexico. (LANL 1983, 04-0113)

LANL (Los Alamos National Laboratory), 1983. Engineering Drawing ENG-R2148, Los Alamos, New Mexico. (LANL 1983, 04-0114)

LANL (Los Alamos National Laboratory), 1983 . Engineering Drawing ENG-R5129, Los Alamos, New Mexico. (LANL 1983, 04-0249)

LANL (Los Alamos National Laboratory), Circa 1984. "Inclusion/Elimination Review Los Alamos Country Industrial Waste Line, Los Alamos, New Mexico," Los Alamos National Laboratory Report, Los Alamos, New Mexico. (LANL circa 1984, 04-0116)

LANL (Los Alamos National Laboratory), 1984. Engineering Drawing ENG-R5182, Los Alamos, New Mexico. (LANL 1984, 04-0117)

LANL (Los Alamos National Laboratory), 1984. Engineering Drawing ENG-R1510, Los Alamos, New Mexico. (LANL 1984, 04-0118)

LANL (Los Alamos National Laboratory), 1984. Engineering Drawing ENG-R5365, Los Alamos, New Mexico. (LANL 1984, 04-0119)

LANL (Los Alamos National Laboratory), November 25, 1985. "Cross Index of NPDES Serial #s to Technical Areas and Types of Discharge," Los Alamos, New Mexico. (LANL 1985, 04-0121)

LANL (Los Alamos National Laboratory), 1986. Engineering Drawing ENG-R-5117, Los Alamos, New Mexico. (LANL 1986, 04-0249

LANL (Los Alamos National Laboratory), 1987. Engineering Drawing ENG-R5480, Los Alamos, New Mexico. (LANL 1987, 04-0123)

LANL (Los Alamos National Laboratory), 1987. Engineering Drawing ENG-R5585, Los Alamos, New Mexico. (LANL 1987, 04-0231)

LANL (Los Alamos National Laboratory), 1988. Engineering Drawing ENG-R5125, Los Alamos, New Mexico. (LANL 1988, 04-0259)

LANL (Los Alamos National Laboratory), 1988. "1988 Inventory of Federal Hazardous Waste Activities," Los Alamos, New Mexico. (LANL 1988, 04-0125)

LANL (Los Alamos National Laboratory), April 25, 1988. Beta-Gamma Measurements, Los Alamos, New Mexico. (LANL 1988, 04-0126)

LANL (Los Alamos National Laboratory), April 25, 1988. Gamma Ray Count Rate Data, Los Alamos, New Mexico. (LANL 1988, 04-0127)

LANL (Los Alamos National Laboratory), April 29, 1988. Beta-Gamma Measurements, Los Alamos, New Mexico. (LANL 1988, 04-0128)

LANL (Los Alamos National Laboratory), September 12, 1988. "UHTREX Decommissioning Project Plan," Los Alamos National Laboratory Report, Los Alamos, New Mexico. (LANL 1988, 0483)

LANL (Los Alamos National Laboratory), 1989. Building Records for TA-5, Los Alamos, New Mexico. (LANL 1989, 04-0129)

LANL (Los Alamos National Laboratory), 1989. Engineering Drawing ENG-R7100 Rev., Los Alamos, New Mexico. (LANL 1989, ____)

LANL (Los Alamos National Laboratory), February 1989. "TA-52 UHTREX Reactor Decommissioning Project Management Plan," Los Alamos National Laboratory Report, Document Control Number DAD-HSE-7-PMP-01, R00, Los Alamos, New Mexico. (LANL 1989, 0459)

LANL (Los Alamos National Laboratory), 1990. Engineering Drawing ENG-R5481, Los Alamos, New Mexico. (LANL 1990, 04-0130)

LANL (Los Alamos National Laboratory), circa 1990. NPDES Permit Outfalls, Los Alamos, New Mexico. (LANL circa 1990, 04-0131)

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 International Technology Corporation under Contract Number 9-XS8-0062R-1, Los Alamos, New Mexico. (LANL 1990, 0145)

LANL (Los Alamos National Laboratory), September 17, 1991. NPPES Outfalls, Los Alamos, New Mexico. (LANL 1991, 04-0261)

LANL (Los Alamos National Laboratory), 1991. Engineering Drawing ENG-R7100, Los Alamos, New Mexico. (LANL 1991, 04-0262)

LANL (Los Alamos National Laboratory), 1991. "Waste Stream Characterization Reports," Los Alamos National Laboratory Reports, Los Alamos, New Mexico. (LANL 1991, 04-0133)

LASL (Los Alamos Scientific Laboratory), March 15, 1945. "Manhattan District History "Y" Project," Los Alamos Scientific Laboratory Report, Los Alamos, New Mexico. (LASL 1945, 04-0134)

LASL (Los Alamos Scientific Laboratory), December 1946. "Safety Practice M-4 Report," Los Alamos Scientific Laboratory Report, Los Alamos, New Mexico. (LASL 1946, 04-0136)

LASL (Los Alamos Scientific Laboratory), September 11, 1947. "A Technical Maintenance Group Report on General Background Data Concerning the Los Alamos Scientific Laboratory Required for Planning Purposes," Los Alamos Scientific Laboratory Report LAB-A-5, Los Alamos, New Mexico. (LASL 1947, 0460)

LASL (Los Alamos Scientific Laboratory), November 4, 1947. "A Technical Maintenance Group Report on Background Data Concerning the Organization, Space Occupancy, and Building Requirements of the Los Alamos Scientific Laboratory," Los Alamos Scientific Laboratory Report LAB-A5-2, Los Alamos, New Mexico. (LASL 1947, 0461)

LASL (Los Alamos Scientific Laboratory), June 1949. "Property Classification, Buildings, and Structures," Los Alamos, New Mexico. (LASL 1949, 04-0139)

LASL (Los Alamos Scientific Laboratory), 1955. Engineering Drawing ENG-R118, Los Alamos, New Mexico. (LASL 1955, 04-0243)

LASL (Los Alamos Scientific Laboratory), August 9, 1955. Engineering Drawing ENG-RS16, Los Alamos, New Mexico. (LASL 1955, 04-0238)

LASL (Los Alamos Scientific Laboratory), 1955. "A Survey of Some Los Alamos County Canyons for Radioactive Contamination Spring 1953 to Spring 1955," Los Alamos Scientific Laboratory Report, Los Alamos, New Mexico. (LASL 1955, 0492)

LASL (Los Alamos Scientific Laboratory), 1957. Engineering Drawing LA-AX-C1.1, Los Alamos, New Mexico. (LASL 1957, 04-0236)

LASL (Los Alamos Scientific Laboratory), Circa 1960. TA-5 Beta Site — Little Eva Notebook 10/27/59 – 1/28/60, Los Alamos, New Mexico. (LASL circa 1960, 04–0141)

LASL (Los Alamos Scientific Laboratory), 1961. Engineering Drawing ENG-R-2418, Los Alamos, New Mexico. (LASL 1961, 04-0248)

LASL (Los Alamos Scientific Laboratory), May 15, 1962. "Report on Mortandad Canyon Soil Analyses," Los Alamos Scientific Laboratory Report, Los Alamos, New Mexico. (LASL 1962, 04-0142)

LASL (Los Alamos Scientific Laboratory), circa 1967. TA-5 Structure Description, Los Alamos, New Mexico. (LASL circa 1967, 04-0144)

LASL (Los Alamos Scientific Laboratory), 1968. Engineering Drawing ENG-C 31835, Los Alamos, New Mexico. (LASL 1968,04-0241)

LASL (Los Alamos Scientific Laboratory), 1968. Engineering Drawing ENG-C 31840, Los Alamos, New Mexico. (LASL 1968, 04-0242)

LASL (Los Alamos Scientific Laboratory), circa 1969. "Gaseous Waste Management," Los Alamos Scientific Laboratory, Los Alamos, New Mexico. (LASL circa 1969, 0702)

LASL (Los Alamos Scientific Laboratory), circa 1972. Ten Site Waste Treatment Data (handwritten), Los Alamos, New Mexico. (LASL circa 1972, 04-0145)

LASL (Los Alamos Scientific Laboratory), February 1, 1972. LASL Pollutant Information, Los Alamos, New Mexico. (LASL 1972, 04-0146)

LASL (Los Alamos Scientific Laboratory), circa 1973. Listing of Potential Radionuclide Releases at TAs 32 through 52, 1967–1970, TA Building, Nomenclature, and Releases, Los Alamos, New Mexico. (LASL circa 1973, 04-0147)

LASL (Los Alamos Scientific Laboratory), June 7, 1973. "Environmental Assessment for AEC/ALO Project No. 19, Improve Septic Tank Systems, LASL Tech Areas," Los Alamos, New Mexico. (LASL 1973, 0493)

LASL (Los Alamos Scientific Laboratory), 1975. Engineering Drawing ENG-E378 Sheet D, Los Alamos, New Mexico. (LASL 1975, 04-0250)

LASL (Los Alamos Scientific Laboratory), July 1977. "LASL Ten Year Decontamination/Decommissioning Site Plan, FY 1980 thru FY 1989," Los Alamos Scientific Laboratory Report, Los Alamos, New Mexico. (LASL 1977, 0649)

LASL (Los Alamos Scientific Laboratory), circa 1977. "Material Disposal Areas at LASL", Los Alamos Scientific Laboratory Report, Los Alamos, New Mexico. (LASL circa 1977, 0701)

LASL (Los Alamos Scientific Laboratory), 1972-1978. Pages 1, 2, 5-9, 11, 15, 17-19, 21, 25, 27-29, 31-33, 35-38, 41-43, 45, 50, 53-60; Los Alamos Scientific Laboratory Notebook, Los Alamos, New Mexico.

LASL (Los Alamos Scientific Laboratory), 1980. Engineering Drawing R5277, Los Alamos, New Mexico. (LASL 1980, 04-0260)

LASL (Los Alamos Scientific Laboratory), no date. "Laboratory/Pan Am History Book," ENG-7, TA-3, Building 410, Room 1026, Betty Lea, Los Alamos National Laboratory, Los Alamos, New Mexico. (LASL no date, 0202)

Madrid, S., September 20, 1991. Telephone communication between K. Roberson and S. Madrid on International Technology (IT) Corporation Pone Log, Los Alamos, New Mexico. (Madrid 1991, 04-0225)

Martin, R., December 7, 1973. "Survey of TA-5 (Beta Site)," Los Alamos Scientific Laboratory Memorandum to H-1 General Monitoring Section File from Robert Martin (H-1), Los Alamos, New Mexico. (Martin 1973, 04-0151)

Martz, M., March 6, 1986. "Preliminary Reconnaissance Findings—Transformers and Capacitors," Los Alamos Laboratory Memorandum HSE-8:86-265 to Anthony Drypolcher (HSE-8) from Marji Martz (HSE-8), Los Alamos, New Mexico. (Martz 1986, 04-0152)

McAtee, L., August 28, 1981. "Sub Project B: Line Removal, Work Package I.2.TA35," Los Alamos National Laboratory Memorandum to Radioactive Liquid Waste Collection System Improvement Project File from Lee McAtee, Los Alamos, New Mexico. (McAttee 1981, 04-0154)

McAtee, L., September 3, 1981. "Radioactive Liquid Waste System Improvement Project Subproject B, Work Package I.5.TA-48," Los Alamos National Laboratory Memorandum H-1-81 to D. Willenberg (ENG) from L. McAtee, Los Alamos, New Mexico. (McAtee 1981, 04-0155)

McInroy, November 7, 1991. "Information Needs Regarding USTs for OU 1129," Los Alamos National Laboratory Memorandum EM-8:91-591 to Joe Cramer (EES-13) from Dave McInroy (EM-8), Los Alamos, New Mexico. (McInroy 1991, 04-0219)

Meyer, D. D., August 12, 1954. "Justification for Addition to Waste Treatment Facilities at Ten-Site," Los Alamos Scientific Laboratory Memorandum to John Bolton (Engineering) from Dean Meyer (H-1), Los Alamos, New Mexico. (Meyer 1954, 04-0156)

Meyer, D. D., December 28, 1977. "Other Sites of Interest, Los Alamos Scientific Laboratory Memorandum to Margaret Anne Rogers from D. D. Meyer, Los Alamos, New Mexico. (Meyer 1977, 04-0157)

Montoya, G. M., 1985. "Site Characterization & Enhancement Program, August 1985," Los Alamos National Laboratory Lab Book A000490, Los Alamos, New Mexico. (Montoya 1985, 04-0158)

Montoya, G. M., October 30, 1985. "Site Characterization Enhancement Program," Los Alamos National Laboratory Memorandum HSE-1-GM-75 to Allen M. Valentine from Gilbert M. Montoya (HSE-1), Los Alamos, New Mexico. (Montoya 1985, 04-0159)

Montoya, G. M., June 5, 1990. "Los Alamos Power Reactor Experiment No. 2 (LAPRE II) Site Characterization Summary Report," Los Alamos National Laboratory Memorandum HSE-7-90-11 to Ray Garde (HSE-7) from Gilbert M. Montoya (HSE-7), Los Alamos, New Mexico. (Montoya 1990, 04-0161)

Montoya, G. M., May 14, 1991. "TA-35 Los Alamos Power Reactor Experiment No. 2 (LAPRE) Decommissioning Project Management Plan", Document Control Number DAD-HSE-7-PMP-03, R00 Los Alamos National Laboratory, Los Alamos, New Mexico. (Montoya 1991, 04-0162)

Montoya, J. B., July 2, 1976. "Technical Area 5 Clean Up," Los Alamos Scientific Laboratory Memorandum to Jim Parsons (ENG-4) from J. B. Montoya (ENG-3), Los Alamos, New Mexico. (Montoya 1976, 04-0163)

Montoya, J. B., July 2, 1985. "Structure Removal," Los Alamos National Laboratory Memorandum to A. J. Ahlquist from J. B. Montoya, Los Alamos, New Mexico. (Montoya 1985, 04-0164)

Nunes, H., October 17, 1991. "TA-35, TSL-2, PCB Spill Removal, PI#10767, Excavation Permit #5499, SWMU No. 35-0018," Los Alamos National Laboratory Memorandum ENG-1/HN/92-10 to Raul Morales (EM-8) from H. Nunes, Los Alamos, New Mexico. (Nunes 1991, 04-0220)

Penland, J. R., July 13, 1959. "HE Contamination of Abandoned Structures," Los Alamos Scientific Laboratory Memorandum to S. E. Russo (ENG-3) from J. R. Penland (H-3 Safety Office), Los Alamos, New Mexico. (Penland 1959, 04-0167)

Penland, J. R., July 29, 1959. "Contamination Survey: Building Beta-4, TA-5," Los Alamos Scientific Laboratory Memorandum to S. E. Russo (ENG-3) from J. R. Penland (H-3 Safety Office), Los Alamos, New Mexico. (Penland 1959, 04-0168)

Perkins, B., March 2, 1986. "Environmental Surveillance HSE-8 Initial Field Observation Report," Los Alamos, New Mexico. (Perkins 1986, 04-0169)

Perkins, B. L., July 1976. "Incineration Facilities for Treatment of Radioactive Wastes: A Review", Los Alamos Scientific Laboratory Report LA-6252, Los Alamos, New Mexico. (Perkins 1976, 0629))

Peterson, R. E., editor, January 1959. "Los Alamos Power Reactor Experiment Number One: LAPRE-I," Los Alamos Scientific Laboratory Report LA-2292, Los Alamos, New Mexico. (Peterson 1959, 04-0240)

Purtymun, W. D., February 1971. "Plutonium in Stream Channel Alluvium in the Los Alamos Area, New Mexico," Los Alamos Scientific Laboratory Report LA-4561, Los Alamos, New Mexico. (Purtymun 1971, 0190)

Purtymun, W. D., April 1973. "Regional Survey of Tritium in Surface and Ground Water in the Los Alamos Area, New Mexico, August 1966 through May 1969," Los Alamos Scientific Laboratory Report LA-5234-MS, Los Alamos, New Mexico. (Purtymun 1973, 0191)

Purtymun, W. D., M. N. Maes, and R. Peters, 1984. "Environmental Surveillance at Los Alamos During 1983," Los Alamos National Laboratory Report LA-10100-ENV, Los Alamos, New Mexico. (Purtymun et al. 1984, 0210)

Purtymun, W. D., and M. Maes, 1987. "Environmental Surveillance at Los Alamos During 1986," Los Alamos National Laboratory Report LA-10992-ENV, Los Alamos, New Mexico. (Purtymun and Maes 1987, 0203)

Radzinski, B., July 20, 1991. Personal communication between L. Clark and B. Radzinski, International Technology (IT) Corporation Telephone Log, Los Alamos, New Mexico. (Radzinski 1991, 04-0171)

Regan, Bill, September 1967. "UHTREX Goes Critical" in The Atom, Los Alamos Scientific Laboratory Report, Los Alamos, New Mexico. (Regan 1967, 0462)
Reider, R., April 22, 1959. "J-11," Los Alamos Scientific Laboratory Memorandum to H-3 Files from R. Reider (H-3), Los Alamos, New Mexico. (Reider 1959, 04-0172)

Reider, R., October 29, 1959. "Nuclear Criticality Safety Committee Meeting Record, October 26, 1959," Los Alamos Scientific Laboratory Memorandum to Distribution from Roy Reider (Safety Director), Los Alamos, New Mexico. (Reider 1959, 04-0173)

Reider, R., November 9, 1959. "Nuclear Criticality Safety Committee Meeting Record, November 6, 1959," Los Alamos Scientific Laboratory Memorandum to Distribution from Roy Reider (Safety Director), Los Alamos, New Mexico. (Reider 1959, 04-0174)

Roberson, K., July 23, 1991. Notes recorded during site inspection of TA-55 on International Technology (IT) Corporation Field Activity Daily Log, Los Alamos, New Mexico. (Roberson 1991, 04-0211)

Roberson, K., July 25, 1991. Notes recorded during site inspection of TA-48 on International Technology (IT) Corporation Field Activity Daily Log, Los Alamos, New Mexico. (Roberson 1991, 04-0175)

Roberson, K., August 5, 1991. Notes recorded during site inspection of TA-35 on International Technology (IT) Corporation Field Activity Daily Log, Los Alamos, New Mexico. (Roberson 1991, 04-0226)

Roberson, K., August 7, 1991. Notes recorded during site inspection of TA-35 on International Technology (IT) Corporation Meeting Log, Los Alamos, New Mexico. (Roberson 1991, 04-0227)

Roberson, K., August 21, 1991. Notes recorded during site inspection of TA-35 (east end) on International Technology (IT) Corporation Meeting Log, Los Alamos, New Mexico. (Roberson 1991, 04-0228)

Roberson, K., August 23, 1991. Notes recorded during site inspection of TA-52 and TA-63 on International Technology (IT) Corporation Field Activity Daily Log, Los Alamos, New Mexico. (Roberson 1991, 04-0229)

Romero, R., February 19, 1985. "Initial Soil Sampling Results at TSL-10 (TA-35)," Los Alamos National Laboratory Memorandum HSE-8:85-159 to Allen Valentine (HSE-1) from Richard Romero (HSE-8), Los Alamos, New Mexico. (Romero 1985, 04-0176)

Roy F. Weston, Inc., August 1989. "Site Database Task 6, TA-42, -48, and -55," Los Alamos National Laboratory (Working Draft), Los Alamos, New Mexico. (Roy F. Weston, Inc. 1989, 0486)

Roy F. Weston, Inc., September 1989. "Site Database Task 7, TA-4, -5, and -52," Los Alamos National Laboratory (Working Draft), Los Alamos, New Mexico. (Roy F. Weston, Inc. 1989, 0487)

Roy F. Weston, Inc., September 1989. "Reconnaissance Sampling Plan Task 7, TA-4, -5, and -52," Los Alamos Natinal Laboratory (Preliminary Draft), Los Alamos, New Mexico. (Roy F. Weston, Inc. 1989, 0689)

Russo, S. E., July 21, 1959. "Contamination Survey: Building Beta-4, TA-5," Los Alamos Scientific Laboratory Memorandum to Distribution from S. E. Russo (Engineering Department), Los Alamos, New Mexico. (Russo 1959, 04-0177)

Russo, S. E., September 18, 1959. "Return of Laboratory Structures," Los Alamos Scientific Laboratory Memorandum to William F. Jenike (LAAO Supply and Contracts Branch) from S. E. Russo (Engineering Department), Los Alamos, New Mexico. (Russo 1959, 04-0178)

Russo, S. E., November 30 1959. "Return of Laboratory Structures: Beta Site, TA-5," Los Alamos Scientific Laboratory Memorandum to William F. Jenike (LAAO Supply & Contracts Branch) from S. E. Russo (Engineering Department), Los Alamos, New Mexico. (Russo 1959, 04-0179)

Russo, S. E., October 6, 1972. "Proposed Use of Beta Site," Los Alamos Scientific Laboratory Memorandum to Carl N. Henry (A-2) from S. E. Russo (ENG-3), Los Alamos, New Mexico. (Russo 1972, 04-0180)

Salazar, M. and J. Elder, May 30, 1991. "Decommissioning of the UHTREX Reactor Facility at Los Alamos, New Mexico," (Rough Draft), Los Alamos National Laboratory Report, Los Alamos, New Mexico. (Salazar and Elder 1991, 0623)

Sattizahn, J. E., August 4, 1971. "Effluents from TA-48," Los Alamos Scientific Memorandum to H. F. Schulte from J. E. Sattizahn (CNC-11), Los Alamos, New Mexico. (Sattizahn 1971, 04-0181)

Schmidt, R. A., October 15, 1984. "Trace Organic Solvents in Core Drilling at TA-55," Los Alamos National Laboratory Memorandum HSE3-84-301 to Incident File from R. A. Schmidt, Los Alamos, New Mexico. (Schmidt 1984, 04-0182)

Scholl, J. L., April 1989. "Los Alamos Site Characterization Program Special Projects Report," (draft), prepared for Los Alamos National Laboratory by NUS Corporation, Los Alamos, New Mexico. (Scholl 1989, 0485)

Scholl Fritz, L., September 12, 1985. "Structure TA-5-1," Los Alamos National Laboratory Memorandum HSE8-85-1103 to David Snow (Cross Cultural Research Systems) from Lynn Scholl Fritz (HSE-8), Los Alamos, New Mexico. (Scholl Fritz 1985, 04-0082)

Scholl Fritz, L., October 25, 1985. "TA-35 Oil Spill/PCB Soil Sampling Survey and Results," Los Alamos National Laboratory Memorandum to File from Lynn Scholl Fritz (HSE-8), Los Alamos, New Mexico. (Scholl Fritz 1985, 04-0083)

Schulte, H. F., April 1, 1959. "Ventilation Requirements for Hot Cell and Dry Box Systems at TA-48," Los Alamos Scientific Laboratory Memorandum to John Bolton (ENG-DO) from H. F. Schults, Los Alamos, New Mexico. (Schulte 1959, 04-0183)

Schulte, H. F., September 30, 1959. "Contamination Survey: Buildings DP-32, TA-5-1, and TA-5-6," Los Alamos Scientific Laboratory Memorandum to S. E. Russo (ENG-3) from H. F. Schulte (Industrial Hygiene), Los Alamos, New Mexico. (Schulte 1959, 04-0184)

Shafer, S. B., circa 1989. ER Program Site Visits, Roy F. Weston, Inc. Field Notebook, Control #52, Los Alamos, New Mexico. (Shafer circa 1989, 04-0187)

Shipman, T. L., December 11, 1957. "Planned Overexposures—Waste Disposal—Ten Site," Los Alamos Scientific Laboratory Memorandum to N. E. Bradbury from T. L. Shipman, Los Alamos, New Mexico. (Shipman 1957, 04-0230)

Smithour, M., September 6, 1991. Telephone communication between K. Roberson and M. Smithour on International Technology (IT) Corporation Telephone Log, Los Alamos, New Mexico. (Smithour 1991, 04-0221)

Smithour, M., September 20, 1991. Telephone communication between K. Roberson and M. Smithour on International Technology (IT) Corporation Telephone Log, Los Alamos, New Mexico. (Smithour 1991, 04-0222)

Smithour, M., January 23, 1992. Telephone communication between K. Roberson and M. Smithour on International Technology (IT) Corporation Telephone Log, Los Alamos, New Mexico. (Smithour 1992, 04-0223)

Smithour, M., January 31, 1992. Telephone communication between K. Roberson and M. Smithour on International Technology (IT) Corporation Telephone Log, Los Alamos, New Mexico. (Smithour 1992, 04-0224)

Soholt, L., October 12, 1988. "Results of Screening Analyses of Soil Material Collected from Industrial Waste Line 66 Connecting TA-52 to TA-50," Los Alamos National Laboratory Memorandum HSE8-88-603 to Miguel Salazar (HSE-7) from Lars Soholt (HSE-8), Los Alamos, New Mexico. (Soholt 1988, 04-0189)

The Zia Company, February 26, 1986. "Septic Tank Report," The Zia Company Report, Los Alamos, New Mexico. (The Zia Company 1986, 04-0205)

Umphres, J., October 15, 1986. "Oil Spill, South Side of TSL-125, TA-35," Los Alamos National Laboratory Memorandum to Charles Nylander (HSE-8) from J. Umphres, Los Alamos, New Mexico. (Umphres 1986, 04-0193)

USGS, 1984. Topographic Map, Frijoles Quadrangle, New Mexico Map No. 35106-G3-TF-024, Denver, Colorado. (USGS 1984, 04-0239)

Voelz, G. L., March 8, 1971. "Radioactive Effluents and Releases," Los Alamos Scientific Laboratory Memorandum to E. E. Wingfield from G. L. Voelz, Los Alamos, New Mexico. (Voelz 1971, 04-0194)

Vogt, G., September 6, 1952. "Space Assignment—Disposition of Beta-11, 12, and 13," Los Alamos Scientific Laboratory Memorandum to George Williams (Eng.-3) from Glenn Vogt (H-Division), Los Alamos, New Mexico. (Vogt 1952, 04-0196)

Warren, J. L., November 18, 1974. "Areas of Concern at TA-35 to Waste Management," Los Alamos Scientific Laboratory Memorandum H8-WM-336 to File from John Warren (H-8), Los Alamos, New Mexico. (Warren 1974, 04-0197)

Winburn, D. C, March 30, 1979. "Removal of Tritium Works from TSL-2 Basement," Los Alamos Scientific Laboratory Memorandum L-DO/A-605-79 to Distribution from D. C. Winburn, Los Alamos, New Mexico. (Winburn 1979, 04-0201)

Wingfield, E. E., January 29, 1960. "Demolition of Buildings by Fire," Los Alamos Scientific Laboratory Memorandum to Distribution List from Edwin E. Wingfield (AEC), Los Alamos, New Mexico. (Wingfield 1960, 04-0202)

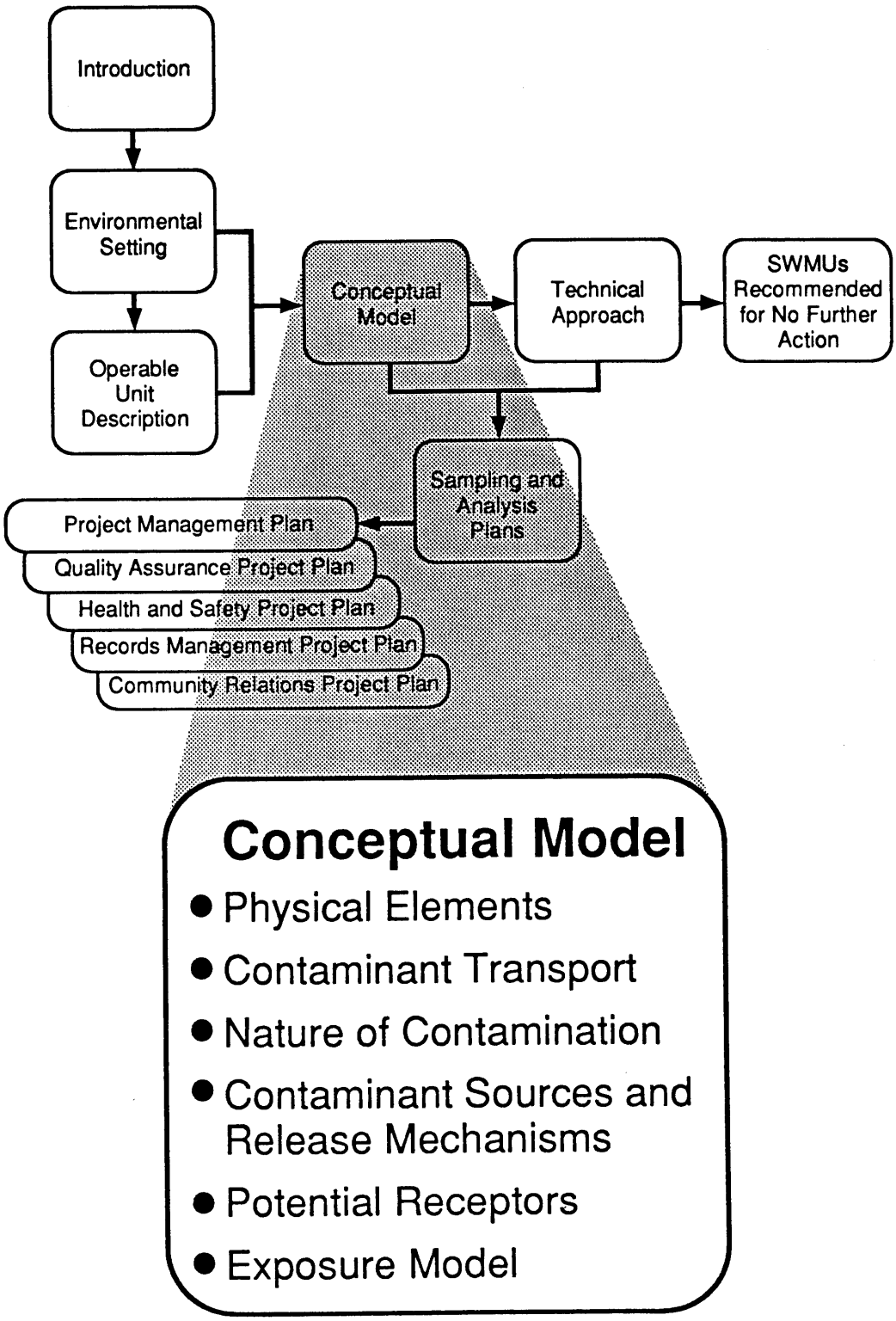
Wingfield, E. E., May 27, 1960. "Demolition of Buildings by Burning," Los Alamos Scientific Laboratory Memorandum to Those Listed Below from E. E. Wingfield (AEC), Los Alamos, New Mexico. (Wingfield 1960, 04-0203)

Wingfield, E. E., March 4, 1971. Letter to Harold M. Agnew, Director, Los Alamos Scientific Laboratory, from E. E. Wingfield (Operations Branch), Los Alamos, New Mexico. (Wingfield 1971, 04-0204)

Wolfsburg, A., April 16, 1991. Personal communication between K. Roberson and A. Wolfsburg, International Technology (IT) Corporation Telephone Log, Los Alamos, New Mexico. (Wolfsburg 1992, 04-0246)

Wolfsburg, A., April 16, 1992. Personal communication between K. Roberson and A. Wolfsburg, International Technology (IT) Corporation telephone log, Los Alamos, New Mexico. (Wolfsburg 1992, 04-0246)

CHAPTER 4


Introduction
Environmental Setting
Operable Unit Description
Conceptual Model
Technical Approach
SWMUs Recommended for No Further Action
Sampling and Analysis Plans
Project Management Plan
Quality Assurance Project Plan
Health and Safety Project Plan
Records Management Project Plan
Community Relations Project Plan
Conceptual Model
Physical Elements
Contaminant Transport
Nature of Contamination
Contaminant Sources and Release Mechanisms
Potential Receptors
Exposure Model

4.0 CONCEPTUAL MODEL FOR CONTAMINANT TRANSPORT AND EXPOSURE IN OPERABLE UNIT 1129

4.1 Introduction

The conceptual model for Operable Unit (OU) 1129 has been developed to determine the possible mechanisms of contaminant transport and the likely pathways in which potential receptors could be exposed. The model takes into account the current understanding of the physical environment, site operational practices, contaminant behavior, and current and future use scenarios.

4.2 Summary of the Physical Environment at OU 1129

OU 1129 is located on Mortandad Mesa at an approximate elevation of 7,000 ft. It is bounded by Mortandad Canyon and its tributaries, Ten Site and Effluent canyons to the north, Cañada del Buey to the east, and Pajarito Canyon to the south. OU 1129 is located within the central portion of the Los Alamos National Laboratory (the Laboratory) facility. Figure 4-1 is a conceptual three-dimensional block diagram, which represents the primary environmental influences on constituent migration at OU 1129.

The OU 1129 mesa top is sparsely vegetated with juniper and piñon trees, grasses, and brush. The adjacent canyons are vegetated primarily with many varieties of conifer, including ponderosa and piñon pine. The mesa sides sporadically support vegetation where soil is present and support little vegetation in areas where tuff is exposed.

The pertinent information on climate for OU 1129 can be found in Chapter 2.0 of this Resource Conservation & Recovery Act (RCRA) Facility Investigation (RFI) Work Plan and in Section 2.5.3, Climate, of the 1991 Installation Work Plan (LANL 1991, 0553).

4.2.1 Geologic Conditions

Soils vary considerably in thickness and distribution across the mesa tops at OU 1129. In general, soils are a sandy, clayey loam within the Hackroy and Nyjack series classification. Soil thicknesses range from 0 to 40 in. and vary in composition from area to area (see Section 2.2.4, Soils). Soils are absent along steep canyon edges and in erosional channels cut into the mesas. In much of the active Technical Areas (TAs) at OU 1129, soils are covered by asphalt, concrete, or physical structures (e.g., TA-35, -48, and -55). TAs that are inactive or have limited activity, such as TA-4, -5, -42, -52, -63, and -66, are more likely to have soils exposed to the environment.

Underlying the soil horizon (when present) at OU 1129 is the Pleistocene-age Bandelier Tuff. The Bandelier Tuff is an extrusive volcanic deposit consisting of slightly welded to welded ash-flow tuffs, pumice, and volcanic breccias. The formation ranges from 260 to 1,050 ft thick (LANL 1991, 0553). Porosity in the tuff ranges from 20% to 60% by volume (Abrahams 1963, 0011); however, effective porosity (interconnected porosity) is likely to be considerably less. Cooling and tectonic fractures are common throughout the formation.

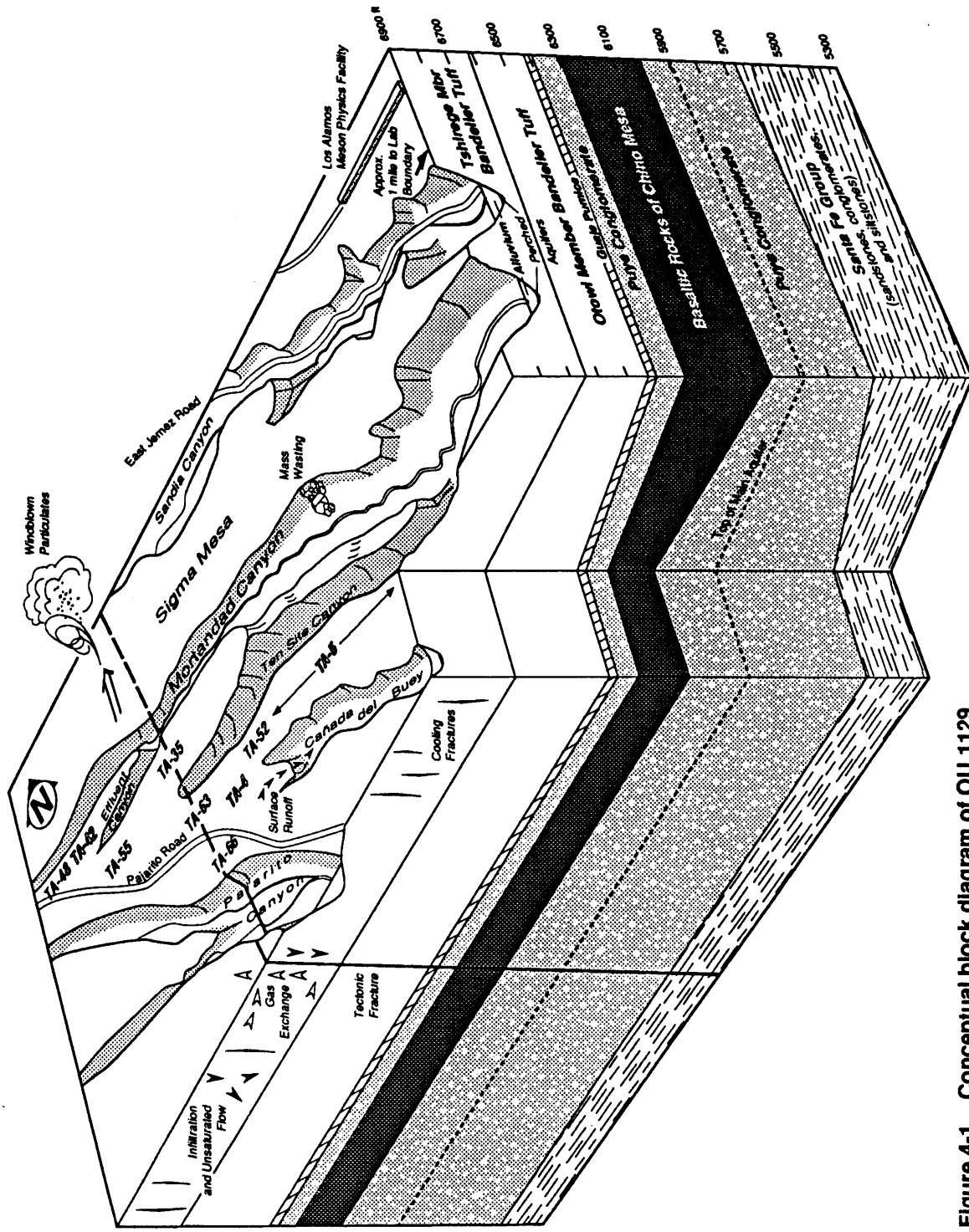


Figure 4-1. Conceptual block diagram of OU 1129.

4.2.2 Hydrologic Conditions

The regional groundwater table is located approximately 950 ft beneath OU 1129 within older alluvial deposits beneath the Jemez volcanic sequence (Figure 4-1). No hydraulic connection has been demonstrated between the shallow perched aquifers of the Laboratory and the main aquifer; the OU 1129 field investigation will be initially restricted to surface soils and the vadose zone of the Bandelier Tuff. Depths to which sampling will be conducted is discussed for each individual solid waste management unit (SWMU) in the sampling and analysis plans in Chapter 7.0. Moisture content within the shallow vadose zone of the tuff is typically very low—5% to 10% by volume (see Chapter 2.0). Unsaturated movement of fluids is expected to be limited within unfractured tuff conditions. The extent of fluid movement under saturated conditions is expected to vary widely as a result of the wide range of matrix porosity, textural and compositional variation, and fracture density, width, rugosity, cementation, etc., within the tuff.

Perennial surface water is not found within OU 1129. Surface run-off from storm events or snowmelt is channeled through storm sewers, diversion channels, or natural drainage to the mesa edge, which enables it to eventually reach the canyon floor. Water generated from facility operations accounts for discharges of highly variable volumes. Current liquid effluent discharge within OU 1129 occurs at a permitted outfall into containment lagoons at the east end of TA-35. Historical, nonpermitted discharges in various SWMUs are the areas of interest in this OU 1129 Work Plan.

4.3 Contaminant Transport at OU 1129

Contaminant transport within OU 1129 may occur according to three primary transport scenarios:

- Resuspension and possible transport of soil particles by the action of wind,
- Vapor or liquid-phase transport in the vadose zone, and
- Surface water run-off and erosion.

These three mechanisms, as well as site-specific factors such as contaminant type(s), volume(s), release history, and physical conditions of the site, govern the movement of contaminants from a release.

4.3.1 Aeolian Transport at the Soil Surface

Aeolian processes that foster the movement of soil particles along the surface can be an effective transport mechanism for contaminants at OU 1129. The most significant aeolian processes include wind resuspension and dispersion of smaller soil particulates, and saltation of larger particulates. Only wind resuspension provides a direct potential exposure hazard because only the smaller particulates (less than 100 µm) are able to become suspended and are small enough to pose an inhalation threat. Particles transported by saltation do not remain suspended and are not small enough to be inhaled. Both processes can move significant quantities of contaminated material over time.

Present air emissions are not a concern of the Environmental Restoration (ER) Program; stacks currently emitting in OU 1129 are permitted through national emission standards for hazardous air pollutants or RCRA. This RFI Work Plan is concerned with the surficial deposition of particulates of prepermit emissions of currently or previously existing stacks and the potential aeolian transport of any contaminated soils regardless of the source of contamination. Resuspension of soil particles through any disturbance mechanism may expose potential receptors to contaminants. The potential for inhalation exposure and movement of contaminated soil can be more problematic during the breezy spring months in Los Alamos, especially in dry years when soils are most prone to wind erosion.

Factors affecting aeolian transport processes at OU 1129 include soil particle size, soil moisture, topography, vegetation cover, wind velocity, and wind direction. Laboratory-made structures, topography, and the nature and quantity of vegetation cover account for a surface that will create wind turbulence. Wind turbulence promotes and enhances the ability for wind to entrain and move particulates. Constituents released into the soil can be resuspended as respirable aerosols in wind-blown dust. Wind may cause contaminant migration by suspension and redeposition to previously uncontaminated areas. Disturbance of soil from site work, such as digging and excavation activities, will expose previously buried soil to the wind. Freshly exposed soils are rich in small, readily transportable particulates. Some sites of sufficient size and/or contamination may require mitigating actions to reduce dust emissions. Mitigating measures may include continuously watering the soil surfaces during work, covering the work areas at night or other times when work is not ongoing, and halting activities when the wind speed increases above a threshold level.

Atmospheric conditions at the Laboratory are conducive to the rapid vaporization of volatile organic compounds (VOCs) in the shallow vadose zone. Organic vapors that are released to the atmosphere at the original SWMU or through vapor-transport pathways, such as vertical fractures, can be redistributed by aeolian transport. This type of contaminant redistribution is not a significant factor in OU 1129 because of the rapid off-gassing of organic vapors in the air and the relative age of the SWMUs.

4.3.2 Vapor/Liquid-Phase Transport in the Vadose Zone

At OU 1129, liquid-phase contaminants are expected in the vadose zone. Fluids will migrate through primary effective porosity and secondary open fracture zones. The rate of fluid migration depends on the degree of saturation in the effective (interconnected) pore spaces. Unsaturated flow of fluids will occur through a medium when saturation is less than 100%. Unsaturated hydraulic conductivity can vary tremendously as changes in the soil moisture content occurs. Fluid migration in the tuff below OU 1129 is expected to be limited as a result of the low unsaturated hydraulic conductivity (10^{-8} cm/s) and the moisture content as discussed in Chapter 2.0. Saturated flow in the vadose zone can occur when 100% of the pore spaces of the tuff are filled with fluid. Migration under saturated flow conditions in the vadose zone, which can develop from significant infiltration events such as extended rainfall, snowmelt, or continuous discharge, can be extremely variable. Permeability in the tuff under saturated conditions has been measured at 10^{-8} cm^2 (see Chapter 2.0).

4.3.3 Tectonic and Cooling Fractures

Fractures within the tuff are common at OU 1129. Approximately four fault traces exist within the OU boundaries (Vaniman and Wohletz 1990, 0541). Presently, the trace of most concern is at the east end of TA-35, at which potential liquid plume migration down Ten Site Canyon could be affected. The fracture systems associated with tectonic events can have high hydraulic conductivities, depending on the amount of montmorillonite clay that has developed as a result of solution transport and weathering of the tuff.

Joints or extension fractures are a result of the cooling tuff unit at the time of emplacement. These fractures are commonly filled with caliche near the surface and grade downward to clay, and may be open at depths greater than 30 ft. Fracture networks may restrict contaminant migration to a large vertical component. Filled fractures inhibit moisture movement. Open fractures are effective barriers to liquid-phase unsaturated flow because fluid cannot migrate across. They can provide flow paths for vapor transport under unsaturated conditions or for rapid water movement under saturated or near-saturated conditions. Roots have been found in joints as deep as 30 ft, which suggests that joints or fractures may be important infiltration pathways (see Chapter 2.0). The extent of fracturing in the Bandelier Tuff below a depth of 30 ft is not well documented.

4.3.4 Infiltration

Precipitation that infiltrates the soil generally flows vertically into the vadose zone. The downward migration of water in the vadose zone may be impeded by a layer of clay (montmorillonite), which may develop at the soil/tuff interface on account of weathering (LANL 1990, 0144). Vegetation, where present, assimilates a portion of the water infiltrating the vadose zone and releases it to the atmosphere through evapotranspiration. Infiltration studies at the Laboratory indicate that only the shallow portions of the vadose zone are normally influenced by the infiltration process. Moisture readings in the tuff rarely exceed 5% to 10% saturation below depths of 33 ft (Abeele et al. 1981, 0009).

Fluids infiltrating the vadose zone can be discharged to surface water through perched aquifers, seeps, or springs. Several hydrogeologic studies indicate that perched groundwater and surface water are not hydraulically connected to the main aquifer, which is estimated to be about 950-ft-below OU 1129 (see Chapter 2.0) (LANL 1991, 0553). Wells drilled to perched water zones are for investigative or monitoring purposes only. The perched water is not used; only the main aquifer is capable of supplying water (Devaurs 1985, 0046).

The transport of fluids and constituents in the vadose zone is limited by several primary environmental factors (i.e., precipitation, clay content of soils, unsaturated hydraulic conductivity, thickness of unsaturated zone, storm-sewer drainage). The annual amount of precipitation at OU 1129 is relatively low. Precipitation that does occur is generally associated with a storm event; during surface water run-off, flows travel overland because of the sudden influx of water. Some soils contain clay, which absorbs water, lowers the permeability, and retards downward migration. In some areas, the clay may act as a localized aquitard. Storm Sewers manage the precipitation that falls on pavement or buildings at the TAs (e.g., TA-35) and prevent the precipitation from infiltrating the subsurface. Some of the water that actually does infiltrate the subsurface may provide recharge to the perched aquifer.

4.3.5 Vapor-Phase Migration

Vapor-phase migration in the vadose zone for VOCs and tritium will be controlled by concentration gradients for the constituents; formation characteristics, such as effective porosity and moisture content; fractures; and local atmospheric conditions. Vapor migration can cause an exchange of gases with the atmosphere (i.e., contaminant evaporation) through primary porosity, fracture zones, or Laboratory-made structures. The low moisture content and moderate to high effective porosity of the tuff at the Laboratory is conducive to the lateral and vertical movement of volatile organic vapors in the vadose zone.

4.3.6 Surface Water Run-off and Erosion

As discussed above, precipitation that occurs at OU 1129 is not always infiltrated. Portions of OU 1129 contain barriers (i.e., asphalt, concrete, or physical structures) that prohibit storm water infiltration to the soil. As a result, storm water is mostly diverted to storm sewers at these locations. Surface water produced by a storm event, which is not diverted to storm sewers, erodes soil and runs overland into small channels leading into the canyons. This water contributes to ephemeral-stream flow. Ephemeral-stream volume directly relates to the amount and manner in which precipitation has fallen. Because of the subsequent erosion of soil and rock, run-off water can carry constituents released either in dissolved form or as contaminated soil sediments. Ephemeral-stream transport is not considered in this Work Plan. Constituents transported by soil erosion to the nearby canyons will be addressed in the Work Plan for OU 1049.

Erosional processes by water and general mass wasting of the mesa tops may expose and mobilize contaminated soils or buried wastes. These processes will promote the distribution of contaminants through wind and surface water. Eventually, these erosional processes may lead to transport to adjacent canyons and associated ephemeral streams.

4.4 Potential Wastes and Waste Characteristics

Facility operations throughout OU 1129 have generated a variety of hazardous and radiological wastes that may have been released to the environment. Data obtained from archival information (see Chapter 3.0) suggest that the potential wastes released to the environment comprise the following five basic categories:

- Radionuclides
- Volatile organic compounds (VOCs)
- Semivolatile organic compounds (SVOCs)
- Polychlorinated biphenyls (PCBs)
- Inorganic compounds containing hazardous constituents

Contaminants that presently exist in the environment may have maintained their original chemical or physical characteristics or may have been altered to a derivative compound. Derivative compounds are generated as a result of chemical reactions, transformations, biological activity, or radioactive decay. In many cases, the problems associated with releasing waste to the environment can be significantly minimized or eliminated through physical, chemical, or temporal influences on the parent compound. A list of potential organic, inorganic, and radiological constituents that may persist in the environment at OU 1129 are given in Tables 5.3 through 5.12 in Section 5.0 of the Laboratory Generic Quality Assurance Project Plan (in Appendix T of the IWP [LANL 1991, 0553]). The specific operational characteristics and potential wastes generated at each SWMU will guide which groups of constituents will be sampled for at each site.

4.5 Background Levels

The determination of background concentrations for organic, inorganic, and radioactive constituents at OU 1129 is necessary to set an environmental base line for the site. Background levels are defined as concentrations that occur naturally in the local environment. The ER Program's Framework Studies Team is responsible for developing a complete geologic, hydrologic, and geochemical base line document for the entire Pajarito Plateau area. The ER Program is currently developing base line risk assessment scenarios and criteria that will be presented in the 1992 version of the IWP. This approach will be developed in adequate time for data analysis. The information will be used for evaluating OU 1129 data and determining which sites, if any, contain radiological or hazardous constituents above natural levels.

4.6 Primary Contaminant Sources

Primary contaminant sources represent the principal source from which contaminants can be released to the environment as a result of operational procedures or accidents at OU 1129. These can be divided into the following three basic categories:

- Surface sources
- Subsurface sources
- Atmospheric sources

Surface sources represent the group of SWMUs from which contaminants may have been released directly to the land surface. Examples of SWMUs that fall into this group include outfalls, canyonside disposal areas, and aboveground storage tanks. Table 4-1 presents a more comprehensive list of surface sources at OU 1129. Spills or leaks commonly impact a small area localized to the immediate vicinity of the source. Continuous discharge from treatment facilities or outfalls may cause a significant area of contamination. Processes that may mobilize contaminants from a surface release include infiltration, volatilization, surface erosion/run-off, and wind dispersion.

Subsurface sources include SWMUs that may release contaminants usually from a source directly into the subsurface environment. Typical SWMUs that fall into this category include septic systems, underground storage tanks, and buried waste lines (Table 4-1). The size of the area impacted from a subsurface source will depend on

TABLE 4-1

CONCEPTUAL MODEL PRIMARY CONTAMINANT SOURCES

Surface Sources	Subsurface Sources	Atmospheric Sources
• Outfalls	• Septic systems	• Incinerator emission stacks
• Container storage areas	• Leach fields	• Air exhaust systems
• Transformers	• Filter pits	• Evaporator systems
• Surface impoundments (overflow)	• Sumps	• Surface impoundments
• Lagoons	• Surface impoundments	
• Aboveground storage tanks	• Underground storage tanks	
• Decontamination facilities	• Buried waste lines	
•Sumps, drains	• Treatment facilities	
• Treatment facilities		
• Testing/firing sites		

the nature of contaminants, the rate and volume of the release, depth of release, and local hydrogeologic characteristics. Contaminant transport from a subsurface source may include liquid- and vapor-phase movement in the primary porosity and fracture porosity in the vadose zone.

RCRA is concerned with the historic atmospheric discharges of particulate contaminants of concern (COCs) from currently permitted stacks. SWMUs associated with this type of source consist of the contaminant deposited on soils surrounding the release site. Typical examples of atmospheric sources include incinerator stack emissions, air exhaust systems, and hot cell or other process vents (Table 4-1). Releases from this type of source are associated with diffuse surface contamination that can potentially cover a large area. The areal extent of potential contamination is related to emission volumes and types, prevailing winds, and climatic conditions. Processes controlling contaminant distribution are atmospheric dispersion, particle size, dry deposition, volatilization, and resuspension in wind-blown soils. Stack emissions may be modeled to predict areas of maximum deposition and expected concentrations for sampling plan design.

4.7 Primary Release Mechanisms

Primary release mechanisms consist of two types: operational and accidental. An operational loss of contaminants would be the release of constituents through routine process operations; intentional, but unplanned, releases may also have occurred. This would include system discharges, outfalls, septic systems, air emissions, or test procedures. An accidental loss of contaminants would include unintentional releases, such as leaking underground storage tanks, surface overflows, spills, leaks, or operational accidents.

4.8 Mobilizing Processes for Contaminant Distribution

Mobilizing processes are those events that mobilize contaminants within a medium or among media. Mobilizing processes for water include the discharge of ephemeral streams, percolation and migration in the vadose zone, groundwater transport, or evaporation. Stream sediments are considered soils because streams are ephemeral. Mobilizing processes for soil include aeolian processes, plant uptake, or soil gas. Aeolian processes (i.e., wind resuspension, dispersion, and deposition) are the mobilizing processes for airborne particulates or soil gas.

4.9 Present and Future Land Use

OU 1129 is bounded on three sides by other Department of Energy (DOE) land used by the Laboratory, and on one side by an insular parcel of uninhabited San Ildefonso Pueblo land. Laboratory land is used for building sites, experimental areas, waste disposal, roads, and utility rights-of-way. However, these uses account for only a small part of the total land area. Most land provides a buffer zone for security and safety and is a reserve for future Laboratory operations (LANL 1991, 0553).

Within OU 1129, access to the TAs may be restricted according to security required by site operations. Access at TA-55 is restricted to authorized personnel only and is secured by fences. TA-66 is not secured. TA-48 is restricted and secured by fences except for some office complexes. Building 87 and 213 at TA-35 are fenced, but the rest of the facility is not secured. TA-52 is partially fenced, but most of the SWMUs in TA-52 are outside fenced areas. TAs-4, -5, -42, -63, and unsecured areas of TAs-48 and -52 may be accessed by unauthorized visitors. Laboratory employees are known to use dirt roads within the OU as jogging and biking trails.

Current program guidance for the future land use at OU 1129 states that the current institutional activities and restrictions will apply for the next 100 years. At the termination of Laboratory activities, DOE may turn the area containing OU 1129 over to the National Park Service as an addition to Bandelier National Monument.

4.10 Identification of Potential Receptors

Potential receptors at present and while OU 1129 continues to be operated by the Laboratory are defined as Laboratory employees, visitors, and possible trespassers. For the future use scenario, potential receptors are defined as itinerant recreational users. Because of OU 1129's central location within DOE-controlled property, no significant pathway of exposure of the general public beyond the site boundary is believed to exist.

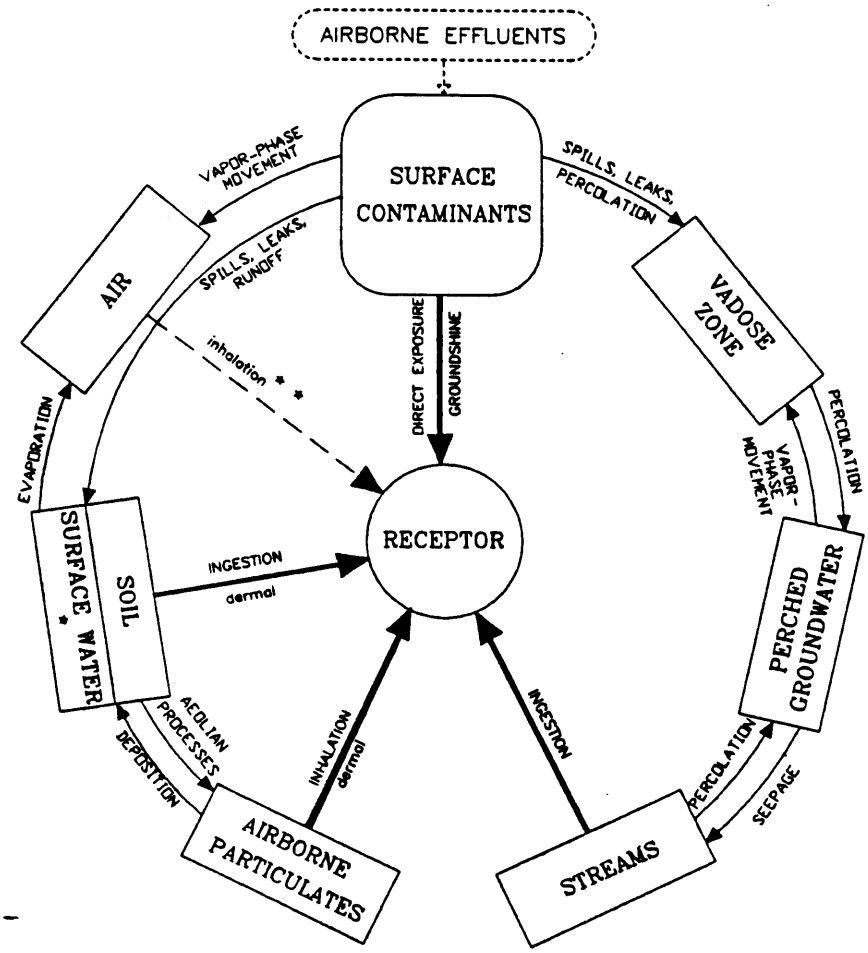
Under the occupational exposure scenario, potential receptors are exposed to contaminants within or in the vicinity of an industrial or experimental site. At OU 1129, this scenario applies to those individuals who work or visit on or near the site and may be routinely exposed for short periods to contaminated media. Occupational exposure standards are not in the scope of RCRA. Data gathered during the RFI will help to assess migration potentials and risk scenarios in a consistent manner with Environmental Protection Agency concerns over future unrestricted public use scenarios.

The future recreational scenario addresses people who may spend a limited amount of time at or near a site while hiking, riding, camping, or picnicking. No hunting or fishing is allowed in Bandelier National Monument. Animals that graze the area and are later hunted in adjacent areas are considered to be of insignificant numbers and not a contributor to the local food chain. In general, no commercial or private foodstuff is produced in the areas of concern. Casual food gathering in the area is limited to piñon nuts, mushrooms, and few other plants or herbs. Ingestion of contaminated biota is not considered a likely pathway of significant exposure.

4.11 Exposure Pathways

Receptors may be exposed to radioactive or hazardous materials from one or more media. The medium (i.e., soil, water, or air) of exposure will likely be a secondary contaminant source, which is defined as the medium contaminated with COCs from one of the principal sources. Contaminants could subsequently be released from the secondary sources and allow exposure through a variety of mobilizing processes. Potential contact with these media may lead to exposure of a receptor. Figure 4-2 represents a conceptual model of surface contaminant transport to potential receptors within OU 1129, and Figure 4-3 represents a conceptual model of subsurface contaminant transport to potential receptors within OU 1129. The concept behind Figures 4-2 and 4-3 requires that when subsurface contaminants (Figure 4-3) become exposed to the surface (from erosion, mass wasting, or other processes), the paths shown for surface contaminants in Figure 4-2 then become applicable.

Viable exposure pathways under RCRA could include inhalation or ingestion of contaminants containing either hazardous or radioactive constituents, and for radionuclides could include groundshine and/or air immersion from direct ionizing radiation. The degree of health risk from exposure is a function of the type of contaminant, method and duration of exposure, and characteristic of the receptor. In the conceptual model for OU 1129, direct ingestion of contaminated soil is the pathway likely to present the most risk. Other pathways will not present as much risk for the following reasons: near-surface direct radiation sources are expected to be insignificant; potable groundwater sources do not exist in the OU; food crops are not grown in the OU and animals that graze in the OU are not harvested; and contaminant air concentrations from aeolian processes during dusty periods are expected to be insignificant. Modeling and risk assessment efforts will focus on predicting conditions at future times under this conceptual model, and data needs will be developed to support these activities.



NOTES:

* Seeps, streams, and temporary water.

* * Pathway of minimal potential risk.

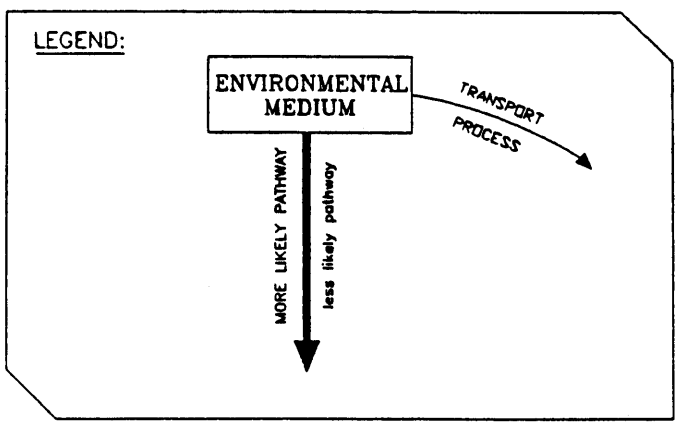
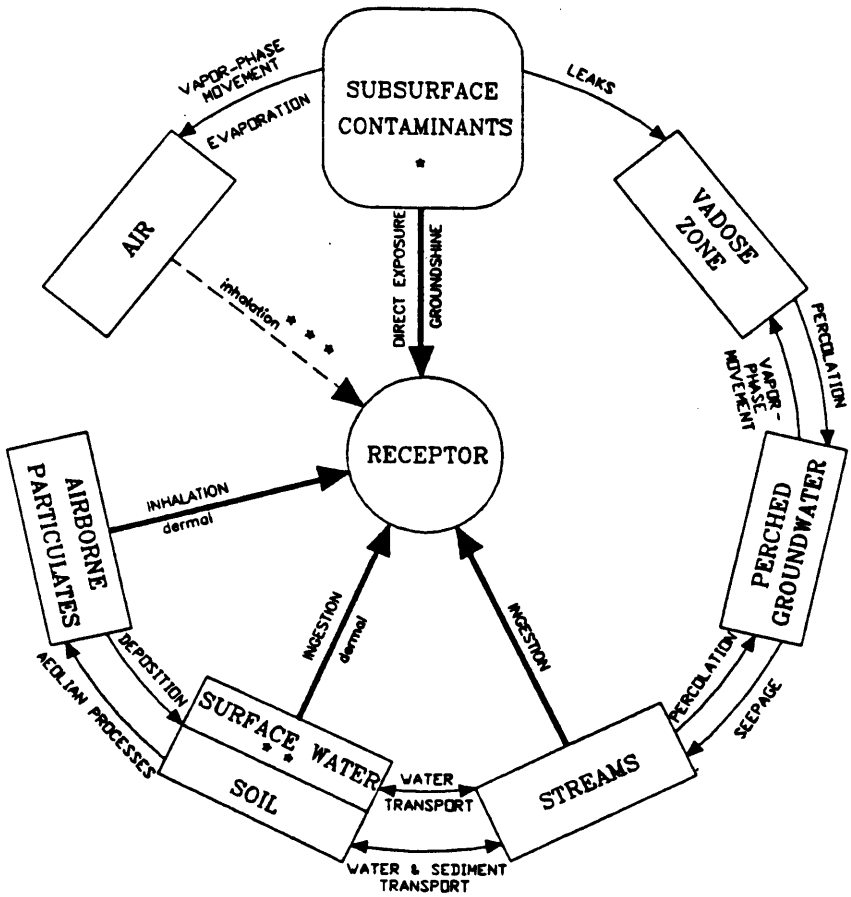


Figure 4-2. Conceptual model of surface contaminant transport to potential receptors within OU 1129.



NOTES:

* Contaminants that become exposed to the surface follow the surface contaminant conceptual model.

* * Seeps, streams, and temporary water.

* * * Pathway of minimal potential risk.

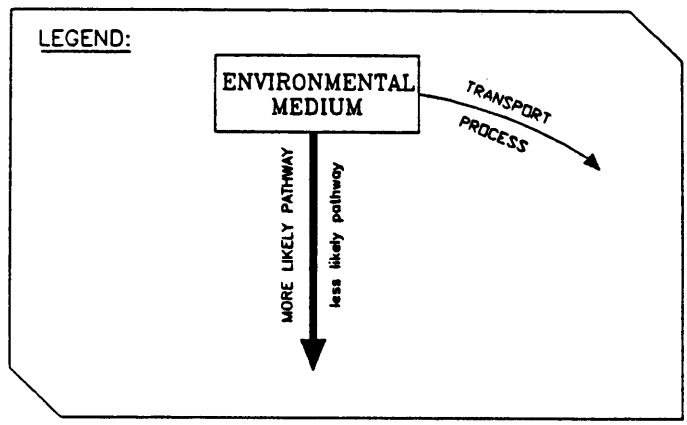


Figure 4-3. Conceptual model of subsurface contaminant transport to potential receptors within OU 1129.

REFERENCES

Abrahams, J. H., Jr., January 1963. "Physical Properties of and Movement of Water in the Bandelier Tuff, Los Alamos and Santa Fe Counties, New Mexico," US Geological Survey Administrative Release, Albuquerque, New Mexico. (Abrahams 1963, 0011)

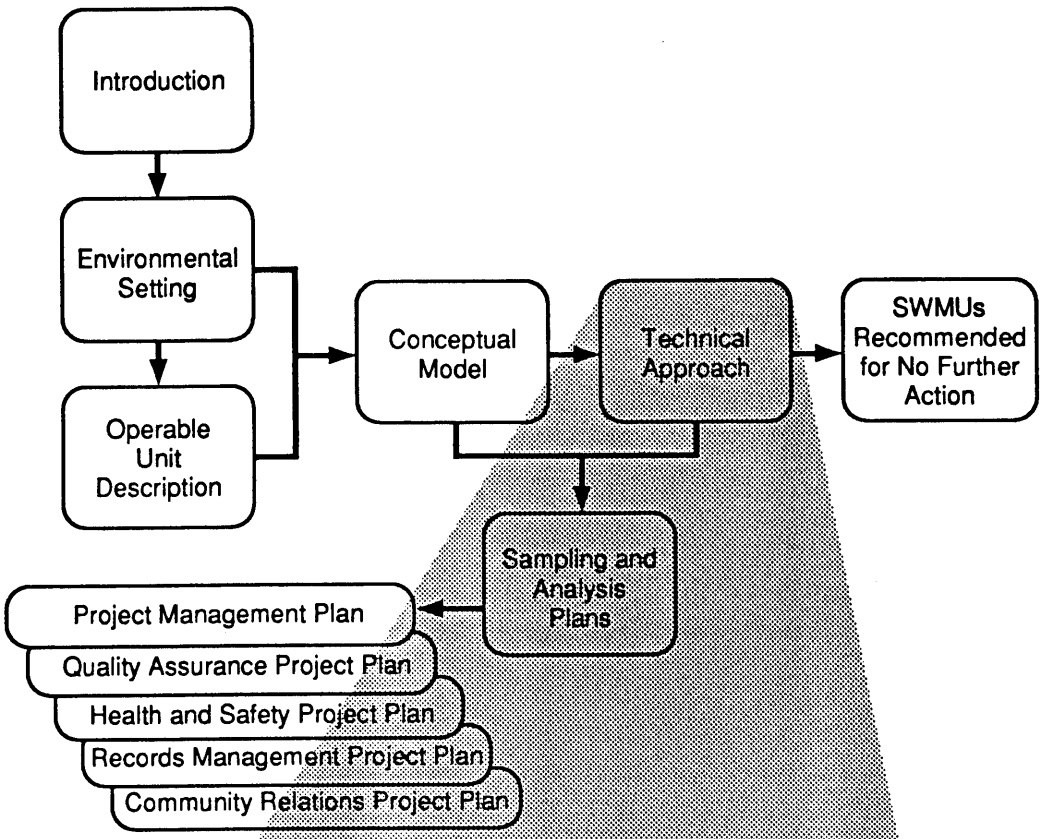
Abeele, W. V., M. L. Wheeler, and B. W. Burton, October 1981. "Geohydrology of Bandelier Tuff," Los Alamos National Laboratory Report LA-8962-MS, Los Alamos, New Mexico. (Abeele et al. 1981, 0009)

Devaurs, M., November 1985. "Core Analyses and Observation Well Data from Mesita del Buey Waste Disposal Areas and in Adjacent Canyons," Los Alamos National Laboratory Report LA-UR-85-4003, Los Alamos, New Mexico. (Devaurs 1985, 0046)

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)

Vaniman, D., and K. Wohletz, November 14, 1990. "Results of Geological Mapping/ Fracture Studies: TA-55 Area," Los Alamos National Laboratory Memorandum EES1-SH90-17, Los Alamos, New Mexico. (Vaniman and Wohletz 1990, 0541)

CHAPTER 5



Technical Approach

- OU 1129 Decision Process
- Data Quality Objectives
- Field and Analytical Data Quality Requirements

5.0 TECHNICAL APPROACH

The goal of this Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) is to ensure that the environmental impacts associated with past and present activities within Operable Unit (OU) 1129 are thoroughly investigated in compliance with Los Alamos National Laboratory's (the Laboratory's) RCRA Part B (Hazardous and Solid Waste Amendments [HSWA] Module) permit. To accomplish this goal, the nature and extent of contamination must be identified, and risk must be assessed for human and environmental receptors along any reasonable environmental pathways that may lead to exposure. The technical approach used in this Work Plan focuses efforts on meeting required site characterization objectives in a cost-effective manner. This approach uses a health-risk-based decision-making process (consistent with the Laboratory Installation Work Plan [IWP] [LANL 1991, 0553] and proposed Subpart S to 40 Code of Federal Regulations [CFR] 264) for recommending solid waste management units (SWMUs) for no further action (NFA) or for further study of possible remedial actions under a corrective measures study (CMS). As discussed in Chapter 1.0, a decision analysis approach will be employed in the RFI report and CMS to manipulate data gathered as a result of the RFI.

5.1 Summary of the OU 1129 Technical Approach

The basic technical approach for OU 1129 is summarized as follows:

- Archival data is gathered from available sources to help define a basic understanding of the processes and events that produced each SWMU and the contaminants of concern (COCs) that may be present at each SWMU.

- The archival data is evaluated to identify those SWMUs for which no potential hazard exists so that the number of sites that must undergo field investigation can be reduced.

- The SWMUs that require field investigation are assessed on the basis of archival information to determine whether the initial characterization effort will be a broad-based Phase I field investigation or a more detailed Phase II investigation.

- Phase I field investigations are carried out where needed to determine the presence or absence of COCs and to supplement existing information on source terms or site conditions.

- Data gathered during Phase I investigations are used to determine which SWMUs need further characterization and which may be recommended for NFA. For SWMUs that require further study, Phase I data are used and modeled to help design Phase II sampling and analysis plans (SAPs). The RFI Work Plan will be amended and submitted for Environmental Protection Agency (EPA) review and approval when Phase II SAPs are completed for sites requiring Phase II investigation. Interim phase reports will be submitted at least quarterly as characterization work proceeds.

- Phase II field investigations are conducted where appropriate to characterize the nature and extent of contamination and to obtain the data necessary for a quantitative assessment of risk posed by COCs.

- Quantitative risk assessment is conducted for each site once the data needs are satisfied by the field investigation.

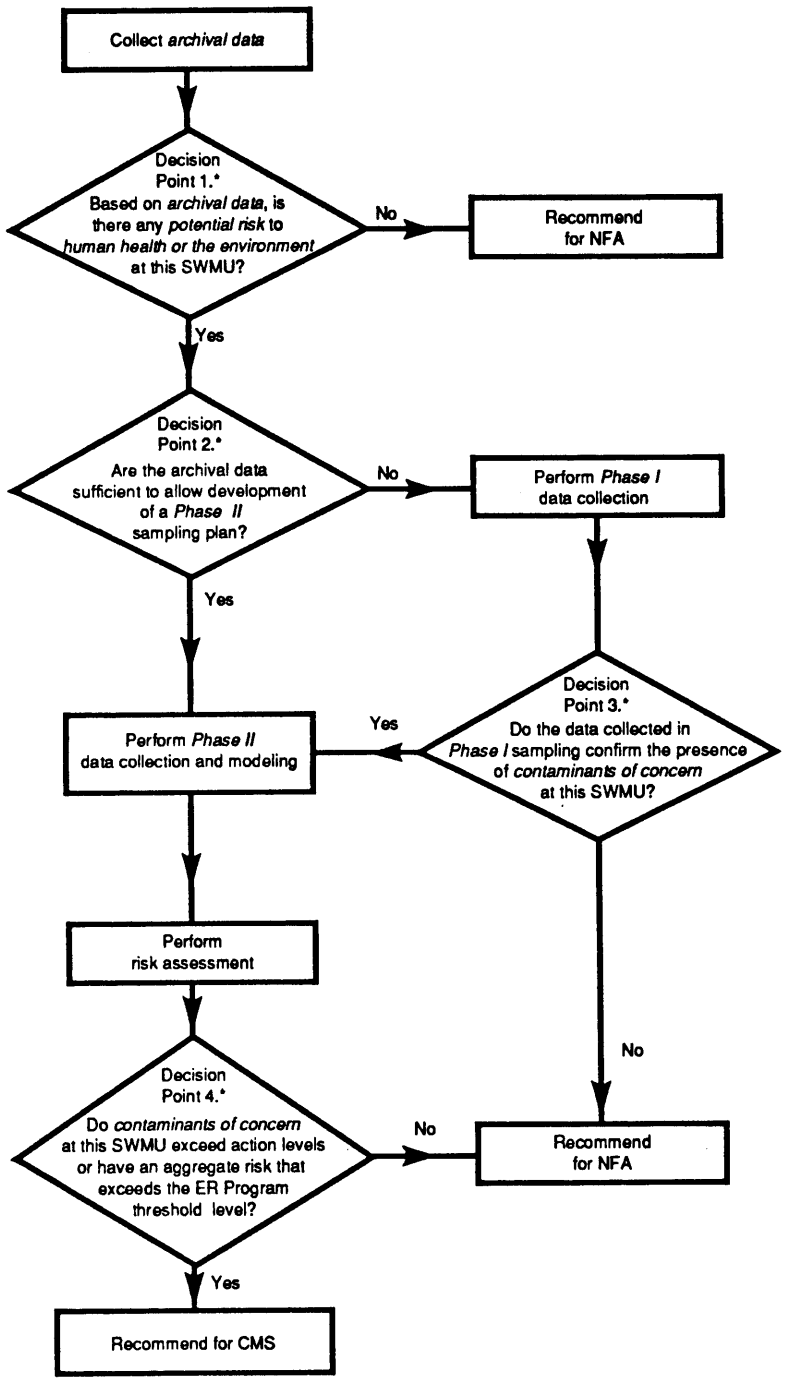
- An RFI report is compiled that contains the results of field investigations and recommendations for SWMUs evaluated by the decision process. SWMUs are recommended for CMS when the analytical sample mean exceeds action levels for individual components, or when aggregate risk assessment results exceed the programmatic threshold; the remaining SWMUs are recommended for NFA. Recommendations of NFA will be supported by appropriate criteria, which are discussed in the following text.

The technical approach and decision process used in this Work Plan are discussed in detail in the following sections.

5.2 OU 1129 Decision Process

All SWMUs within OU 1129 are evaluated using the four-step decision process illustrated in Figure 5-1. Italicized terms used in this diagram are defined in Table 5-1. Each of the four diamonds in the diagram represents a point at which a decision is or will be made for each SWMU under consideration. To ensure simplicity in the process, each question posed has only two possible answers, "yes" or "no." The process is designed to identify those SWMUs that can be recommended for NFA as early in the process as possible, with the least expenditure of resources. Those SWMUs that cannot be recommended for NFA after Phase I and II investigations and risk assessment are complete will be candidates for a CMS. Candidate SWMUs for voluntary corrective action/interim action will be identified as appropriate within the process.

Module VIII of the HSWA permit establishes Corrective Action Requirements (CARs). Task IV, Investigative Analysis, specifies that the permittee must identify all relevant and applicable standards for the protection of human health and the environment. Task VI, Identification and Development of the Corrective Action Alternative or Alternatives, further specifies that based on the results of the RFI, the permittee must identify, screen, and develop the alternatives for removal, containment, treatment, and/or remediation of contamination on the basis of objectives established for corrective action. Cleanup requirements can be divided into three categories: (1) contaminant-specific requirements that address specific contaminants, (2) location-specific requirements that are based on a specific site setting, and (3) action-specific requirements associated with specific response actions. In the absence of the SWMUs being investigated, the identification of potential CARs at this time would be premature. The full tabulation of potential location-specific, contaminant-specific, and action-specific requirements will be provided in future technical reports as adequate SWMU information is obtained through the RFI process.



*Pending ER Program Office direction, candidate SWMUs may be screened for voluntary corrective action/interim action (VCA/IA) at any of these points.

Figure 5-1. Decision Process for OU 1129 (italicized terms are defined in Table 5-1).

TABLE 5-1

TERM DEFINITIONS

Archival Data: Available information collected to date from published and unpublished records pertaining to the history or processes of a solid waste management unit (SWMU). Records can include written communication such as reports, memoranda, letters, notes, or calculations. Verbal communication, if substantiated in writing or other independent testimony, can be considered as archival data. Archival data generally has unknown data quality.

Potential Risk: A judgmental determination on the potential release of contaminants of concern to the environment at a SWMU solely on the basis of archival data. A potential risk is based on the likelihood that a release may have occurred at a SWMU and may have entered a potential migration pathway leading to offsite receptors. No potential risk is associated with the SWMU if any of the criteria for no further action (NFA) in Table 5-2 are met.

Contaminants of Concern (COCs): Organic, inorganic, or radioactive solids, liquids, or gases that, because of quantity, concentration, or physical/chemical characteristics, may cause or contribute to a threat to human health or the environment. Contaminants of concern may consist of one or more Resource Conservation and Recovery Act (RCRA)-regulated or Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)-regulated constituents or of radioactive elements/daughter products.

Phase I: The initial sampling phase of site assessment work intended to collect adequate information to confirm the presence or absence of contaminants of concern in the environment. Phase I investigations may also include the gathering of geological, geophysical, and geochemical data considered necessary for modeling and other data analysis needs. Information collected during Phase I sampling and analysis will determine if Phase II sampling is necessary or if a recommendation for NFA is warranted for the SWMU.

Phase II: The second sampling phase of site assessment at SWMUs that have COCs, which is determined on the basis of very complete archival data or Phase I sampling investigations. Phase II sampling and analysis will help to determine the physical-chemical characteristics of the site and attempt to delineate the nature and extent of contamination. Data collected will be used for contaminant fate and transport modeling, risk assessment, treatability studies, and corrective measure studies, as required.

Human Health or Environment: Strictly under RCRA, pertaining specifically to the health and environment of the general public; occupational exposures to Laboratory employees are addressed under other applicable or relevant and appropriate requirements (ARARs), not under the Environmental Protection Agency's (EPA's) guidelines for the general public.

Waste Characterization: The process of quantitatively and qualitatively describing, to the compound level, the 40 CFR 261 Appendix VIII and 40 CFR 264 Appendix IX COCs within Operable Unit (OU) 1129.

Site Characterization: The process of quantitatively and qualitatively describing the physical environment and its relationship to COCs within OU 1129.

5.2.1 Decision Point 1:

On the basis of archival data, is there any potential risk to human health or the environment at this SWMU?

Section J of the Laboratory HSWA permit allows the Laboratory to submit an application for a permit modification at locations in which information exists that demonstrates that hazardous wastes, including hazardous constituents, have not been released from SWMUs that pose a threat to human health or the environment. The function of Decision Point 1 is to differentiate, on the basis of available archival data and observation, between SWMUs that clearly do not pose a potential risk to receptors and those that will require further investigations. This decision must be made on the basis of qualitative archival information and requires professional judgment on the part of the decision maker.

A "yes" decision indicates that the SWMU under consideration poses some degree of potential risk or that the available data are insufficient to deny the possible existence of risk. All such SWMUs are recommended for further consideration at Decision Point 2. A "no" decision indicates that, on the basis of professional judgement, the SWMU poses no potential risk and should be recommended for NFA. Because of the judgmental nature of this decision, a recommendation of NFA cannot be made unless the available documentation and/or site inspections clearly show that a release of COCs has not occurred, or if a release is documented, the release is physically prohibited from migrating to off-site receptors, the site has been adequately remediated, or the release is permitted under current regulations. See Chapter 6.0 of this Work Plan for a complete discussion of NFA recommendation information. Each recommendation of NFA must be justified by one or more of the criteria listed in Table 5-2.

Evaluation at Decision Point 1 divides the OU 1129 SWMUs into two sets: one set consists of SWMUs recommended for NFA and another set consists of SWMUs that must be evaluated at Decision Point 2. Because the first decision is made on the basis of existing archival information, all SWMUs in OU 1129 were evaluated at Decision Point 1 during the preparation of this Work Plan. SWMUs recommended for NFA at Decision Point 1 and the criteria used for the basis of such recommendations are presented in Chapter 6.0.

5.2.2 Decision Point 2:

Are the archival data sufficient to allow development of a Phase II sampling plan?

Decision Point 2 allows the set of SWMUs requiring further characterization to be sorted for development of Phase I or Phase II SAPs. The purpose of this decision is to determine which SWMUs need Phase I characterization before a more detailed (and expensive) Phase II investigation. Within OU 1129, pre-existing analytical data will not be used for action level comparisons or risk calculations; archival data is used only for NFA recommendation or sampling plan design. Archival data was reviewed against several criteria to help determine if Phase I or Phase II sampling is more appropriate. These criteria include the following:

TABLE 5-2

CRITERIA USED FOR A RECOMMENDATION OF NFA AT DECISION POINT 1

(NOTE: These criteria are designed to comply with guidance in proposed Subpart S, to 40 CFR 264 as published in the Federal Register, Vol. 55 No. 145, Section VI D.)

Archival data for certain SWMUs in OU 1129 indicate that they may be candidates for no further action under terms proposed in Subpart S because they pose no threat to human health or the environment. These SWMUs fall into four groups on the basis of the following criteria:

A) The SWMU or AOC has never been used for the management (i.e., generation, treatment, storage, or disposal) of RCRA hazardous wastes or radioactive wastes.

B) Site design, conditions, or institutional controls preclude any releases from the SWMU that would pose a threat to human health or the environment.

C) The SWMU or AOC is part of an active process that operates under the current RCRA operating permit, or other applicable regulations.

D) The SWMU has been characterized or remediated in accordance with current applicable state or federal regulations, and the available data indicate that COCs are not present in concentrations that exceed natural background levels.

Further discussion of these criteria and individual SWMUs recommended for NFA is in Section 6.1, et seq., of the Work Plan.

- probability that COCs are present and correctly identified,
- probability that the lateral and horizontal extent are accurately known
- suitability ofexisting anlaytical data (for both location and analytes) to the design of a Phase II SAP, and
- knowledge of experimental or operational processes that contirbitued to the SWMU waste stream.

Some SWMUs have an archival data set that provides significant insight into the nature and extent of contamination. This may eliminate the need for Phase I investigation and may also allow development of a very targeted initial Phase II investigation. However, because essentially all data available from archival records are either of unsubstantiated quality or only concerned with the radionuclide components of the waste stream, some additional field investigation and analysis will be necessary for SWMUs going into Decision Point 2. At the present time, no SWMU is being considered for initial Phase II sampling. All investigated SWMUs will undergo Phase I sampling to confirm archival information and to allow for development of cost-effective Phase II sampling plans. This contingency will not allow any SWMU surviving the decision process beyond Decision Point 1, regardless of archival data, to be recommended for NFA without a minimum amount of characterization done under strict RCRA/ER Program quality assurance (QA) requirements.

Decision Point 2 does not provide a mechanism for recommending SWMUs for NFA. The decision made at Decision Point 2 may produce two sets of SWMUs: one set that requires Phase I sampling and another set that can proceed directly to Phase

II sampling. Because the decision made at Point Decision 2 is based on existing data, each SWMU was recommended for Phase I or Phase II sampling during Work Plan preparation.

5.2.3 Phase I Sampling Process

The phased approach to site characterization used in this Work Plan is consistent with EPA and Laboratory IWP guidelines. The technical approach for OU 1129 uses a minimal Phase I field investigation to confirm the presence or absence of COCs at a site. A detailed discussion of the Phase I SAPs is found in Chapter 7.0 of this Work Plan.

Phase I sampling will take place at SWMUs in which contamination is suspected but not confirmed by archival data. The goal of Phase I sampling is not complete characterization of the site, but simply discovery of COCs. The initial step of Phase I investigations will be a comprehensive geodetic and environmental (radiological and VOC) survey to further refine site knowledge and confirm or allow the revisionof SAPs. The Phase I sampling process design will include efforts to model the "worst-case" condition of the contaminant scenario so that Phase I sampling points can be chosen, within a predicted three-dimensional (3-D) envelope, that have a high chance of yielding confirmatory results. For most investigations in Phase I, sampling will be done on a 3-D random basis within this envelope. (See Appendix C for a discussion of modeling in SAP design.) "Real-time" analytical data obtained through field laboratories from initial sampling will be used to continually evaluate the data needs for Decision Point 3 (discussed in Section 5.2.4). As analytical results become available, SAPs will be revised as necessary to acquire the needed data. In this manner, Phase I is an iterative, flexible process. Data acquired through Phase I investigations will serve as input for Decision Point 3.

Additionally, the quantitative data from Phase I will be used to help design a more efficient Phase II sampling program. Phase I data will help identify accepted statistical concepts for evaluating the sufficiency of sample numbers and additional data needs for modeling plume condition and extent and future migration potential.

5.2.4 Decision Point 3:

Do the data collected in Phase I sampling confirm the presence of COCs at this SWMU?

Decision Point 3 is designed so that Phase I-sampled SWMUs, at which the absence of COCs is confirmed, can be recommended for NFA. For those locations at which COCs are confirmed, Phase I data will be used in the development of Phase II SAPs. For the purposes of Decision Point 3, the presence of COCs at a SWMU is considered confirmed if

1) the analytical results for the COC chosen show it to be present in the sample when analyzed by any of the methods listed in Section 5 of the Laboratory ER Program's Generic Quality Assurance Project Plan (QAPjP) (LANL-ER-QAPjP) at data quality Level III or IV, *and*

2) the concentration of any naturally occurring COC exceeds the natural background level for that constituent.

The absence of COCs is confirmed if none of the suspected constituents are detected or none of the suspected COCs exceed their respective background levels. The ER Program is currently conducting a pilot study on soils and the Bandelier Tuff. The study will determine the background concentration range of target list metals and radionuclides. The investigation will also collect data on some physical and chemical parameters that control mobilities of the constituents. Initial results of the study will be presented in the 1992 revision of the IWP and will be available for use in adequate time for data analysis.

A "yes" answer at Decision Point 3 indicates that the presence of COCs at the SWMU has been confirmed by analytical data of at least Level III gathered by a technically sound sampling effort, and that the SWMU must then be evaluated at Decision Point 4. A "no" answer indicates that the absence of COCs at the SWMU has been confirmed by a technically sound and QA-validated sampling effort and justifies a recommendation of NFA. Decision Point 3 is the second point in the decision process at which a recommendation of NFA can be made for a SWMU (refer to Figure 5-1).

The data required to make a decision at Decision Point 3 are the concentrations of suspected COCs at selected sample locations at each SWMU. The purpose of Phase I sampling is to acquire the analytical and field data needed to make a defensible decision at Decision Point 3. Information on site history, physical site characteristics, chemical and physical behavior of suspected constituents, and other factors must all be considered in determining the appropriate locations and depths at which samples must be collected to confirm the presence or absence of potential COCs. Data quality objectives and data needs for Phase I sampling are discussed further in Section 5.3.1.

5.2.5 Phase II Sampling and Modeling Process

The purpose of Phase II sampling is to develop a more complete picture of the nature and extent of contamination at a site. Phase II SAPS will vary significantly for individual SWMUs as a function of the amount and type of data available from archives and from Phase I sample results. Sources of potential variation in the environmental measurement process will be included in the design of Phase II sampling plans. Data on these variation sources may come from an analysis of Phase I results and from data supplied by the Laboratory ER Program Office background studies program because no pilot or reconnaissance studies within OU 1129 were conducted to specifically address this concern.

Phase II will likely be an iterative process for most sites; real-time analytical data will be used to model the progress of the investigation against the data quality objectives (DQOs) for the phase. The Phase II data needs will be amended as necessary to accommodate future program guidance on risk assessment methods. As Phase II analytical data becomes available, comprehensive data analysis and continued modeling of plume extent and migration potential will be conducted. The initial SAPs will be compared to contaminant dispersion and transport model results, and the initial site conceptual model or sampling rationale for completeness and suitability. These SAPS will then be revised as appropriate. The data set resulting from Phase II will serve as the data input to the subsequent risk assessment process.

5.2.6 Risk Assessment Process

Because health-risk-based assessment is integral to the Laboratory RCRA process, all SWMUs in OU 1129 that undergo Phase II investigation will include an assessment of risk. This assessment will include the total data set, which is obtained through archival review and Phase I and/or Phase II sampling activities, for each SWMU. The risk assessment methodology for OU 1129 will reflect the guidance set out in proposed Subpart S to 40 CFR 264 and the ER Program Office's 1992 IWP. DQOs for Phase II investigations at OU 1129 will include any requirements, as these requirements are available from the Laboratory ER Program Office, specific to the gathering of data for risk assessment not otherwise covered. The risk assessment results will serve as input to Decision Point 4.

5.2.7 Decision Point 4:

Do contaminants of concern at this SWMU exceed action levels or have an aggregate risk above the ER Program threshold value?

Decision Point 4 is the final step in the decision process and functions as a point at which SWMUs that have undergone field investigations will be recommended either for CMS or NFA. The purpose of Decision Point 4 is to evaluate the total set of validated data now available for each SWMU. Concentrations of individual COCs at each SWMU will be compared to the action level for that COC, and the calculated aggregate risk from COCs at the SWMU will be compared to the acceptable aggregate risk values determined by the ER Program Office. Risk assessment methodologies to be adopted by the Laboratory are assumed to reflect the basic concepts of the proposed Subpart S to 40 CFR 264; calculation of risk as additive for sites with multiple contaminants is assumed. A recommendation of NFA at this point in the decision process will be justified for a SWMU if each of the following criteria are met:

- the mean sample concentration for any listed COC does not exceed the risk-based action level for that COC, and
- the aggregate risk value for the sum of the health-risk-quantified COCs present does not exceed the acceptable risk value set by the ER Program Office.

The analysis of data during the OU 1129 RFI investigation will follow EPA and Laboratory IWP guidance for using a 90% (one-tailed) confidence interval. Uncertainty will be handled according to methods shown in Appendix H of the Laboratory IWP (LANL 1991, 0553) and applicable EPA documents.

A CMS (or an alternative response action) is required for SWMUs in which one or more COC is present at a level that exceeds the risk-based action level specified in 40 CFR 264 Proposed Subpart S for that constituent, or in which the cumulative risk posed by two or more COCs exceeds acceptable levels. For radionuclides, numbers for comparison to analytical values are expected to be published in a future Laboratory IWP or some future EPA guidance document. However, pending further ER Program Office guidance, the need to carry a SWMU into the CMS or for corrective action whenever COCs are detected in concentrations that exceed Subpart S action levels may not be necessary. If further site-specific risk assess-

ment indicates that human health and the environment are not at risk (e.g., if no plausible pathway exists from source to potential receptors), then no further action may be appropriate. The ER Program Office is expected to promulgate criteria for this circumstance.

5.3 Data Quality Objectives

Data must be collected at three stages in the decision process. The first stage involves the initial collection of pertinent archival information. This information serves as data input for Decision Points 1 and 2. The data required to make a decision at Decision Point 3 are collected during Phase I sampling, the second stage of data collection. Phase II sampling is the third stage of data acquisition. The data needs for Decision Point 4 determine the scope of Phase II efforts.

Because these decisions must be technically sound and validated to be defensible, an attempt has been made to collect as much reliable archival information about each site as possible. To ensure that data of appropriate and sufficient type, quantity, and quality are collected during Phase I and Phase II sampling, the DQO process has been applied to the development of the Phase I and Phase II SAPs. These SAPs are presented in Chapter 7.0 of this Work Plan.

The DQO process is a seven-step process developed by the EPA for planning effective and efficient data collection programs (EPA 1987, 0086). A well-planned data collection program will ensure that the right type, amount, and quality of data are collected. Quality environmental data are needed to make defensible environmental decisions.

The DQO process is a valuable tool for the following reasons:

- it provides a logical, iterative structure for study planning and encourages focusing on critical questions,
- it provides a focused method to determine data needs,
- it helps data users plan for uncertainty, and
- it facilitates communication among the technical team members and minimizes the amount of time and money spent collecting data.

The seven steps in the DQO Process are as follows:

1. State the problem to be resolved.
2. Identify the decision to be made (or the question that must be answered).
3. Identify input to the decision (or identify data needs).
4. Specify the domain of the decision.
5. Develop a decision rule (or logic statement).

6. Develop uncertainty constraints.

7. Optimize design for obtaining data (develop sampling and analysis plans).

This seven-step process is followed as closely as possible in developing DQOs for the OU 1129 Work Plan. While Decision Points 1 and 2 require the decision maker to be confident in the archival data, decisions can be made from archival data of uncertain data quality without a formal set of DQOs. Although not formally documented, the Laboratory ER project leaders have agreed that accepting archival data at face value is necessary for RFI planning. A more formal process is used to develop the DQOs to support Decision Point 3 (post-Phase I) and 4 (post-Phase II).

Decision Points 3 and 4 require data of certain quality for both determination of the nature and extent of contamination and for risk analysis. At OU 1129, EPA and IWP guidelines for addressing sampling and analytical uncertainties will be followed. For the sampling and analytical effort to determine the nature and extent, a confidence interval of 90% (one-tailed) will be used. All Phase I data used in making a decision at Decision Point 3 will be of at least data quality Level III, with 5% of samples confirmed at Level IV. These uncertainty constraints are adopted globally in the OU 1129 DQO process. As previously stated, risk assessment data needs have not been fully defined by the methods to be used; however, the assumption used in this Work Plan is that methods similar to those in proposed Subpart S to 40 CFR 264 will be used. Additionally, background concentration values are not yet available; it is assumed that the Laboratory ER Program Office will supply a discussion of the methodologies and uncertainties associated with these studies when they are complete. As required, DQOs for OU 1129 will be reviewed and amended for consistency as information becomes available.

5.3.1 Phase I Data Quality Objectives

DQOs for Phase I SAPs have been developed using the seven-step process described. DQOs for the Phase I SAPs are discussed in following subsections and shown in Figure 5-2.

5.3.1.1 Problem Statement

For many of the SWMUs within OU 1129, some COCs are suspected, but their presence has not been confirmed and no data are available on the concentrations or specific locations of contaminants. Environmental samples must be collected and analyzed to confirm the presence or absence of COCs at the site.

5.3.1.2 Question to be Answered

Do the data from Phase I sampling confirm the presence of COCs at this SWMU? This question and its two possible answers are discussed in Section 5.2.4, Decision Point 3.

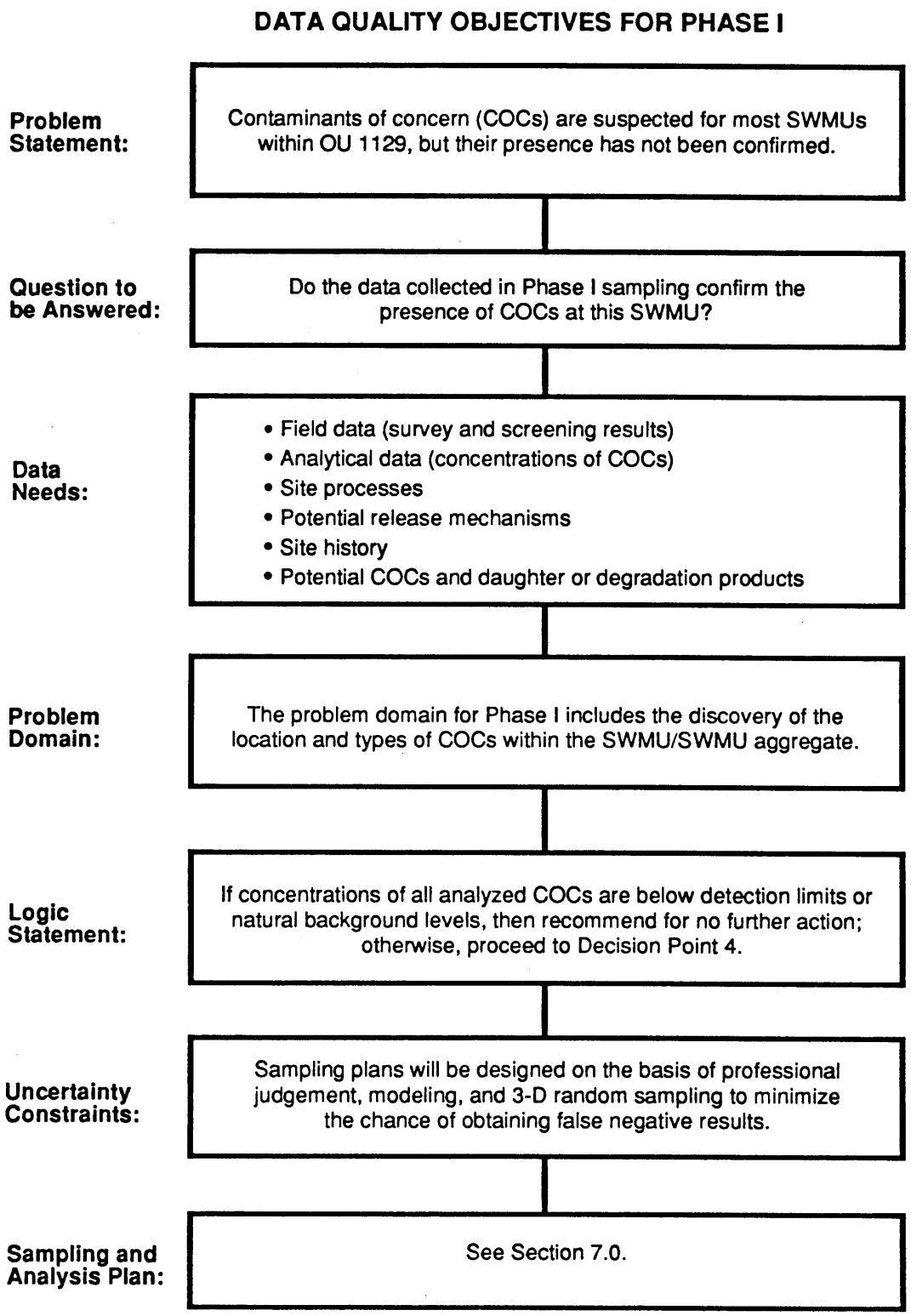


Figure 5-2. Data quality objectives for Phase I.

5.3.1.3 Decision Inputs/Data Needs

Two sets of decision inputs (data needs) that are necessary to support the decisions made at Decision Point 3 have been identified. These sets include the following:

- the information necessary to design an adequate Phase I SAP, and
- the field and analytical data that will be collected during the sampling program.

The first set includes information that must be gathered before development of the sampling plan. The second set includes the concentrations of COCs at the site as determined by analyses of samples collected at the site. In developing SAPs, SWMUs will be grouped into aggregates on the basis of proximity and similarity of COCs or processes. This aggregation is useful in implementing the sampling operation described earlier in this section, which uses real-time analytical methods and is designed to reduce sampling time and cost. Design of the SAP hinges on two important considerations:

1. What COCs are suspected at the site at present?
2. Where are the highest concentrations of these COCs most likely to occur?

Consideration of these questions will help to determine the locations and depths at which samples should be collected and what analyses should be run for those samples. A more complete discussion of the modeling and data analysis efforts used to develop a range of reasonable answers to these two questions is found in Chapter 7.0. The following general data needs for SAP development help create a SAP that is focused and cost effective:

- Processes that have operated at the site.
- Potential release mechanisms and history (e.g., was there a one-time release in 1952, or were there routine releases on a weekly basis between 1957 and 1974).
- COCs potentially released to the environment.
- Likely present state of parent COCs (daughter products of radionuclides, degradation products of organic compounds, etc.).
- Behavior of COCs by medium of concern, including migration potential.

These approaches are considered necessary for cost-effective implementation. However, SAP design for areas of multiple SWMUs in close proximity (e.g., at the east end of TA-35) require a broader analytical effort to develop a more complete picture of COCs present. SAPs that address sites in which multiple processes or

multiple potential waste streams exist will include key sampling for the full list of constituents in 40 CFR 261 Appendix VIII, and 40 CFR 264 Appendix IX.

5.3.1.4 Problem Domain

The problem domain for Phase I sampling includes the discovery of the location and types of COCs within the SWMU or SWMU aggregate.

5.3.1.5 Decision Rule/Logic Statement

The decision made at Decision Point 3 will be based on the following rule:

> If, for all samples collected for the SWMU in Phase I, the maximum concentration of any COC in any sample does not exceed detection limits or the natural background concentration for that constituent, the SWMU will be recommended for NFA. Otherwise, the SWMU will undergo further study.

This decision will not be based on a statistical characterization of the levels of contamination at a SWMU or SWMU aggregate for two reasons: (1) any type of averaging of sample results would dilute maximum value and increase the chances of making a Type II error (i.e., to get a false negative result or to determine that COCs are absent when they are actually present); and (2) the goal of Phase I investigation is not complete characterization, but rather simply determining whether COCs are present or absent. However, at most sites the SAP for Phase I will be geostatistically based, at least in part, wherever substantial uncertainty of contaminant locations exists. (See Appendix C for a discussion of statistical sampling used in SAP creation.) The comparison of sample values to background concentration ranges will be statistically based, depending on the characterization methods for background determinations that the Laboratory ER Program Office employs. Methodology for these comparisons will be added to the Work Plan as they are developed.

5.3.1.6 Uncertainty Constraints

To fully validate and define a decision to recommend a SWMU for NFA at Decision Point 3, Phase I SAPs have been designed to minimize the chances of obtaining false negative results. This has been done by focusing sampling toward the area determined judgmentally and through modeling to most likely contain the highest concentrations of COCs. As stated in Section 5.3.1.5, Decision Rule/Logic Statement, statistical constraints regarding handling and comparison of Phase I data to background depend on which method the ER Program Office adopts. The use of 3-D random sampling at some Phase I sites is one effort of controlling false positive error, but a comprehensive statistical effort is reserved for Phase II sampling plans.

5.3.2 Phase II Data Quality Objectives

DQOs for Phase II SAPs have been developed using the seven-step process described previously. DQOs for the Phase II SAPs are discussed in the following subsections and shown in Figure 5-3.

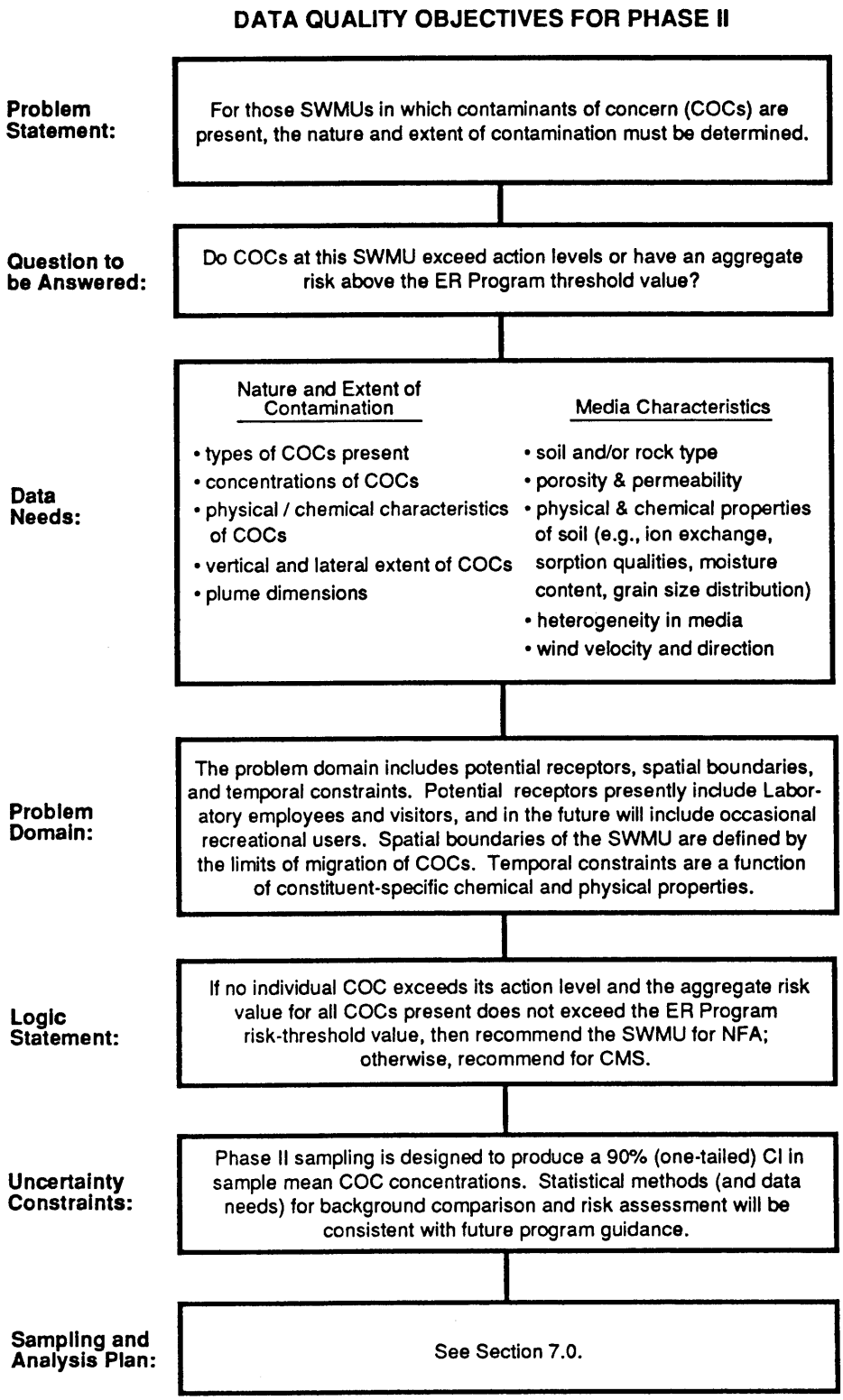


Figure 5-3. Data Quality Objectives for Phase II.

5.3.2.1 Problem Statement

For the majority of SWMUs in which the presence of COCs has been confirmed, either by archival information or data collected during Phase I sampling, a complete picture of the nature and 3-D extent of contamination is unknown. Environmental samples must be collected and analyzed to define the nature and extent of contamination so that the health risk posed by the COCs can be assessed. Transport, climate, and exposure modeling for future use scenarios must be employed to assess future risk.

5.3.2.2 Question to be Answered

Do contaminants of concern at this SWMU exceed action levels or have an aggregate risk above the ER Program threshold value? This question and its two possible answers are discussed in Section 5.2.7, Decision Point 4.

5.3.2.3 Decision Inputs/Data Needs

The purpose of Phase II sampling is to obtain the data needed to support the decision made at Decision Point 4. In general, enough must be known about the nature and extent of contamination at the site to facilitate a health-risk-based assessment. To meet this end, two sets of decision inputs must be defined during Phase II sampling. These sets include the following:

- the spatial extent of the contaminant plume in 3-D, and migration potential over time, and
- the concentrations of all COCs present at various locations and depths within the plume.

To develop a SAP that will obtain these data, all information obtained to date must be considered, including archival information and data collected during Phase I sampling and analysis investigations. Before an adequate Phase II SAP can be designed, the following decision inputs must be considered:

1. What COCs are known to be present at the site?
2. Which area(s) is likely to have maximum concentrations of COCs?
3. What is the migration potential of the contaminant plume?

Consideration of these questions will help to determine the locations and depths at which samples should be collected and the types of analyses that should be run on each sample. Phase II sampling efforts will be designed on the basis of Phase I or other recent analytical data. Phase II sampling will use a random, stratified random, or 3-D random sampling approach as warranted. Data needs for statistical sufficiency of sampling include the number of samples, sample mean, and sample variability, as described in SW-846, Chapter 9 (EPA 1987, 0292), and other EPA guidance documents for statistical analysis. Data needs for transport and exposure modeling and for risk assessment will depend on which codes and methodologies

are adopted by the Laboratory ER Program Office for these purposes. This Work Plan will be amended as required to reflect ER Program office guidance as it becomes available. During the development of Phase II SAPs, SWMUs recommended for Phase II data collection will be grouped into aggregates on the basis of proximity and similarity of sampling techniques and requirements. This aggregation is a cost-effective means of implementing Phase II investigations.

5.3.2.4 Problem Domain

The problem domain includes potential receptors' spatial boundaries (the area of a release and spatial limits of contaminant migration), and temporal constraints (the chemical/physical form of the constituent to look for at present, and future migration potential). Presently, potential receptors at OU 1129 are identified as Laboratory employees and visitors; in the future, OU 1129 will become a part of Bandelier National Monument, and then potential receptors will be identified as occasional recreational users (see Section 4.10, Identification of Potential Receptors).

5.3.2.5 Decision Rule/Logic Statement

If no individual COC exceeds its action level and the aggregate risk value for all risk-based COCs does not exceed the ER Program risk-threshold value, a SWMU will be recommended for NFA; otherwise, a SWMU will be recommended for CMS.

5.3.2.6 Uncertainty Constraints

Sample mean concentration estimates with a 90% (one-tailed) confidence interval will be used for comparison to action levels and for risk assessment. These constraints parallel those in EPA SW-846 (EPA 1987, 0292) and other EPA manuals for statistical analysis of solid waste sites.

5.4 Field and Analytical Data Quality Requirements

Data quality requirements for field and analytical data collected at OU 1129 are governed by the need to make defensible, risk-based decisions for each SWMU. The information collected will be based on sound professional judgment, required EPA protocol, statistical requirements, and overall data objectives for the project. The two-phased site assessment approach proposed for OU 1129 is a logical means of obtaining the goals of the RFI. This section will discuss data quality requirements concerning analytical levels; analytical methods; precision, accuracy, representativeness, completeness, and comparability (PARCC) parameters; and field data quality requirements.

5.4.1 Analytical Levels

The determination of analytical levels for field and laboratory tasks are required to set data quality standards for the project. In general, Levels I and II are associated with on-site portable field instrumentation or tests. Levels III and IV are associated with strict mobile or facility laboratory protocol and documentation that will generate high-quality, defensible data. In accordance with the IWP, this Work Plan assumes availability of real-time Level III analyses. Level V will accommodate all special

analytical methods that are not covered under standard Level III or IV parameters. The quality of Level V work can meet either Level III or IV standards. Investigations at OU 1129 will be performed under a combination of analytical levels to meet the specific project needs.

5.4.1.1 Phase I Analytical Level

Phase I investigations will be performed under analytical Levels I, II, and III. Level I and II data will be collected as part of a field-screening program to allow for qualitative, real-time evaluations of site conditions. Level I field screening will include a variety of portable field instrumentation or field test kits that can continually or periodically give information on site conditions. Level I observations are also used as a critical part of the site Health and Safety Plan and for evaluation of samples to determine proper shipping procedures. Table 5-3 provides additional details concerning the instrumentation and methods for each analytical level.

Level II activities will include the use of field survey methods and portable detection equipment. Field surveys include the use of surface or borehole geophysics to assist in remote sensing activities or assist in the location of sample points. Soil vapor surveys using portable instruments are very useful in providing qualitative to semiquantitative data of samples in the field. Field detection equipment can provide quantitative information on samples that can be used to support field strategy decisions.

Level III will be implemented during Phase I activities to obtain quality analytical data from field laboratories (as planned in the IWP) or facility laboratories that can support any decisions made for each SWMU. In particular, this data must be of sufficient quality to support a recommendation of NFA. Under Level III at OU 1129, strict quality assurance/quality control (QA/QC) and sample documentation procedures will be followed. Laboratory protocol for sample analysis will be performed using EPA's "Test Methods for Evaluating Solid Waste," SW-846, for organic compounds and metals (EPA 1987, 0292). Radionuclide, high explosive, or miscellaneous analytes will be tested for according to other acceptable analytical methods as outlined in the IWP (LANL 1991, 0553). Future Laboratory ER Program Office guidance will determine the exact analytical methods and data quality levels for some COCs that may be compared to background or have actions levels below standard method detection limits (MDL) or practical quantitation limit (PQL) levels. Approximately 5% of Phase I analytical samples will also be analyzed at Level IV for confirmatory purposes.

5.4.1.2 Phase II Analytical Levels

Phase II analytical levels will be similar to those used in Phase I (Levels I, II, and III) with the addition of Levels IV and V. Level V analyses will be performed for all of the nonstandard procedures that are not included under Level III analytical methods. Level IV data quality will be used as appropriate for confirmation of Level III or archival analytical data. This can include analysis for nonconventional parameters, method modifications, 40 CFR 261, Appendix VIII, or 40 CFR 264, Appendix IX suites, or physical testing of soils or rock. QC and documentation for Level V will be equivalent to procedures defined for Level III to maintain the defensibility and quality of data.

TABLE 5-3

INSTRUMENTATION AND METHODS FOR PROPOSED ANALYTICAL LEVELS

LEVEL I: FIELD SCREENING

- Portable Instruments
  - Fidler
  - Geiger-Mueller
  - Micro R Meter
  - Organic Vapor Analyzer (OVA)
  - Photoionization Detector (PID)
  - Explosimeter
  - Oxygen-Level Indicator
  - pH, Temp, Conductivity Meter
- Field Test Methods/Kits
  - OVA Headspace Test
  - HNU Headspace Test
  - Handby Kit
  - Draeger Tubes
  - Hazcat Kits
  - Lab in a Bag®
  - Chloride Test Kits (soil)
  - Hack Kits™

LEVEL II: FIELD SURVEYS/INSTRUMENTATION

- Mobile (or field) Analytical Laboratory (limited QA, documentation)
- Surface Geophysics
- Borehole Geophysics
- Soil Vapor Surveys (portable instruments)
- Scintillation Detectors
- Radiological Screening Laboratory

LEVEL III: LABORATORY METHODS/INSTRUMENTATION

- SW-846 (EPA 1987, 0292) protocol for soil, air, and water analysis for volatile and semivolatile organic compounds, organochlorine pesticides and PCBs, and metals using Los Alamos, off-site, or mobile laboratories (see Table 5-4 for more detail)
- Laboratory, DOE, US Army, or EPA analytical methods for radionuclides, high explosives, or miscellaneous analyses (see LANL-ER-QAPjP, Appendix T of IWP [LANL 1991, 0553])
- Instrumentation typically includes gas chromatography (GC), gas chromatography/mass spectrometry, inductively coupled plasma atomic emission spectroscopy (ICAP), atomic absorption (AA)
- Mobile (or field) analytical laboratory

LEVEL IV: LABORATORY METHODS/INSTRUMENTATION

- Contract Laboratory Program (CLP) level routine analytical services
- Methods and instrumentation similar to Level III above (excluding mobile equipment)

LEVEL V: LABORATORY METHODS

- American Society for Testing and Materials (ASTM) protocol for soil/rock testing
- Method specific protocol

5.4.2 Analytical Methods and PARCC Parameters

Analytical methods selected for the analysis of soil, water, or air samples collected at OU 1129 for the ER Program follow standard laboratory protocol recognized by the EPA. The analytical methods include a variety of techniques that will screen for over 300 individual analytes. Testing for volatile and semivolatile organic compounds, polychlorinated biphenyls (PCBs), and inorganic metals will be performed using EPA's "Test Methods for Evaluating Solid Waste," SW-846 protocol (EPA 1987, 0292). Analyses for radionuclides, high explosives, and miscellaneous analytes will be performed under additional acceptable analytical methods. Table 5-4 summarizes the analytical methods that will be used.

TABLE 5-4

SUMMARY OF ANALYTICAL METHODS FOR THE ANALYSIS OF SAMPLES COLLECTED AT OU 1129

• EPA SW-846 Method 8080a	Organochlorine Pesticides and PCBs
• EPA SW-846 Method 8240a	Volatile Organics
• EPA SW-846 Method 8020a	Aromatic Volatile Organics
• EPA SW-846 Method 8270a	Semivolatile Organics
• EPA SW-846 Method 6010a	Inorganic Metals by Inductively Coupled Plasma Atomic Emission Spectroscopy (ICAP)
• EPA SW-846 Method 7000a	Inorganic Metals by Atomic Absorption (AA)
• EPA SW-846 Method 9010a	Cyanide
• EPA SW-846 Method 7470a	Mercury
• EPA Method 418.1	Total Petroleum Hydrocarbons
• Radionuclides - LANL or DOE Method [b]	Gross Alpha, Total Uranium, Gross Beta, Isotopic Uranium (U-234, -235, -238), Gamma Spectroscopy, Radium-226, Americium-241, Strontium/Yttrium-90, Cesium-137, Tritium, Isotopic Plutonium (Pu-238, -239, -240), Europium-152, Isotopic Thorium (Th-228, -230, -232), and Neptunium-237
• High Explosives - US Army Method [b]	
• Miscellaneous Analytes [b]	
• Physical testing of soil or rock—American Society for Testing and Materials (ASTM) Protocol	

[a] Refer to EPA (1987, 0292) for additional information.
[b] Refer to Laboratory ER Generic QAPjP (Appendix T of IWP [LANL 1991, 0553]) for additional information.

Tables 5.3 through 5.12 and 9.1 in the Laboratory's Generic QAPjP contain additional information concerning these analytical methods for constituents of interest at OU 1129 (Appendix T of IWP [LANL 1991, 0553]). The Generic QAPjP lists the individual constituents analyzed under each method, the corresponding chemical abstract service numbers, and the PQL or MDL for each constituent using the specific method.

PARCC parameters (precision, accuracy, representativeness, completeness, and comparability) are analytical and sampling quality assurance goals that are established to ensure that quality data are generated. A thorough discussion of the PARCC parameters for the Laboratory ER Program is presented in Section 5.0 of the Generic QAPjP.

5.4.3 Sample Collection Quality Requirements

Numerous field activities have an impact on the overall data quality for an ER program. The activities that have a direct effect on data quality include equipment calibration schedules and procedures, sample method selection and technique, sample containers, preservatives, sample holding times, the number or type of QC samples, sample documentation, and equipment decontamination. To ensure that

data quality is maintained in the field, specific details for each of these activities are included as part of the SAPs (Chapter 7.0) and in the Laboratory Standard Operating Procedures Manual for the ER Program (LANL 1991, 0411).

5.5 Decision Analysis Methodology

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

5.6 Natural Resource Damage

The ER work at the Laboratory is performed in compliance with a RCRA Part B operating permit. However, this work is also performed in accordance with applicable sections of Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as required by Department of Energy (DOE) Order 5400.4. CERCLA Section 120 extends natural resource damage liability to federal facilities, which includes the Laboratory. The first part of the natural resource damage assessment is a Preassessment Screen that is governed by regulation in 43 CFR 11. The Preassessment Screen will be used to determine whether a full natural resource damage assessment is appropriate. The Preassessment Screen will be integrated with the CERCLA ecological assessment process for this OU. A general description of the Preassessment Screen and the ecological assessment will be written for inclusion in the IWP. Any modifications of the general procedure that might be necessary for this OU will be described in future reports of progress pertaining to this OU facility investigation. This is consistent with the "Guidance for Natural Resource Trusteeship and Ecological Evaluation for Environmental Restoration at DOE Facilities" (DOE 1991, 0560).

REFERENCES

EPA (Environmental Protection Agency), March 1987. "Data Quality Objectives for Remedial Response Activities, Development Process," EPA/G-87/003, OSWER Directive No. 9355.0-7B, prepared by CDM Federal Programs Corporation, Washington, D.C. (EPA 1987, 0086)

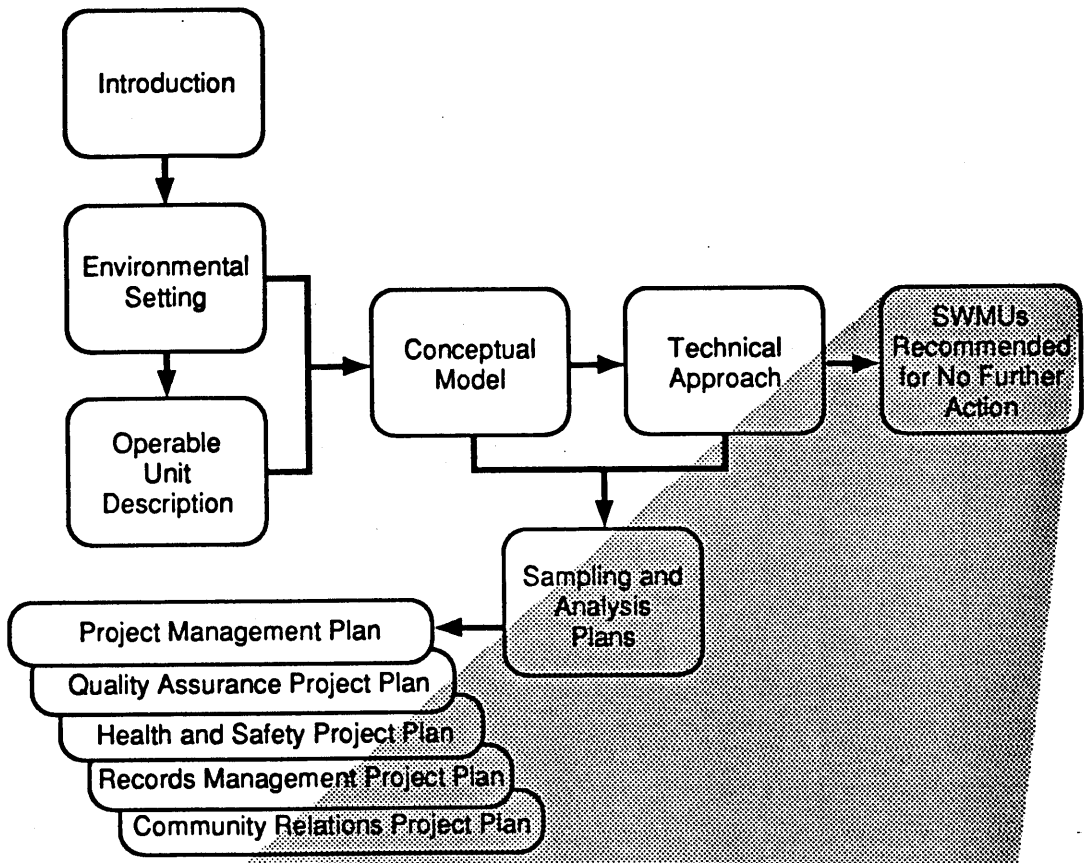
EPA (Environmental Protection Agency), December 1987. "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," SW-846, proposed update package for third edition, Office of Solid Waste and Emergency Response, Washington, D.C. (EPA 1987, 0292)

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), May 1991. "Environmental Restoration Standard Operating Procedures," Vols. I, II, and III, Los Alamos, New Mexico. (LANL 1991, 0411)

DOE (US Department of Energy), June 1991. "Natural Resource Trusteeship and Ecological Evaluation for Environmental Restoration at Department of Energy Facilities," DOE/EH-0192, National Technical Information Service, US Department of Commerce, 5285 Port Royal Road, Springfield, Virginia, 22161. (DOE 1991, 0560)

CHAPTER 6



SWMUs Recommended for No Further Action

- NFA Criteria
- SWMUs Recommended for NFA

6.0 SOLID WASTE MANAGEMENT UNITS RECOMMENDED FOR NO FURTHER ACTION

All solid waste management units (SWMUs) in Operable Unit (OU) 1129 will be evaluated according to the decision process presented and discussed in Section 5.2, OU 1129 Decision Process. At Decision Point 1 of the decision process, some SWMUs and areas of concern (AOCs) are recommended for No Further Action (NFA). These recommendations are made on the basis of available archival information that indicates those SWMUs or AOCs that pose no potential threat to human health or the environment. A brief discussion of the criteria used to support a recommendation of NFA for each of these SWMUs is provided in Section 6.1. Table 6-1 summarizes the justification for those SWMUs in OU 1129 that are recommended for NFA.

6.1 Criteria Used to Support a Recommendation of NFA

According to proposed Subpart S to 40 Code of Federal Regulations (CFR) 264 (EPA 1990, 0432), a SWMU can be recommended for NFA if it can be demonstrated that the SWMU poses no threat to human health or the environment (EPA 1990, 0432). For most SWMUs in OU 1129, such a recommendation cannot be considered until the potential threat posed by suspected contaminants of concern (COCs) has been assessed through a field investigation. However, several SWMUs in OU 1129 can be recommended for NFA without environmental sampling on the basis of archival information that proves the site poses no current or future threat to human health or the environment. After a review of archival information, a total of 61 SWMUs, SWMU subunits, and AOCs in OU 1129 listed in the 1990 SWMU report have been proposed for NFA (Table 6-1). In all cases, the evidence used for these NFA recommendations outweighs the evidence that was originally used to list the site as a SWMU. To be considered for NFA, a SWMU or AOC must meet at least one of the following four criteria, which are consistent with the terms outlined in proposed Subpart S:

A) The SWMU or AOC has never been used for the management (i.e., generation, treatment, storage, or disposal) of Resource Conservation and Recovery Act (RCRA) hazardous wastes or radioactive wastes.

B) Site design, conditions, or institutional controls preclude any releases from the SWMU that would pose a threat to human health or the environment.

C) The SWMU or AOC is part of an active process that operates under the existing Resource Conservation and Recovery Act operating permit, or other applicable regulations.

D) The SWMU has been characterized or remediated in accordance with current applicable state or federal guidelines, and available data indicate that COCs are not present in concentrations that exceed natural background levels.

These four criteria are discussed further in the following paragraphs.

Criterion A: The site has never been used for the management (i.e., generation, treatment, storage, or disposal) of RCRA hazardous wastes or radioactive wastes.

Archival information for some SWMUs in OU 1129 confirms that the sites have never been involved in management of hazardous or radioactive wastes. These sites do not pose a threat to human health or the environment because no contaminant source term exists. Examples of SWMUs or AOCs in OU 1129 that meet this criterion include:

- Sites that were planned for the purpose of waste management, but were never constructed, installed, or used as such.
- Sites that have managed only nonhazardous waste materials or materials not considered to be waste. Examples include tanks used for storage of chemical products, or recently installed septic tanks that have handled only sanitary waste from office buildings in which hazardous or radioactive materials have never been managed.
- Sites at which nonsystematic releases from production processes occurred, or sites at which one-time spills that were immediately cleaned up occurred. One-time spills that were not adequately cleaned up are considered waste disposal sites and will not be recommended for NFA.

Criterion B: Site design, conditions, or institutional controls preclude any releases from the SWMU that would pose a threat to human health or the environment.

Several sites within OU 1129, while used for management of hazardous wastes, provide essentially no pathways for contaminant migration, and therefore have no potential for a release to the environment. Examples of such sites include designated storage areas located inside buildings and polychlorinated biphenyl (PCB)-oil leaks from transformers located inside buildings. Even if a primary release from the SWMU occurred at these sites, migration of the released materials would be attenuated inside the building or containment structure, and COCs would not reach the outside environment. These sites do not warrant further investigation as part of the RCRA facility investigation (RFI) and will be recommended for NFA.

Criterion C: The SWMU is part of an active process that operates under the existing RCRA operating permit, or other applicable regulations, and has no release history before permitting.

Controlled releases that are regulated under other applicable regulations may also be recommended for NFA. However, this criterion will only be used if archival information indicates that releases from the site have been regulated throughout the release history. For example, if an outfall operated for several years before a permit

was obtained, the site will not be recommended for NFA unless one of the other criteria in this section apply.

Criterion D: The SWMU has been characterized or remediated in accordance with current, applicable state or federal regulations, and available data indicate that COCs are not present in concentrations that exceed natural background levels.

Several SWMUs in OU 1129 have been remediated or have undergone decontamination and decommissioning (D&D). In most cases, archival sampling data indicate the following:

- Naturally occurring COCs are not present above background concentrations referenced in the sampling report.
- The toxicity characteristic levels in 40 CFR 261.24 are not met or exceeded.
- COCs are not detected by the methods in Tables 1, 2, or 3 of Appendix III, 40 CFR 261.

Generally, most of the older D&D projects were inadequate for the following reasons:

- Older cleanup projects addressed only radioactive contamination and did not assess hazardous chemical contamination.
- Remediation was conducted to less-stringent or outdated cleanup standards.
- Adequate data quality assurance was not applied to the sampling programs.
- Specific D&D information such as sample locations and analytical results are poorly documented.

Recommendations for NFA will not be made on the basis of these older D&D efforts. Any site known or suspected to contain residual contamination above natural background levels will be investigated further. Since 1988, some OU 1129 SWMUs have been remediated as RCRA Closures, New Mexico Environment Department underground storage tank (UST) removals, or as part of other internal Laboratory cleanup programs. These recent remediation efforts have addressed RCRA hazardous wastes that are required under the RFI and have been conducted to current applicable cleanup standards. Data acquired during these investigations are considered adequate to support NFA recommendations.

6.2 SWMUs Recommended for NFA

SWMUs and AOCs in OU 1129 that have been recommended for NFA on the basis of archival information are listed in Table 6-1. The first column of Table 6.1 provides

the number/letter designation of the SWMU or AOC, as listed in the 1990 SWMU report (LANL 1990, 0145), and the type or name of the site. SWMUs that were listed on the HSWA Module VIII (EPA 1990, 0306) are indicated in this column with an asterisk.

The second column of the table provides an indication of which of the four NFA criteria (Criteria A, B, C, or D as discussed in Section 6.1) were used to support the NFA recommendation.

The third column consists of a brief description of the SWMU followed by a discussion of the justification for the NFA recommendation. The site descriptions are meant to provide a very concise summary of information about the site. For more information, the reader is referenced to the appropriate subsection of Chapter 3.0 in which all available archival information about each site is summarized. The justification provided focuses on the specific reason(s) that no further investigation is proposed for a particular site. The reason(s) provided correspond with the NFA criteria discussed in Section 6.1 and are consistent with terms proposed for NFA determinations in Subpart S (EPA 1990, 0432)

The fourth column provides a listing of references used as supporting documentation for the NFA recommendation. These documents are the same as those referenced in the Operable Unit Description in Chapter 3.0, and consist primarily of D&D reports and memoranda, site characterization summaries, Environmental Restoration Program site investigation reports, and the 1990 SWMU report (LANL 1990, 0145).

TABLE 6-1

SWMUs RECOMMENDED FOR NFA AT DECISION POINT 1

SWMU No. and Type	NFA Criteria A	B	C	D	Description/Justification	References
5-003* Calibration Chamber	•	•			SWMU No. 5-003 consists of a 35-ft-deep shaft or calibration chamber excavated into the tuff (see Section 3.2.2.1). The chamber is lined with lead bricks and has been backfilled with soil. Instruments with sealed radioactive sources were calibrated in this chamber, but there is no reason to suspect release of radionuclides. The lead bricks are the only potentially hazardous material remaining at this site. However, because of the low solubility of solid lead at normal pH, the bricks do not pose an environmental hazard. The pH of the immediate environment would have to be lowered to extremely acidic conditions to enable the lead to dissolve and migrate from the site. No further action (NFA) is recommended because there is no reason to suspect soil contamination in the vicinity of the chamber.	1990 SWMU report (LANL 1990, 0145); Janecky 1992, 04-0234.
35-001 Material Disposal Area W (MDA-W)		•			SWMU No. 35-001 consists of two 4-in.-diameter, 125-ft-long stainless-steel tubes suspended vertically inside 8-in. diameter carbon-steel-cased wells (see Section 3.3.2.1). Each tube, which is backfilled under pressure with nitrogen and sealed, contains 150 liters of liquid sodium reactor coolant contaminated with ^{239}Pu and associated fission products. Gross-gamma activity emitted from the site is monitored. Sodium and radionuclides could not be released from the tubes unless the steel tubes were cracked. If the tubes were breached, the sodium would be expected to react explosively with moisture in the soil or tuff. Because the steel tubes have not shown signs of cracking, it is believed that no releases of sodium have occurred. Furthermore, potential contamination of the surrounding tuff cannot be assessed without drilling deep wells adjacent to the tubes. Such drilling activity would greatly increase the likelihood of breaching the containment tubes and could cause a potentially dangerous release. This site is recommended for NFA for the following reasons: no evidence of a release exists; the engineered controls presently in place preclude any migration of contaminants to the environment; assessment/remediation options pose a greater risk to human health and the environment than not investigating the site; and this site is designated as a MDA-W, which will be maintained under perpetual institutional control.	Warren 1974, 04-0197; LASL 1977, 0649; LANL 1981, 04-0209.

* Designated as an HSWA Module SWMU (LANL 1990, 0145).

TABLE 6-1 (continued)

SWMUs RECOMMENDED FOR NFA AT DECISION POINT 1

SWMU No. and Type	NFA Criteria A	B	C	D	Description/Justification	References
35-002* Material Disposal Area X (MDA-X)				•	SWMU No. 35-002, MDA-X, was the location of the Los Alamos Power Reactor Experiment No. 2 (LAPRE II) reactor, which was buried in place after it was decommissioned in 1959 (see Section 3.3.2.1). This site was remediated in 1991 as an Environmental Restoration Interim Action (ERIA). All reactor-related equipment and contaminated soils were removed, and confirmatory soil sampling has been conducted to verify removal of all contaminants of concern (COCs) including radionuclides and hazardous chemicals. The decontamination and decommissioning (D&D) effort and soil sampling plan were implemented with Environmental Protection Agency (EPA) concurrence, and results of the completed project will be submitted to the EPA. No further investigation into this site as part of the OU 1129 RCRA Facility Investigation is recommended until EPA's final review and recommendation of the removal activities is completed.	Warren 1974, 04-0197; Montoya 1991, 04-0161; Fresquez 1991, 04-0080; Montoya 1991, 04-0162; Montoya pers. comm. in Roberson 1991, 04-0227.
35-003(i)*	•				SWMU No. 35-003(i) consisted of two steel surge tanks that were used to accommodate gas pressure excursions from the gas laser facility in TA-35-29 (see Section 3.3.2.1). Helium and nitrogen gases were the only substances handled by these tanks. The tanks were moved from inside TA-35-27 in 1974. (The surge tanks were never associated with the wastewater treatment plant as is implied by their designation as a subunit of SWMU No. 35-003.) NFA is recommended for this SWMU because the tanks never managed RCRA hazardous or radioactive wastes.	DOE 1987, 0264; LASL no date, 0402.
35-003(p)		•		•	SWMU No.35-003(p) is the former Air Filter Building (TA-35-7). This building was decontaminated and decommissioned in 1979 and 1980. This building housed air filtering equipment for treating contaminated air from building TA-35-2, the original laboratory/office building completed in 1951. The removal of the building along with the material associated with the phase separater pit has been requested. This site is recommeded for the following reasons: the building has previously undergone D&D activity; no evidence of a release exists following the 1980 D&D activity; this building is currently scheduled for D&D and removal.	LANL 1981, 04-0209; Hansen and Umphreys 1992, 04-0263.
35-004(c)		•			SWMU No. 35-004(c) is an outdoor container storage area located on the south side of TA-35-125 (see Section 3.3.2.1). It is used for the storage of drums of dielectric oil. The storage area is associated with the waste oil treatment system, SWMU No. 35-007, and is located in a covered, bermed area that is equipped with sumps and pumps for spill containment. Oil stains were observed within this bermed area, but the berm is designed to prevent spills from reaching the environment. NFA is recommended for this site because site design precludes the migration of COCs to the environment.	1990 SWMU report (LANL 1990, 0145); Roberson 1991, 04-0226.

*Designated as an HSWA Module SWMU (LANL 1990, 0145).

TABLE 6-1 (continued)

SWMUs RECOMMENDED FOR NFA AT DECISION POINT 1

SWMU No. and Type	NFA Criteria A	B	C	D	Description/Justification	References
35-004(d) 35-004(e)* 35-004(f) 35-004(k) 35-004(l) 35-004(n) Container Storage Areas		•			SWMU Nos. 35-004(d, e, f, k, l, and n) are container storage areas located inside buildings (see Section 3.3.2.1). A site inspection in August 1991 revealed no evidence of spills at these sites. NFA is recommended for these sites because even if spills occurred at these storage areas, site design physically precludes migration of COCs to the environment. In addition, SWMU No. 35-004(n) is a RCRA-permitted waste storage area.	1990 SWMU report (LANL 1990, 0145); Roberson 1991, 04-0226.
35-005(a) 35-005(b) 35-006* Inactive Surface Impoundments				•	SWMUs Nos. 35-005(a and b) are the former sites of gunite-lined waste oil impoundments that were removed and closed in 1989 as Laboratory voluntary corrective actions (see Section 3.3.2.1). SWMU No. 35-006 was an unlined waste oil impoundment that was replaced by SWMU No. 35-005(a) in 1985. (Because SWMU Nos. 35-006 and 35-005[a] occupied the same site, all remedial actions undertaken for 35-005[a] also pertain to 35-006.) In 1989, following verbal approval of a closure plan by the New Mexico Environment Department (NMED), the contents of both impoundments, the concrete liners, and contaminated soils were removed, and the excavated pits were backfilled. However, post-closure verification samples collected in 1990 revealed that above-background concentrations of total petroleum hydrocarbons (TPH) were present in surface samples at SWMU No. 35-005(a), and above-background concentrations of volatile organic compounds (VOCs), TPH, and alpha activity were present in the subsurface at SWMU No. 35-005(b). In January 1992, final closure reports for these sites were submitted to EPA and NMED. These sites are currently awaiting resolution of an NMED notice of deficiency (NOD) regarding sampling sufficiency.	1991 LANL IWP (LANL 1991, 0553); Fresquez 1990, 04-0074; Fresquez 1991, 04-0076; Fresquez 1991, 04-0081.

* Designated as an HSWA Module SWMU (LANL 1990, 0145).

TABLE 6-1 (continued)

SWMUs RECOMMENDED FOR NFA AT DECISION POINT 1

SWMU No. and Type	NFA Criteria A	B	C	D	Description/Justification	References
35-007 Waste Oil Treatment System	•	•			SWMU No. 35-007 is a closed-loop system used for reprocessing nonpolychlorinated biphenyl (non-PCB) dielectric oil, which is not a RCRA hazardous waste (see Section 3.3.2.1). The system is located within a curbed spill retention area designed to contain oil spills. A container storage area, SWMU No. 35-004(c), and a storage tank, SWMU No. 35-011(c), are also located inside this bermed area. NFA is recommended at this site because the materials managed are not hazardous wastes, and because site design prohibits the migration of spilled oil from the site to the environment.	1990 SWMU report (LANL 1990, 0145); Roberson 1991, 04-0226.
35-011(a) Underground Storage Tanks		•			SWMU No. 35-011(a) consists of two active aboveground fiberglass tanks located in the basement of building TA-35-2 (see Section 3.3.2.1). The tanks receive potentially contaminated wastewater. The tanks and surrounding floor were inspected in August 1991, and no evidence of spills was observed. If a spill did occur, the wastewater would flow into floor drains that are tied in to the sanitary waste lagoons east of TA-35 (SWMU No. 35-010). NFA is recommended for this site because a direct release from this site to the environment is precluded by containment within the basement or by diversion through floor drains to the sanitary waste lagoons.	1990 SWMU report (LANL 1990, 0145); Roberson 1991, 04-0228.
35-011(b) Underground Storage Tank				•	SWMU No. 35-011(b) consists of an inactive underground storage tank (UST) (TA-35-159) that formerly stored contaminated waste dielectric oil, which may have contained PCBs and possibly other COCs (see Section 3.3.2.1). Further investigation showed the UST has been emptied and abandoned in place, and the ground above the tank has been covered with concrete; therefore, there is currently little potential for off-site migration of COCs. The site is scheduled to be investigated and remediated in accordance with NMED UST regulations. No further investigation is recommended as part of the OU 1129 RFI because the Laboratory must close the site to comply with state UST regulations.	Umphres pers. comm. in Roberson 1991, 04-0226. McInroy 1992, 04-0255.

* Designated as an HSWA Module SWMU (LANL 1990, 0145).

TABLE 6-1 (continued)

SWMUs RECOMMENDED FOR NFA AT DECISION POINT 1

SWMU No. and Type	NFA Criteria A	B	C	D	Description/Justification	References
35-011(c) Underground Storage Tank		•		•	SWMU No. 35-011(c) consists of an active UST (TA-35-197) and an associated aboveground tank. These tanks are associated with the oil-reprocessing facility, SWMU No. 35-007 (see Section 3.3.2.1). Currently, this system handles only non-PCB dielectric oil, but the tanks may have received oils contaminated with water in the past. The aboveground tank is located within a bermed area that precludes migration of COCs to the environment. The UST was leak-tested in 1991 and found to be tight; therefore, it is assumed that the tank has not leaked in the past. NFA is recommended for this site because leakage from the UST is not suspected, and because potential releases from the aboveground tank are prevented by site design from reaching the environment.	1990 SWMU report (LANL 1990, 0145); International Technology Corporation 1991, 0648.
35-011(d) Underground Storage Tanks				•	SWMU No. 35-011(d) includes two USTs that were formerly used for storage of dielectric oils (see Section 3.3.2.1). The tanks were removed and inspected in 1991 and found to have no leaks. However, the area around the tanks is essentially saturated with oil, because of leakage from an aboveground oil-handling facility formerly located at the area. This spill area is designated as SWMU No. 35-014(f). NFA is recommended for the USTs because they have been removed and it was determined that they were not the source of the spilled oil. The oil-contaminated area, which includes the former UST locations, will be investigated as SWMU No. 35-014(f).	Carmichael 1991, 04-0215. McInroy 1991, 04-0219.
35-012(a) Inactive Storage Tank				•	SWMU No. 35-012(a) consists of one UST (TA-35-158) that received dielectric oils, solvents, etc. from spills that occurred inside TA-35-85 (see Section 3.3.2.1). The tank was leak-tested before removal, and no leaks were found. The tank was removed in 1990 as an RCRA interim status closure and the pit was backfilled and covered with asphalt. NFA is recommended for this SWMU because remediation is complete, and the results of confirmatory sampling were submitted to EPA and NMED in the final closure report (estimated date of submittal was December 1, 1991).	McInroy 1991, 04-0219.
35-012(b) Inactive Storage Tanks	•				SWMU No. 35-012(b) consists of two aboveground siege tanks (TA-35-278 and -279) located near the canyon edge southwest of TA-35-207. The tanks were installed, but were reportedly never used. The site is recommended for NFA because the tanks were never used for management of hazardous constituents.	Umphres pers. comm. in Roberson 1991, 04-0226.

TABLE 6-1 (continued)

SWMUs RECOMMENDED FOR NFA AT DECISION POINT 1

SWMU No. and Type	NFA Criteria A	B	C	D	Description/Justification	References
35-013(a) 35-013(b) 35-013(c) 35-013(d) Sumps and Drains	•	• • • •			SWMUs No. 35-013(a through d) consist of several sumps, drains, and catch basins that are all located within buildings (see Section 3.3.2.1). The sumps and drains receive contaminated sanitary and industrial wastewater. Catch basins included in SWMU No. 35-013(a) reportedly have never been used, and one pair of floor drains included in SWMU No. 35-013(d) have never been used. Potential contamination cannot be adequately addressed without removal of the floors, and there is no potential for this contamination to migrate further to the environment. Any contamination beneath the buildings is considered to be under institutional control until the buildings undergo D&D. NFA is recommended for these sites because site design precludes the migration of COCs to the environment.	1990 SWMU report (LANL 1990, 0145); Umphres pers. comm. in Roberson 1991, 04-0226.
35-014(e_3) Operational Release		•			SWMU No. 35-014(e_3) is the site of a dielectric oil spill located on the west side of TA-35-85 between buildings TA-35-85 and TA-35-222. The site has since been covered with concrete and new construction (see Section 3.3.2.1). Since the concrete acts as a cap, there is essentially no mechanism for physical transport of potentially hazardous materials from the site. Contamination can be considered to be under institutional control until the buildings and concrete undergo D&D. NFA is recommended because site conditions and institutional controls preclude any releases that might pose a threat to human health or the environment.	1990 SWMU report (LANL 1990, 0145); Roberson 1991, 04-0226.
C-35-005 C-35-006 Potential Release Sites	• •				Potential release site C-35-005 was a spill of 100 gal. of non-PCB-contaminated dielectric oil, and site C-35-006 was a spill of 5 gal. of organic waste solvent (see Section 3.3.2.1). Spills at these two sites were cleaned up immediately following the incidents (1986 and 1988, respectively). NFA is recommended for these sites because they involved one-time spills that were immediately cleaned up, and because the amounts of spilled materials remaining after cleanup do not present a risk to human health or the environment.	1990 SWMU report (LANL 1990, 0145); Bailey 1986, 04-0023.
C-35-008 Potential Release Site		•	•	•	Potential release site C-35-008 is a leaking PCB transformer (ID No. 5618) located in the basement of building TA-35-2 (see Section 3.3.2.1). The oil/water mixture that leaked from the transformer underwent cleanupunder the Toxic Substance Control Act (TSCA). NFA is recommended because a potential release to the environment was prohibited by site design and conditions, and the transformer has been removed.	1990 SWMU report (LANL 1990, 0145).

TABLE 6-1 (continued)

SWMUs RECOMMENDED FOR NFA AT DECISION POINT 1

SWMU No. and Type	NFA Criteria A	B	C	D	Description/Justification	References
42-004 (C-42-001) Canyon Disposal				•	SWMU No. 42-004, a canyon disposal site, was used for dumping building debris (see Section 3.4.2.1). (Note: SWMU No. 42-004 is the same as C-42-001.) Soil samples collected and analyzed in 1991 as part of an ERIA contained gross-alpha, -beta, and -gamma at background levels. No VOCs, semivolatile organic compounds (SVOCs), or PCBs were detected. Toxicity characteristic leaching procedure (TCLP) metals (Ag, As, Ba, Cd, Cr, Hg, Pb, and Se) were below regulatory level in 40 CFR 261.24, Table 1. NFA is recommended for this site because the site has been characterized and it has been determined that COCs are not present in concentrations that might pose a risk to human health or the environment.	Fresquez 1991, 04-0075.
48-002(d) Container Storage Area		•			SWMU No. 48-002(d) is an active container storage area located inside building TA-48-1 and is currently used only for temporary storage of boxes of solid radioactive waste (see Section 3.5.2.1). A site inspection in 1991 revealed no visible evidence of past releases. NFA is recommended because site conditions preclude migration of COCs from the site to the environment.	1990 SWMU report (LANL 1990, 0145); Roberson 1991, 04-0175.
48-004(a) 48-004(b) 48-004(c) Sumps and Tanks		• • •			SWMU Nos. 48-004 (a, b, and c) consist of several sumps and tanks that were abandoned in place within building TA-48-1 (see Section 3.5.2.1). If COCs have seeped through the floors of the building, contamination cannot be adequately addressed without removal of the floors, and there is no potential for this contamination to migrate to the environment. Any contamination beneath the building is considered to be under institutional control, and will be assessed when the buildings undergo D&D. NFA is recommended for these sites because even if primary releases from the sumps and tanks occurred, site design would preclude the migration of COCs to the environment.	1990 SWMU report (LANL 1990, 0145).
48-004(d) Sumps and Tanks	•	•			SWMU No. 48-004(d) is a small tank that was installed below the hot cell in the basement of TA-48-1, but has never been used (see Section 3.5.2.1). NFA is recommended for this site because the site was never used, and because site design and conditions preclude migration of COCs from the site to the environment.	1990 SWMU report (LANL 1990, 0145); Roberson 1991, 04-0175.

TABLE 6-1 (continued)

SWMUs RECOMMENDED FOR NFA AT DECISION POINT 1

SWMU No. and Type	NFA Criteria A	B	C	D	Description/Justification	References
48-006 Active Septic System	•				SWMU No. 48-006, an active septic system, was installed in the early 1980s and has only served office buildings in which hazardous or radioactive materials have never been managed (see Section 3.5.2.1). NFA is recommended for this site because there is no contaminant source term and there is no reason to suspect releases of COCs from this septic system.	1990 SWMU report (LANL 1990, 0145).
48-008 Leakage from PCB Transformers	•	•			SWMU No. 48-008 consists of two PCB transformers that are located inside the basement of building TA-48-1 (see Section 3.5.2.1). Oil that leaked from these transformers was cleaned up in accordance with TSCA guidelines, and no visible signs of oil stains were observed during a site inspection in July 1991. NFA is recommended for this site because a potential release to the environment is precluded by site design and conditions, and because the leakage represents a nonsystematic release that was immediately cleaned up.	1990 SWMU report (LANL 1990, 0145); Helmick pers. comm. in Roberson 1991, 04-0175.
52-001(a)* Filter Pit 52-001(b)* Heat Dump Building 52-001(c)* Heat Dump Pad				• • •	SWMU Nos. 52-001(a through c) consist of equipment that was associated with the filter and cooling systems of the Ultra-High-Temperature Reactor Experiment (UHTREX) reactor (see Section 3.6.2.1). These sites underwent D&D in 1989 and were decontaminated to levels below Department of Energy (DOE) guidelines for radioactivity. There was no process-related source for nonradioactive hazardous constituents at these particular sites, and therefore no hazardous contaminant source term. NFA is recommended because the sites have undergone remediation and COCs are not present at levels that pose a risk to human health or the environment.	Salazar and Elder 1991, 0623; Elder 1991, 04-0218.
52-001(d)* Sump Pump Room, Hot Cells, Duct Work		•		•	SWMU No. 52-001(d) consists of contaminated equipment inside building TA-52-1 that was associated with the UHTREX reactor (see Sections 3.6.2.1 and 3.6.2.4). The contaminated equipment was removed in 1989, and the building was decontaminated to levels that do not exceed DOE guidelines for radioactivity. NFA is recommended for this SWMU because the sites have undergone remediation and COCs are not present at levels that might pose a risk to human health or the environment. In addition, site conditions preclude a release of COCs from inside the building to the environment.	Salazar and Elder 1991, 0623.

* Designated as an HSWA Module SWMU (LANL 1990, 0145).

TABLE 6-1 (continued)

SWMUs RECOMMENDED FOR NFA AT DECISION POINT 1

SWMU No. and Type	NFA Criteria A	B	C	D	Description/Justification	References
52-002(b)* 52-002(f)* Active Septic Systems	• •				SWMU Nos. 52-002(b and f) are active septic systems that were installed in the early 1980s and have only served office buildings in which hazardous or radioactive materials have never been managed (see Section 3.6.2.1). NFA is recommended because there is no contaminant source term and no reason to suspect releases of COCs from these septic systems.	1990 SWMU report (LANL 1990, 0145); Smithour 1991, 04-0222.
52-002(c)* 52-002(d)* Active Septic Systems	• •				SWMU Nos. 52-002(c and d) represent septic systems that were apparently planned but were never constructed (see Section 3.6.2.1); NFA is recommended because the sites do not exist and have never been used for the management of hazardous or radioactive materials.	Smithour 1991, 04-0222.
52-002(g)* Active Septic System	•				SWMU No. 52-002(g) is not an active septic system as designated in the 1990 SWMU report, but simply a sewage holding tank that was installed in 1989 or 1990 (see Section 3.6.2.1). The holding tank serves offices in a new building in which hazardous and radioactive materials have never been managed. NFA is recommended because the site has never been used in the management of hazardous or radioactive materials.	Smithour 1991, 04-0222.
52-003(b) Industrial Waste Lines				•	SWMU No. 52-003(b) consisted of underground industrial waste lines that transported liquid wastes from the UHTREX reactor to a waste treatment facility (SWMU No. 52-003[a]), and from there to TA-50 (see Section 3.6.2.1). The lines were removed in 1988 during the UHTREX D&D Project. The extent of COCs in the soil along the trench was characterized as part of that effort. NFA is recommended because the site has undergone remediation and confirmatory sampling indicates that COCs are present at levels that do not pose a risk to human health or the environment.	Soholt 1988, 04-0189; Salazar and Elder 1991, 0623; Elder 1991, 04-0218.
52-004 Inactive Outfall	•				SWMU No. 52-004 is an inactive outfall from which only noncontact cooling water associated with a simulated fuel rod cooling process was discharged (see Section 3.6.2.1). A radiation survey conducted in the area of the outfall during a 1988 ER Program site reconnaissance did not exceed background levels. NFA is recommended because the site was never used for the management of hazardous or radioactive materials.	DOE 1987, 0264; Roberson 1991, 04-0229.

* Designated as an HSWA Module SWMU (LANL 1990, 0145).

TABLE 6-1 (continued)

SWMUs RECOMMENDED FOR NFA AT DECISION POINT 1

SWMU No. and Type	NFA Criteria A	B	C	D	Description/Justification	References
55-001 Cementing Process 55-004 Evaporator 55-005 Filtration Unit		•			SWMU Nos. 55-001, 55-004, and 55-005 consist of a cementing process, an evaporator, and a filtration unit, which are situated together inside a series of negative-pressure gloveboxes inside the Plutonium Building, TA-55-4 (see Section 3.7.2.1). All are part of the TA-55 waste minimization process that operates under RCRA Mixed-Waste Interim Status. NFA is recommended because a release of hazardous materials to the environment from these SWMUs is precluded by site design, and because all are part of a process permitted under RCRA Mixed-Waste Interim Status at the Laboratory.	1990 SWMU report (LANL 1990, 0145); Foxx pers. comm. in Roberson 1991, 04-0211.
55-002(a) 55-002(b) Radioactive Waste Container Storage Areas		•			SWMU Nos. 55-002(a and b) are container storage areas for radioactive solid waste (see Section 3.7.2.1). SWMU No. 55-002(a) consists of several separate storage areas located inside building TA-55-4; and SWMU No. 55-002(b) includes dempster dumpsters outside of TA-55-4 that are only used for temporary storage of radioactively contaminated solid waste. NFA is recommended for these sites because site design and conditions preclude a release of COCs to the environment.	1990 SWMU report (LANL 1990, 0145); Foxx pers. comm. in Roberson 1991, 04-0211.
55-003 Containment Area	•	•			SWMU No. 55-003 consists of an aboveground storage tank and the surrounding containment structure (see Section 3.7.2.1). The tank is currently used for storage of pure nitric acid, which is product, not waste. The surrounding secondary containment structure is capable of holding the contents of the entire tank, and is designed to prevent a release of hazardous materials to the environment. NFA is recommended because the tank is not used for storage of hazardous waste, and because a release to the environment is precluded by site design.	1990 SWMU report (LANL 1990, 0145); Foxx pers. comm. in Roberson 1991, 04-0211.
55-006 Glass Breaker		•			SWMU No. 55-006 is a glass breaker designed to break radionuclide-contaminated glassware (see Section 3.7.2.1). The unit is located within a glovebox inside building TA-55-4. NFA is recommended because a release to the environment is prohibited by site design.	1990 SWMU report (LANL 1990, 0145); Foxx pers. comm. in Kaal 1991, 04-0105.

TABLE 6-1 (continued)

SWMUs RECOMMENDED FOR NFA AT DECISION POINT 1

SWMU No. Type	NFA Criteria A	B	C	D	Description/Justification	References
55-007 Thermal Combustion Units		•			SWMU No. 55-007 consists of two currently inactive thermal combustion units that are located in gloveboxes inside TA-55-4 (see Section 3.7.2.1). The units are now awaiting a RCRA mixed-waste operating permit. The units are designed so that emissions are passed through scrubbing solutions and high-efficiency particulate air (HEPA) filters. NFA is recommended because releases of hazardous materials to the environment are restricted by site design, and because the units will not be operational until appropriate RCRA permits are obtained.	Foxx pers. comm. in Roberson 1991, 04-0211.
55-008 Sumps and Tanks		•			SWMU No. 55-008 consists of several sumps and tanks that are located in the basement of building TA-55-4 (see Section 3.7.2.1). If COCs have seeped through the floors of the building, contamination cannot be adequately addressed without removal of the floors, and there is no potential for this contamination to migrate. Any contamination beneath the building is considered to be under institutional control, and will be addressed when the building undergoes D&D. NFA is recommended for this site because even if primary releases from the sumps and tanks occurred, site design would prohibit the migration of COCs to the environment.	1990 SWMU report (LANL 1990, 0145); Foxx pers. comm. in Roberson 1991, 04-0211.
55-009 Sump	•				SWMU No. 55-009 is an inactive monitoring sump located outside of TA-55-4 (see Section 3.7.2.1). The sump was used to monitor sanitary waste liquids from TA-55 for radioactivity before discharge to the TA-35 sewage treatment lagoons. Radioactivity was never detected, but the waste stream may have contained small quantities of hazardous wastes. The sump is no longer used and has been abandoned in place. NFA is recommended because hazardous wastes were not generated, treated, stored, or disposed of at the site, and radioactivity was never detected in the waste stream with the monitoring sump.	Foxx pers. comm. in Roberson 1991, 04-0211.
55-012 Inactive Hazardous Waste Container Storage Area		•			SWMU No. 55-012 consisted of a bottle that contained waste acid and heavy metals that was stored on a shelf in a laboratory inside building TA-55-4 (see Section 3.7.2.1). NFA is recommended because the bottle was removed and the contents disposed of before a site visit in November 1990, and because even if a release had occurred, site design would have precluded a release to the environment.	1990 SWMU report (LANL 1990, 0145).

TABLE 6-1 (concluded)

SWMUs RECOMMENDED FOR NFA AT DECISION POINT 1

SWMU No. and Type	NFA Criteria A	B	C	D	Description/Justification	References
55-013(a) 55-013(b) Hazardous Waste Container Storage Areas		•			SWMU Nos. 55-013(a and b) consist of two active hazardous waste container storage areas (see Section 3.7.2.1). For health and safety reasons, containers of hazardous chemicals (i.e., product, not waste materials) are located under fume hoods. The storage areas are located within building TA-35-3 and -4. NFA is recommended because site design and conditions preclude a release that might pose a threat to human health or the environment.	1990 SWMU report (LANL 1990, 0145); Foxx pers. comm. in Roberson 1991, 04-0211.

REFERENCES

Bailey, M. G., December 3, 1986. "Oil Spill at TA-35, Antares Building," Pan Am World Services, Inc., Memorandum to Joe J. Lopez (Manager PHSE) from Michael G. Bailey (PENV), Los Alamos, New Mexico. (Bailey 1986, 04-0023)

Carmichael, J., September 20, 1991. "Report for an Environmental Restoration Interim Action Reconnaissance Survey at the Former Underground Storage Tank Site TA-35-188," Los Alamos National Laboratory Memorandum EM-8:91-298 to Robert Gonzales (EM-13) from Jeff Carmichael (EM-8), Los Alamos, New Mexico. (Carmichael 1991, 04-0215)

DOE (US Department of Energy), October 1987. "Phase I: Installation Assessment, Los Alamos National Laboratory," Volumes 1 and 2 (draft), Comprehensive Environmental Assessment and Response Program, Albuquerque Operations Office, Albuquerque, New Mexico. (DOE 1987, 0264)

Elder, J., October 30, 1991. "TA-52 Facilities Decommissioned in UHTREX D&D Project: Remove From SWMU and RPIS Lists," Los Alamos National Laboratory Memorandum HS-3-FSA:91-206 to Joe Wanda Cramer (EES-13) from John Elder (HS-3), Los Alamos, New Mexico. (Elder 1991, 04-0218)

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)

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)

Fresquez, P., November 27, 1990. "Final Closure Verification Sampling of Two Former Waste Oil Surface Impoundments (TSL-85 and -125) Located at TA-35," Los Alamos National Laboratory Memorandum HSE-8:90-1220 to John Krueger (HSE-13) from Phil Fresquez (HSE-8), Los Alamos, New Mexico. (Fresquez 1990, 04-0074)

Fresquez, P., March 1, 1991. "Results of an Environmental Restoration Environmental Action (ERIA) Reconnaissance Survey at the Site of the Proposed Nuclear Safeguard Technology Laboratory (NSTL) Near TA-55," Los Alamos National Laboratory Memorandum HSE-8:91-340 to Henry Nunes (EES-13) from Phil Fresquez (HSE-8), Los Alamos, New Mexico. (Fresquez 1991, 04-0075)

Fresquez, P., March 6, 1991. "Results of an Environmental Restoration Verification Survey of a Former Waste Oil Surface Impoundment (TSL-125) at TA-35," Los Alamos National Laboratory Memorandum HSE-8:91-352 to John Krueger (HSE-13) from Phil Fresquez (HSE-8), Los Alamos, New Mexico. (Fresquez 1991, 04-0076)

Fresquez, P., June 17, 1991. "An Environmental Restoration Interim Action (ERIA) Reconnaissance Survey at the Site of the Los Alamos Power Reactor Experiment No. 2 (LAPRE II) Reactor Vessel and Fuel Reservoir Removal Project at TA-35," Los Alamos National Laboratory Memorandum HSE-8:91-1037 to Robert Gonzales

(HSE-13) from Phil Fresquez (HSE-8), Los Alamos, New Mexico. (Fresquez 1991, 04-0080)

Fresquez, P., July 9, 1991. "Results of an Environmental Restoration Verification Survey of a Former Waste Oil Surface Impoundment (TSL-85) at TA-35," Los Alamos National Laboratory Memorandum HSE-8:91-1181 to John Krueger (HSE-13) from Phil Fresquez (HSE-8), Los Alamos, New Mexico. (Fresquez 1991, 04-0081)

Hansen J., and J. Umphreys, April 7, 1991. "Authorization to Perform Preliminary Decontamination and Decommissioning Activities at A-Wing of TSL-2, TSL-3, and TSL-7," Los Alamos National Laboratory Memorar dum N-DO-92 to R. Garde (EM-7) thru T. Hirons (N-DO) from J. Hansen (N-DO) and J. Umphreys (CLS-DO), Los Alamos, New Mexico. (Hansen and Umphreys 1992, 04-0263)

International Technology Corporation, September 27, 1991. "UST Integrity Testing, Los Alamos National Laboratory, September 1991," Los Alamos, New Mexico. (International Technology Corporation 1991, 0648)

Janecky, D., February 25, 1 92. Telephone communication between K. Roberson and D. Janecky on International Technology (IT) Corporation Telephone Log, Los Alamos, New Mexico. (Janecky 1992, 04-0234)

Kaal, K., July 23, 1991. Notes recorded during site inspection of TA-55 on International Technology (IT) Corporation Field Activity Daily Log, Los Alamos, New Mexico. (Kaal 1991, 04-0105)

LANL (Los Alamos National Laboratory), 1981. "Annual Report FY 1980, Surplus LASL Facility Description," Los Alamos, New Mexico. (LANL 1981, 04-0209)

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 International Technology Corporation under Contract Number 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 1990, 0553)

LASL (Los Alamos Scientific Laboratory), no date. "Laboratory/Pan Am History Book," ENG-7, TA-3, Building 410, Room 1020, Betty Lea, Los Alamos National Laboratory, Los Alamos, New Mexico. (LASL no date, 0402)

LASL (Los Alamos Scientific Laboratory), July 1977. "LASL Ten-Year Decontamination/ Decommissioning Site Plan FY 1980 thru FY 1989," Los Alamos Scientific Laboratory Report, Los Alamos, New Mexico. (LASL 1977, 0649)

McInroy, D., November 7, 1991. "Information Needs Regarding USTs for OU 1129," Los Alamos National Laboratory Memorandum EM-8:91-591 to Joe Cramer (EES-13) from Dave McInroy (EM-8), Los Alamos, New Mexico. (McInroy 1991, 04-0219

McInroy, D., April 1, 1992. Meeting between K. Roberson (International Technology Corporation) and D. McInroy (EM-8) on IT Corporation Meeting Log, Los Alamos, New Mexico. (McInroy 1992, 04-0255)

Montoya, G. M., June 5, 1990. "Los Alamos Power Reactor Experiment No. 2 (LAPRE II) Site Characterization Summary Report," Los Alamos National Laboratory Memorandum HSE-7-90-11 to Ray Garde (HSE-7) from Gilbert M. Montoya (HSE-7), Los Alamos, New Mexico. (Montoya 1990, 04-0161)

Montoya, G. M., May 14, 1991. "TA-35 Los Alamos Power Reactor Experiment No. 2 (LAPRE) Decommissioning Project Management Plan," Document Control Number DAD-HSE-7-PMP-03, R00, Los Alamos National Laboratory, Los Alamos, New Mexico. (Montoya 1991, 04-0162)

Roberson, K., July 23, 1991. Notes recorded during site inspection of TA-55 on International Technology (IT) Corporation Field Activity Daily Log, Los Alamos, New Mexico. (Roberson 1991, 04-0211)

Roberson, K., July 25, 1991. Notes recorded during site inspection of TA-48 on International Technology (IT) Corporation Field Activity Daily Log, Los Alamos, New Mexico. (Roberson 1991, 04-0175)

Roberson, K., August 5, 1991. Notes recorded during site inspection of TA-35 on International Technology (IT) Corporation Field Activity Daily Log, Los Alamos, New Mexico. (Roberson 1991, 04-0226)

Roberson, K., August 7, 1991. Notes recorded during OU 1129 Technical Team Meeting on International Technology (IT) Corporation Meeting Log, Los Alamos, New Mexico. (Roberson 1991, 04-0227)

Roberson, K., August 21, 1991. Notes recorded during site inspection of TA-35 (east end) on International Technology (IT) Corporation Field Activity Daily Log, Los Alamos, New Mexico. (Roberson 1991, 04-0228)

Roberson, K., August 23, 1991. Notes recorded during site inspection of TAs-52 and -63 on International Technology (IT) Corporation Field Activity Daily Activity Log, Los Alamos, New Mexico. (Roberson 1991, 04-0229)

Salazar, M. and J. Elder, May 30, 1991. "Decommissioning of the UHTREX Reactor Facility at Los Alamos, New Mexico (Rough Draft)," Los Alamos National Laboratory Los Alamos, New Mexico. (Salazar and Elder 1991, 0623)

Smithour, M., September 20, 1991. Telephone communication between K. Roberson and M. Smithour on International Technology (IT) Corporation Telephone Log, Los Alamos, New Mexico. (Smithour 1991, 04-0222)

Soholt, L., October 12, 1988. "Results of Screening Analyses of Soil Material Collected from Industrial Waste Line 66 Connecting TA-52 to TA-50," Los Alamos National Laboratory Memorandum HSE8-88-603 to Miguel Salazar (HSE-7) from Lars Soholt (HSE-8), Los Alamos, New Mexico. (Soholt 1988, 04-0189)

Warren, J. L., November 18, 1974. "Areas of Concern at TA-35 to Waste Management," Los Alamos Scientific Laboratory Memorandum H8-WM-336 to File from John Warren (H-8), Los Alamos, New Mexico. (Warren 1974, 04-0197)

7.0 SAMPLING AND ANALYSIS PLANS

The Phase I sampling and analysis plans (SAPs) in this chapter have been designed to confirm the presence or absence of contamination at Operable Unit (OU) 1129. Confirmation of the presence or absence of contamination involves identifying the present location of waste streams from waste discharge sources, and the types and concentrations of contaminants of concern (COCs). Data collected from Phase I may be used to make a determination of no further action (NFA) or to design the Phase II SAP. After the Phase I investigation has been conducted at each aggregate, Phase II SAPs will be developed to define the complete nature and extent in accordance with the Phase II data quality objectives (DQOs). As outlined in Chapter 5.0 of this Work Plan, Phase II will follow directly after Phase I whenever possible to make better use of sampling personnel and equipment and to shorten the overall RFI time line.

The OU 1129 SAPs have been developed on the basis of information presented previously in this Work Plan. Refer to Chapter 3.0 for a summary of the archival information for each solid waste management unit (SWMU), Chapter 4.0 for the OU 1129 conceptual model, and Chapter 5.0 for a discussion of the DQOs for OU 1129. Figure 7-1 is a political boundary map of the area surrounding OU 1129. See also Figure 2-6 for SWMU locations.

The SAPs in this Work Plan have been written to address all Hazardous and Solid Waste Amendments (HSWA) Module SWMUs plus associated non-HSWA Module SWMUs (see Chapter 1.0 for a discussion of Module SWMUs) at OU 1129. All SWMUs listed in the 1990 SWMU report have not been addressed in this chapter; those that have not been addressed here will be submitted as technical memoranda at a later date. Table 7-1 lists those HSWA Module SWMUs and non-HSWA Module SWMUs that have been incorporated into SWMU aggregates for the purpose of SAP development. Sections 7.1 through 7.4 highlight the methods and the approach used in designing the SAPs in Sections 7.5 through 7.20, which present Phase I SAPs for SWMU Aggregates A through P at OU 1129.

7.1 Modeling in OU 1129 Sampling Plan Development

A large number of SWMUs and areas of concern (AOCs) within OU 1129 do not have available documentation on the extent of COCs in the subsurface environment. These sampling plans are designed to collect initial data at points considered most likely to yield a "hit" if residual contamination exists. To support the decisions of where to sample first and to what depths, the use of several models and modeling techniques was employed to aid in general sampling plan development.

The use of modeling at this stage of sampling plan development had four principal goals:

1) Developed a conceptual picture of potential worst-case contaminant migration within the two predominant soil regimes. This should help in picking appropriate mini mum sampling depths.

2) Helped define sampling plans in areas in which decontami nation and decommissioning (D&D) or other removal activi-

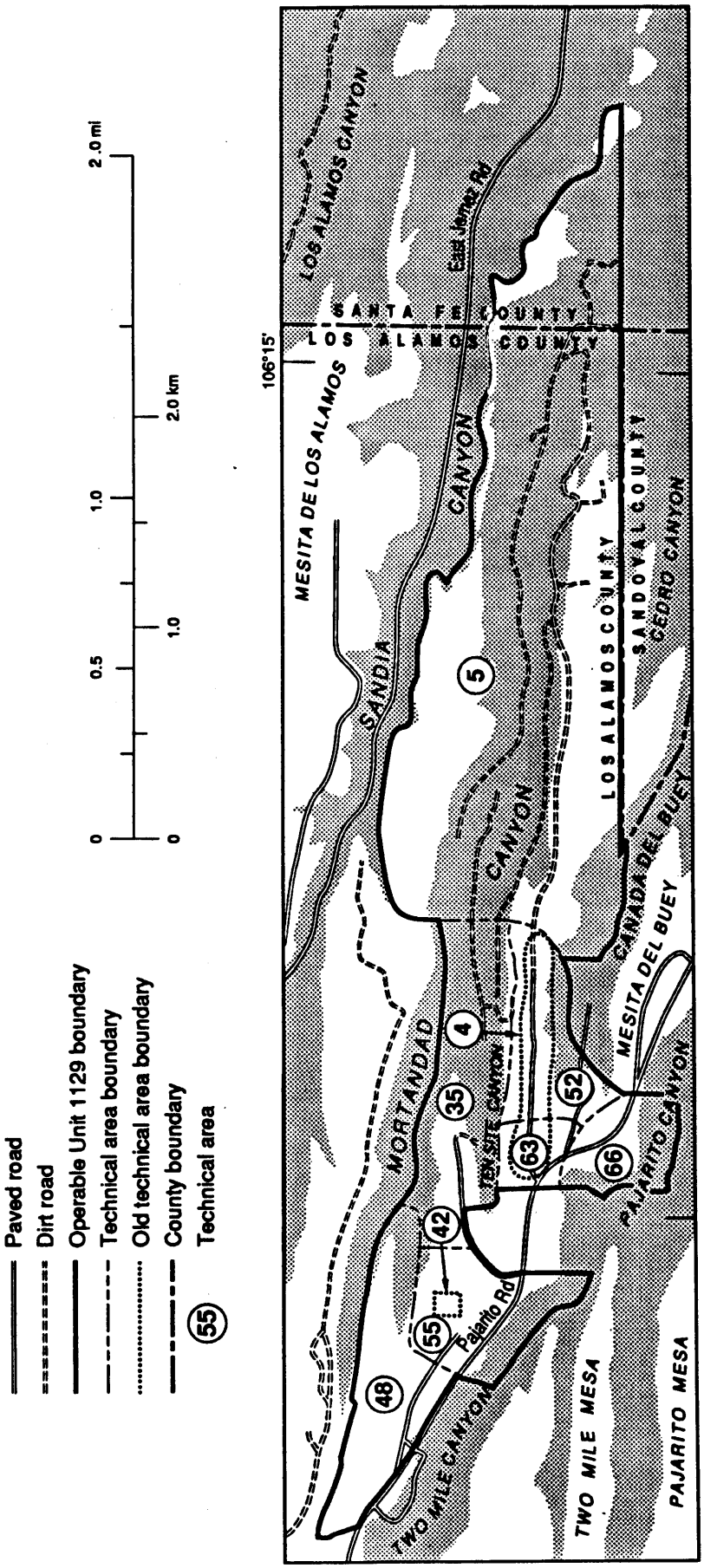


Figure 7-1. Location of technical areas at OU 1129.

TABLE 7-1

LISTING OF HSWA MODULE AND NON-HSWA MODULE PHASE I SAPS FOR OU 1129

SAP Subsection	SWMU Aggregate	SWMUs Within Aggregate
7.5	A	4-001 and 4-002
7.6	B	5-001(a,b) and 5-002
7.7	C	5-004 and 5-005(a)
7.8	D	35-003(a-i) (l-q), 35-003(r), and 55-003 (misc.)
7.9	E	35-008
7.10	F	35-009(a-d)
7.11	G	35-010(a-e)
7.12	H	35-014(a, b)
7.13	I	35-003 (j,k), 35-014(d), 35-015(a)*, and 35-015(b)
7.14	J	42-001(a-c)*, 42-002(a-b)*, and 42-003*
7.15	K	48-001
7.16	L	48-002(a,b)
7.17	M	48-003
7.18	N	48-005
7.19	O	52-002(a), and 52-003(a)
7.20	P	63-001(a,b)

* This SWMU is not listed on the HSWA Module.

ties had provided some sampling data. This should allow the first sampling to intersect zones of highest predicted concentrations.

(3) Predicted depositional concentration locations from available monitoring data for radionuclide stack emissions. This should also allow the first sampling to intersect zones of highest predicted concentrations.

4) Provided some initial estimate of the behavior of radionuclides in an environment containing organic wastes. This should indicate whether radionuclides were confined to the upper soil layers or had a greater migration potential.

To support the first goal, three scenarios involving direct discharge of liquid effluent or chemicals to the soil were created. Modeling for goals two and three used existing data and real-world meteorology. The aqueous speciation and mobility of a common radionuclide, ^{90}Sr, were examined at various pH and concentration levels in the presence of an organic ligand to satisfy the fourth goal. The results of this modeling effort are summarized in the following text.

7.1.1 Choice of Models and Constraints

The SWMUs of OU 1129 are located principally on a mesa top and in small canyon drainages off the mesa top. Because the depth of OU 1129's principal aquifer is several hundred meters, a model for examining the vadose zone was chosen for ground-level liquid effluent. The Environmental Protection Agency (EPA)-sponsored PC Graphical Exposure Modeling System (PCGEMS) was chosen for the modeling effort because it comes packaged with a data-base of EPA-listed organics and their chemical attributes, and contains the SESOIL-84 unsaturated zone model. SESOIL is a seasonal soil compartment model that estimates the rate of vertical chemical transport and transformation in the soil column in terms of mass and concentration distributions among the soil, water, and air phases in the unsaturated zone. The soil column is defined as the compartment that extends from the soil surface through the unsaturated zone to the groundwater table (General Sciences Corp., 1990, 09-0264). The structure of PCGEMS dictated that organic pollutants be used for model transport estimation.

For the modeling of air emissions, the EPA-sponsored AIRDOS/EPA code was used. This code calculates airborne concentrations of radionuclides from constant point sources. AIRDOS considers the effects of radioactive decay, dry deposition, gravitational settling, and precipitation scavenging. For this exercise the code was used for calculating cumulative surface deposition for historical stack releases. The depositional information was then used as input for a second code, SURFER, which was used to krige the results to produce an isoplethic map of the depositional pattern. No specific transport within the vadose zone of the radionuclides deposited was estimated.

An effort was also made to help focus the sampling plans for some areas by modeling the predicted zones of highest concentration on the basis of evaluation of data from previous sampling events associated with the removal of contaminated facilities. Data from these activities were used with the SURFER code to prepare isoplethic maps of contaminants in the area just east of TSL-7 in TA-35. The results of this effort is shown in the sampling plan for Aggregate D, SWMU Nos. 35-003(a-q).

7.1.2 Summary of Vadose Zone Modeling

Three scenarios were developed on the basis of known waste streams and process history within OU 1129. Scenarios 1 and 2 are identical except for the modeled pollutant and involve the hypothetical spill of a 55 gal. drum of an industrial organic compound. The spill is a one-time event that covers an area of 25 m^2. For Scenario 1, benzene (Resource Conservation and Recovery Act [RCRA] waste U019), a light nonaqueous phase liquid (LNAPL), was chosen as an indicator of behavior for many of the industrial solvents potentially present in SWMUs in OU 1129. For Scenario 2, the pollutant chosen was the dense nonaqueous phase liquid (DNAPL), 1,1,2,2 tetrachloroethane (RCRA waste U208). This compound was chosen as roughly analogous to other DNAPLs likely to be encountered, including PCB-contaminated dielectric oils.

In creating Scenarios 1 and 2, this spill was considered likely to occur only on the mesa top at TA-35. For this reason, the local Hackroy soil type was used as the top layer in the SESOIL column. The Bandelier Tuff was considered to underlay the Hackroy soils. Physical parameters for the soil were taken from the Los Alamos soil

survey (Nyhan et al., 1978, 0161). (The soils map for OU 1129 may be found in Appendix C, Figure C-1.) Because of the diversity of numbers published about the Bandelier Tuff, parameters were taken from the published modeling efforts of Travis & Trent (Travis and Trent, 1991, 04-0265). and Travis & Nuttall (Travis and Nuttall, 1985, 04-0266). For all three scenarios, the local climatological summary contained in the 1989 environmental surveillance report (Environmental Protection Group, 1990, 0497) was used to allow the SESOIL code to calculate evapotranspiration rates.

Scenario 3 is an attempt to estimate the migration potential of a low-level waste discharged on a more or less continuous basis into the Totavi soils of Ten Site Canyon. This scenario used the approximate discharge volume of the old TA-35 waste water treatment plant with an assumed concentration of 0.1% of a DNAPL. A DNAPL was chosen because of the potential radionuclide transport with anionic organic ligands (Section 7.1.6).

To develop a maximum or bounding condition of potential migration in all scenarios, the total pollutant load was assumed to have been transmitted into the soil column. No reduction of load through volatilization, run-off, or other process was allowed. The K_d, or soil sorption coefficient, was assumed to be zero and no cation-exchange capacity was assumed to exist within the soil layers. The summary of the results of the SESOIL models is graphed in Figure 7-2. The specific input parameters for the various model components are listed in Appendix C.

7.1.3 Results of Vadose Zone Scenarios 1 and 2

Scenario 1 simulated the spill of 55 gal. of benzene over a 25 m^2 area as a one-time incident on the Hackroy soil type on the TA-35 mesa top. The soil column consisted of three layers. The top two layers were comprised of 8 cm of a sandy loam above 72 cm of a clay loam, all underlain by the Bandelier Tuff. Figure 7-2 shows that the SESOIL model predicted that a maximum pollutant depth of about 3.3 m would occur after a dozen years.

In contrast, Scenario 2 involved a DNAPL and kept all other parameters the same as Scenario 1. The SESOIL results indicate that a maximum pollutant depth of 73.6 m would occur at the end of the 20 year model run. These differences follow the expected results for these two compounds given the increased mass and aqueous solubility of the DNAPL.

Given the conservative nature of these model scenarios, Phase I sampling efforts to depths scaled in time to the predicted curve ought to suffice as a minimum sampling scenario, accepting the model limitations, constraints, and assumptions.

7.1.4 Results of Vadose Zone Scenario 3

This scenario simulated the effluent migration rate for pollutants contained in the continual discharge of the TA-35 waste water treatment plant. The historical discharges over the period 1955 through 1963 were modeled for a 30-year term. Records of the plant's discharges are not complete, but effluent discharged was estimated to average about 90,000 liters a month. Witnesses indicated that a 190,000- liter spill disappeared into the canyon soils within 175 yards of the outfall; for modeling purposes, the discharges were assumed to be loaded onto an area of

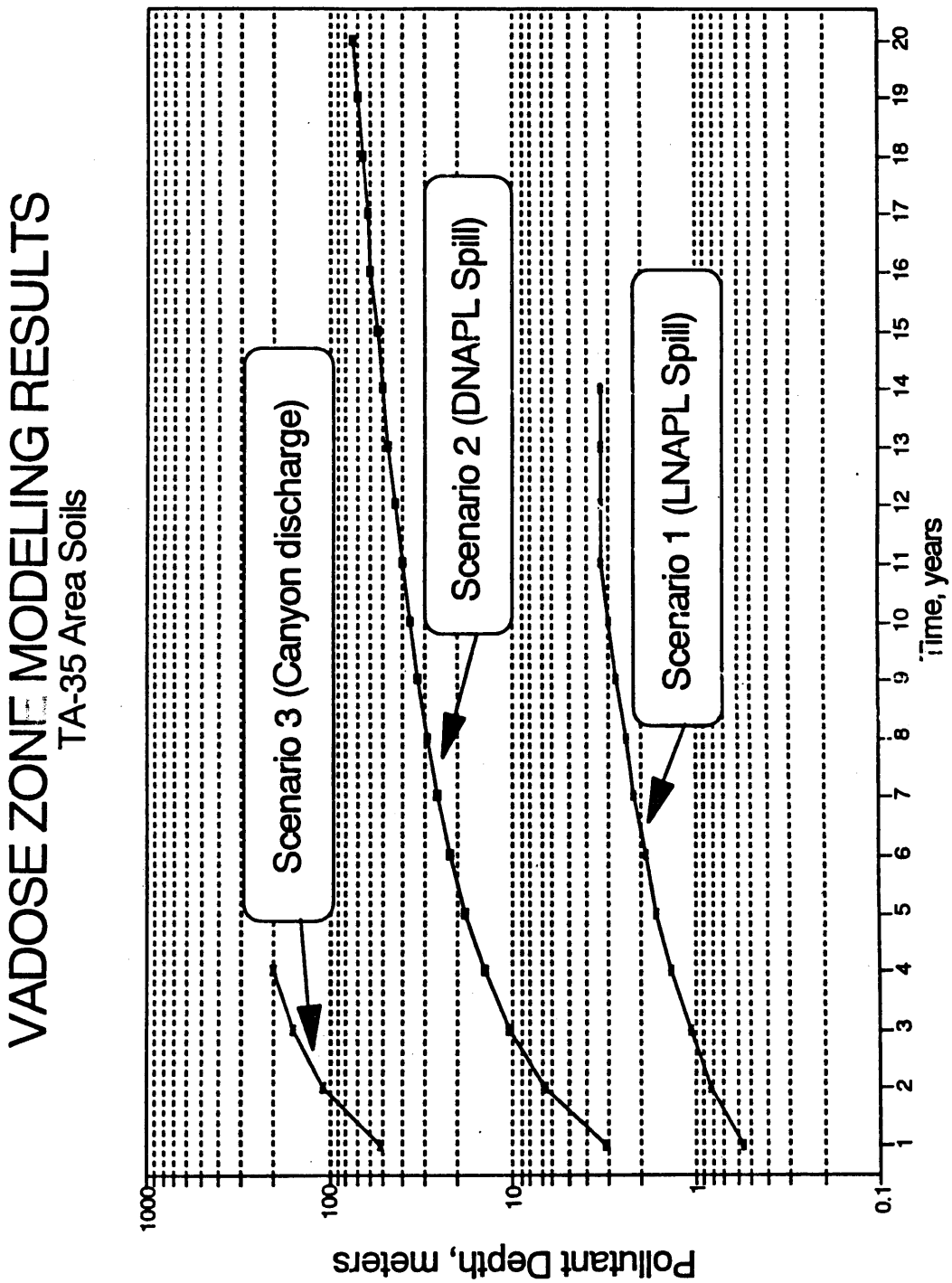


Figure 7-2. Vadose Modeling Results.

5 by 150 m.

The SESOIL model predicted that the DNAPL pollutant would reach the 200-m bottom of the Totavi soil/Bandelier Tuff column in just four years. Results indicate that the Ten Site Canyon area should be explored to a greater depth than on the mesa tops. Because of the proximity of the discharge site to known joint swarms and mapped faults in the Tuff transecting the canyon, some investigation of the area's geologic structure and fracture filling material also seems warranted. These investigations, while broader in scope, are necessary to help define the potential migratory conditions for any contaminant plume.

7.1.5 Results of Airborne Radionuclide Emissions Model

The use of atmospheric dispersion modeling is designed to help define an area of probable maximum deposition of radionuclides from selected stacks. This enables the sampling plan to immediately focus on the areas offering a greater probability of a find. The FE54 stack (further discussed in Section 7.15) on the northeast corner of TA-48-1 was chosen because this stack has a long history of monitoring results. The measured stack parameters (velocity, diameter, and height) were used as inputs, along with the actual measured source term emission rates from 1967 through 1990. The wind rose from TA-59 was used. It was assumed that most emissions occurred during daytime (regular business hours), so stability classes E and F, which normally occur only at night, were ignored. The AIRDOS output was in terms of air concentration by distance of the 16 wind directions analyzed. This output was then converted to a rate of deposition and summed for the total time span. This data was then gridded by a kriging program (SURFER), and isoplethic maps were generated (Figures 7-36 and 7-37)

The results clearly showed that the pattern of deposition is centered about 50 m northwest of the source stack, and that the total plume of deposition has an elongated NNW trending axis. Based on these results, sampling should occur to the northwest of building 48-1.

7.1.6 Aqueous Speciation and Mobility of Strontium

One of the primary concerns within the many SWMUs at OU 1129 is the possibility that radionuclides are present, and if they are present, their level of mobility or migration potential. Waste streams or plumes could occur in OU 1129 that contain both organic compounds and radionuclides. Solute molecule radionuclides are usually readily sorbed by soil particles within the first few centimeters of soil and do not present much of a migration threat in low concentrations. Organic dipoles and large organic ions are preferentially accumulated (sorbed) at the solid-solution interface, primarily because their hydrocarbon parts have a low affinity for the aqueous phase. The soils in OU 1129 usually have a fairly good cation-exchange capacity, so the expected behavior of cationic nuclides will be sorption in the upper soil horizons.

The behavior of radionuclides in an environment in which complexation with anionic ligands of some organic compounds was questionable. However, the PCGEMS system was not suitable for actually modeling transport of cations of metals, but some basic prediction of aqueous speciation and mobility could be derived from the PHREEQE computer code.

Although this Work Plan does not explore this behavior in detail, the initial results of this groundwater chemistry model tended to support the potential for greater mobility of radionuclides in environments in which anionic ligands of heavy organics are present. These results are summarized, with extended captions, in Figures C-2 through C-6 in Appendix C. The sampling plan for Ten Site Canyon (Section 7.14, Aggregate J) considers these data in results from the Scenario 3 vadose zone modeling as partial justification for extending sampling to greater depths where this potentially mixed waste stream occurred.

7.2 Radionuclide Deposition Modeling at OU 1129

Two stack effluent release points have been identified at OU1129 as the most significant airborne contributors to local radionuclide soil deposition. One stack, which was identified as the north stack (FE54) at TA-48 (radiochemistry laboratory), has released plutonium, uranium, and mixed fission products. The second stack, which was identified as a stack vented on the south side of building TA-35-2 at TA-3, has released plutonium and tritium. Both facilities have operated from the 1950s until present. TA-35 stack releases are generally less than those from TA-48 but are considered great enough to pose potential present day health concerns.

TA-48 Releases

Releases from TA-48 date as far back as 1957, although release data were found only from 1967 to present. Available release data indicate that the earlier releases were considerably larger than more recent times, presumably because of both superior engineered mitigating features and increased regulatory concern. A total of about 512 µCi of plutonium has been discharged out of the stack. Of that, 439 µCi or 86% was released between 1967 and 1970. Significant undocumented quantities could have been released before 1967.

Plutonium releases from TA-48 are assumed to be a composite mixture of plutonium isotopes including ^{238}Pu, ^{239}Pu, ^{240}Pu, ^{241}Pu, and ^{242}Pu. The plutonium mixture was separated into individual isotopic contributions using a breakdown for Rocky Flats Plant weapons-grade plutonium. Of these, the ^{238}Pu, and ^{239}Pu are known to contribute most to radiological health concerns and were individually modeled for local deposition. Older plutonium releases have experienced enough radiological decay for significant amounts of ^{239}Pu to become depleted. In addition, the ^{241}Pu component has had enough time to form significant quantities of daughter ^{241}Am. To account for these changes with time, the annual releases were adjusted for both radiological decay and formation of the americium daughter. A current-day cumulative total of 5.2 µCi ^{239}Pu, 30.0-µCi ^{239}Pu, and 9.2- µCi ^{241}Am was calculated to have been released from TA-48 stack FE54.

Uranium releases are documented as far back as 1974. A total of 207 µCi of enriched uranium (^{235}U and ^{238}U) was documented as released from the TA-48 north stack. As with plutonium, significant uranium releases likely occurred before 1974. Uranium half-lives are sufficiently long to preclude changes in composition from radiological decay during the release periods.

Mixed fission products were also released from the TA-48 north stack. A total of 19800 µCi of released fission products were documented from 1974 to present. Additional releases are suspected before 1974. The most significant fission products in the mix includes ^{90}Sr, ^{137}Cs, and ^{144}Ce. As with plutonium, radionuclide releases

occurred sufficiently long ago and half-lives are short enough to require a correction for radiological decay. A current-day cumulative total of significant radionuclides in the mix include 1000-µCi ^{90}Sr, 570-µCi ^{137}Cs, and 48-µCi ^{144}Ce, which were calculated to have been released from TA-48.

TA-35 Releases

Releases from TA-35 date as far back as 1951 although release data were found only from 1974 to present. Available release data indicate that the earlier releases were considerably larger than more recent releases. A total of about 31 µCi of plutonium have been discharged out the stack. Of that, 27 µCi or 87% was released between 1974 and 1979. Significant undocumented quantities could have been released before 1974. As with TA-48 plutonium releases, the older releases at TA-35 must be corrected for radiological decay and americium ingrowth. A current-day cumulative total of 0.34-µCi ^{238}Pu, 1.8-µCi ^{239}Pu, and 0.34-µCi ^{241}Am was calculated to have been released out of the TA-35 stack.

Tritium releases at TA-35 were documented only from 1974. Tritium, with a 12.3-year half-life, must be corrected for radiological decay. Of the 16,400 Ci of tritium released since 1974, a current-day cumulative total of only 7,050 Ci was calculated to remain.

7.2.1 Modeling Local Deposition From Stack Releases

Particulate and tritium depositions from TA-48 and TA-35 stack releases were calculated using the AIRDOS-EPA computer code. While originally developed for calculating radiological doses, AIRDOS-EPA also performs state-of-the-art air dispersion analysis. AIRDOS-EPA is a continuous point source Gaussian dispersion model approved for use by EPA. AIRDOS-EPA is one of only a few codes EPA accepts for demonstrating compliance with the Clean Air Act under 40 CFR 61, Subpart H.

Plume depletion and deposition processes contained in AIRDOS-EPA include dry deposition, gravitational settling, and precipitation scavenging. Of these, only dry deposition is believed to be a significant deposition process. Particulates contained in stack effluents are too small to be appreciably affected by gravity, and annual precipitation is too low for significant precipitation scavenging.

Dry deposition considers the effects of plume contact with the ground and is calculated using a dry deposition velocity that is a function of both the particulates' chemistry and size, and of local vegetation. For these calculations, a dry deposition velocity of 0.0018 m/s is assumed for particulates, and a value of 0.09 is assumed for tritium. These are generic values recommended by the authors of the AIRDOS-EPA code. The tritium value is greater because of its generally greater chemical reactivity.

Stack release parameters are incorporated into the calculation of the plume release height. Release height is the sum of the physical stack height and plume rise. Plume rise is calculated from the plume's momentum using the Rupp formulation which uses plume diameter and exhaust velocity.

The radionuclide releases are modeled as being released uniformly over a single year. Accordingly, meteorological data representative of an entire year is used. The AIRDOS-EPA code requires that average wind speeds be supplied for each of six

atmospheric stability classes in each of sixteen wind direction categories. Appropriate meteorological data used in the analysis were supplied by EM-8, the Environmental Protection Group at the Laboratory.

7.2.2 Levels of Local Radionuclide Deposition

Results from the AIRDOS-EPA analysis show a maximum deposition activity located at about 100 m northwest of both the TA-48 and TA-35 stacks. Maximum alpha activity at TA-48 was calculated for ^{239}Pu with a surface deposition of about $6x10^{-5}$ pCi/cm^2 (0.6 pCi/m^2). Total alpha contributions from ^{238}Pu, ^{239}Pu, ^{240}Pu, ^{241}Am, ^{235}U, and ^{238}U place the cumulative maximum surface alpha activity at about $1.6x10^{-4}$ pCi/cm^2 (1.6 pCi/m^2). Most significant beta/gamma surface concentrations at TA-48 occurred for ^{90}Sr and ^{137}Cs at 870 pCi/cm^2 and 1700 pCi/cm^2, respectively.

At TA-35, the greatest alpha surface concentrations were calculated 100 m northwest of the stack location with a value of $5.0x10^{-6}$ pCi/cm^2 ($5.0x10^{-2}$ pCi/m^2) for ^{239}Pu and a cumulative alpha surface concentration of about $1.0x10^{-5}$ pCi/cm^2 ($1.0x10^{-1}$ pCi/m^2) from all plutonium isotopes and from americium. A maximum surface tritium concentration was estimated to occur between 50 m and 100 m northwest of the stack with a peak value of 0.0045 Ci/m^2.

Isoplethic maps of the modeled deposition for each of these stacks can be found with the sampling plan for the associated SWMUs in Aggregates K (Figures 7-36 and 7-37).

7.3 Three-Dimensional Random Sampling in OU 1129 SAP Development

The goal of Phase I sampling within OU 1129 is to determine the presence or absence of COCs, with those SWMUs containing COCs going on to Phase II sampling, and those not showing any COCs being recommended for NFA. The problem faced was to determine a method that would produce sampling locations and numbers that could be statistically justified.

The commonly used EPA approach to determine how many samples to collect (the variable N) is based on calculating N for a chosen confidence interval (CI), in which N is a function of sample variance and CI is compared to a regulatory threshold value for the sampled pollutant concentration. Unfortunately, no regulatory threshold or action level which make up the bulk of available archival sampling data within the OU, or any other comparison number for radionuclides currently exists. Therefore, this approach to defining sample number adequacy does not suffice at the present time for sites at OU 1129.

7.3.1 Random Sampling Method

Initial site investigations will focus on sampling areas in which known or suspected COCs occur, such that the first efforts will be directed toward those locations likely to yield a "hit" if contamination exists. Because the precise nature of contamination is largely unknown at OU 1129 SWMUs, a three-dimensional (3-D) random sampling approach to aid in designing the Phase I sampling plans was used. This method is consistent with methods proposed in SW-846 (EPA 1986, 0291) for investigation of

large tanks, landfills, and lagoons, in which clear delineation of horizontal and vertical contaminant distribution is not known.

The analogy established within OU 1129 is to treat each SWMU or proximal group of SWMUs as a large 3-D block (Figure 7-3). The lateral extent (from archival sampling data, or estimated from archival descriptions or site visits) for a SWMU sets the maximum x and y limits of the block, while the modeling of worst-case transport scenarios for various pollutants sets the maximum z (or vertical extent) of the block. (For purposes of sampling plan development and modeling, movement of COCs in the vadose zone is assumed to be largely vertical and minimally horizontal; see the modeling description elsewhere.) This block can then be further divided into a series of cells or nodes by placing an arbitrary x-y grid on the surface and by assigning z intervals on the basis of sampling tool dimensions.

Thus, if the x-y-z coordinates for sampling are randomly selected, any individual cell has a theoretically equal chance of being sampled, and in the case of the vertical spacing, the chance of missing a pollutant horizon by using fixed interval sampling is reduced. The results from this sampling method may later be evaluated for effectiveness, and the results used for a better Phase II sampling plan or for justification of NFA recommendations. The advantage of this approach is cost effectiveness; a minimum of sampling locations and analyses can produce a statistically valid view of contamination present (or absent) within the block investigated.

7.3.2 Use of Random Sampling in SAP Development

The use of random sampling in designing a sampling plan for Phase I investigation of any SWMU or SWMU aggregate is straightforward and is combined with modeling results, knowledge of contaminant behavior, and physical features of the sites to produce a realistic sampling plan. The basic process consists of the following steps:

1) The lateral extent of the SWMU or SWMU aggregate is defined according to archival data, contaminant behavior, amount and type of contaminant released, type of release, and soil/surface properties, and a set of x and y coordinates somewhat larger than the spill or release area is chosen.

2) The maximum likely vertical extent is estimated from modeling and depends on type of pollutant.

3) A grid of user-defined spacing is overlaid on the site and sampling grid locations and z sampling depths are randomly generated for as many boreholes and sample intervals within the block as the user directs. (In this case, a small compiled BASIC code was written that restricts random number generation to the range of grid nodes or cells within the specified block.)

4) The sampling plan is then written with the randomly selected sampling locations. The choice of analytical suites for any sample location is user determined. The minimum sampling depth for any borehole is the maximum z value ran-

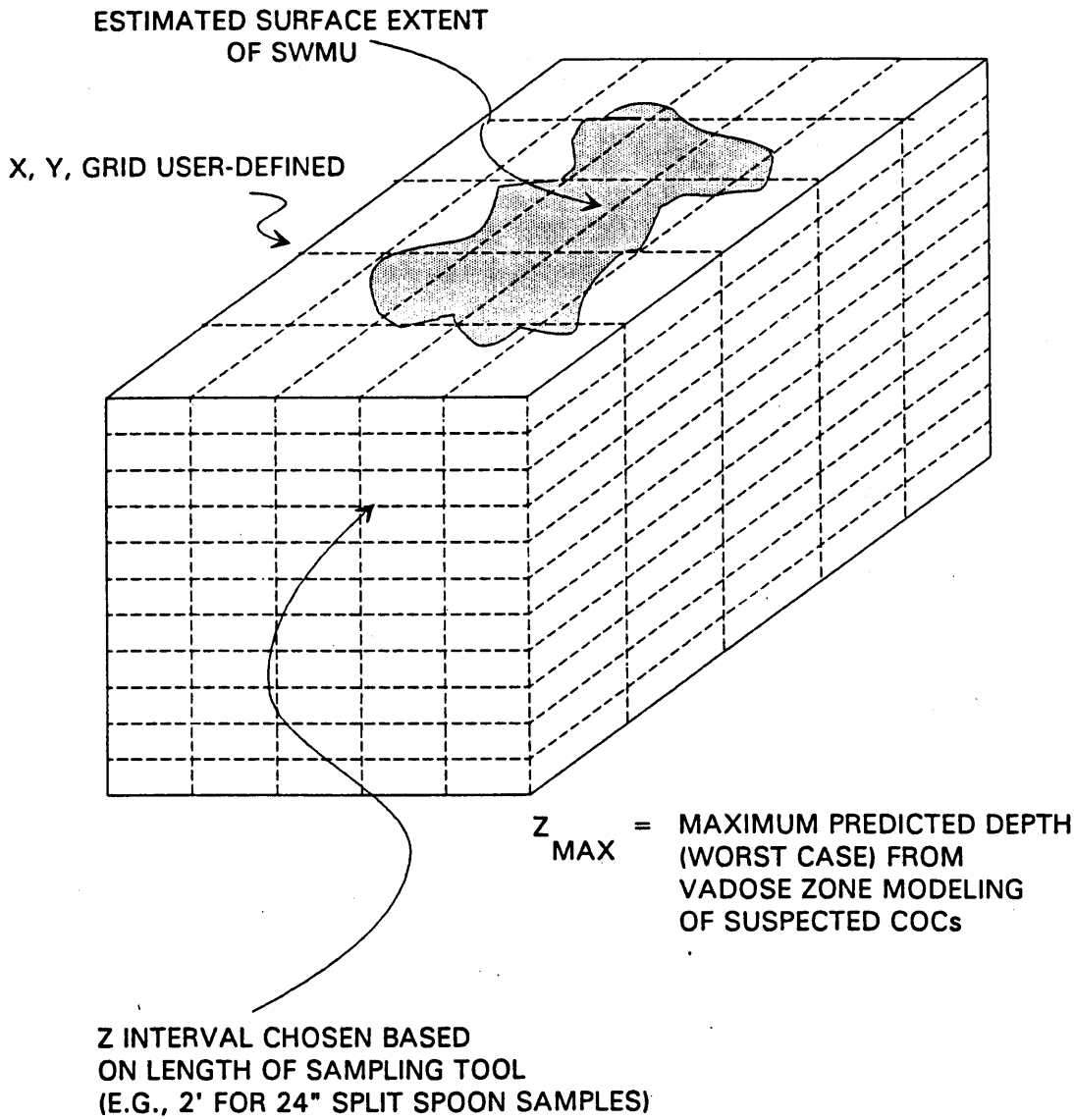


Figure 7-3. 3-D Modeling.

domly chosen unless the plan calls for a default minimum for that hole, as explained in the following text.

In all cases, the user may choose to also sample at some default depth or location. This depends on knowledge of the SWMU or its COCs and their behavior, or on finding any "hot spots" during screening of continuous core, even though this may not be a randomly selected interval. An example is a site with radionuclides that has at least one sample taken near the surface because the concentration of radionuclides through cationic adsorption to soil clay particles is expected. The plan may also state, for example, that for any site at least one sample will be taken at the maximum z depth predicted by the model. The method is designed to allow flexibility in the sampling approach while maintaining a statistically useful basis.

7.4 Surveys

The SWMUs will be field surveyed before sample collection to characterize each site. These surveys include a site engineering (geodetic) survey, which will locate the SWMU and associated features, and an environmental survey, which will initially screen for environmental concerns at each site.

7.4.1 Engineering Survey

Each SWMU will be surveyed according to procedures documented by Los Alamos National Laboratory (LANL) Facilities Engineering. The survey will locate, stake, and document the extent of the SWMU, sampling locations, and surface features. Additional features, grids, or locations will be staked according to aggregate sampling plans discussed later in this chapter. The grids will be used to of locate radiation surveys (walkovers), and in some cases, to select sample locations. Results of the engineering survey will be recorded on the site base map, and all located points and survey lines will be recorded in the New Mexico State Plane (NMSP) Coordinate System. This survey data will be incorporated into FIMAD.

7.4.2 Environmental Survey

An environmental survey will be conducted at each SWMU. These are predominately walking surveys using direct reading or recording instruments. The grid pattern established by the engineering surveys will be followed during the walkovers, so that observations can be tied back to base maps of the site. As described in some sampling plans later in this section, environmental surveys will be conducted in erosional cuts or outfalls to complement the data collected using the grid patterns. A preliminary radiological survey using a scintillometer will be conducted at each site. Additional radiological surveys, surveys for electromagnetism, and surveys for volatile organic compounds (VOCs) will be conducted as described in the individual sampling plans. Any positive results or observations will be recorded on the base map of the SWMU. In addition to characterization of the SWMUs, these surveys will be used to ensure the health and safety of personnel working at the sites.

For some sampling plans, the environmental survey will be used to select locations for biased sampling, the purpose of which is to identify contaminants at the site. The results of the environmental survey will be used as a preliminary assessment for areas where contaminants are not expected. Negative environmental results are not

conclusive evidence of the absence of contaminants; however, positive results obtained at the beginning of SWMU characterization will allow for convenient redirecting of the investigation plans.

7.5 SWMU Aggregate A, Phase 1

SWMU Aggregate A consists of SWMU Nos. 4-001 and 4-002, located on the north side of Puye Road at the eastern edged of TA-4. Both of these SWMUs are listed in the HSWA Module VIII (EPA 1990,0306) (Table 1-1). SWMU No. 4-001 represents a former firing site and SWMU No. 4-002 is a canyonside disposal area associated with the site. Figure 7-4 depicts the location of the SWMUs.

7.5.1 Sampling Plan Rationale and Objectives

Archival information indicates that the contaminants that may be present at the Technical Area (TA) 4 firing site (SWMU No. 4-001) and the corresponding canyonside disposal site (SWMU No. 4-002) consist of depleted uranium, high explosives (HEs) (because of two D&D activities and weathering, high explosives are not expected to be found), and various metals (Section 3.1). These COCs were released from routine munitions tests conducted at the firing site between 1944 and 1946. During these years, shot debris from the firing site was periodically bulldozed over the mesa to the canyonside disposal site. In August of 1985, during the Los Alamos Site Characterization Program (LASCP) cleanup effort the pit was cleaned of all debris, backfilled, and contoured. No radioactivity subsurface or surface contamination was detected during this cleanup operation (Montoya 1985, 04-0156). A radiation survey conducted in 1988 found two projectiles and a piece of shrapnel that exceeded background for beta/gamma activity (LANL 1988, 04-0126; LANL 1988, 04-0127; Shafer circa 1989, 04-0187). In early 1991, one surface soil sample was collected at the TA-4 firing pit. All metals were below EPA guidelines. Total beryllium and uranium were determined to be at background levels. No HE or semivolatile organic compounds (SVOCs) were detected (Fresquez 1991, 04-0232). A detailed description of the site activities and history of these SWMUs is found in Section 3.1 of this Work Plan.

The objective of this Phase I sampling plan is to determine the presence or absence of soil contamination at the former firing site and surface disposal site. Sampling activities are biased toward areas in which residual contamination is most likely to be present on the basis of the following conceptual model for a release at this site:

- Previous D&D activities have removed a vast majority of contaminants.
- Any remaining contaminants should be found as point sources.
- Erosion of soils containing point sources is the only likely transport mechanism.

The surface investigation at Aggregate A is designed primarily to answer the following decision points:

1) Does surface soil contamination currently exist in Aggregate A?
2) Where and how extensive are the surface and near-surface artifacts? (projectiles, shrapnel, and other potentially contami-

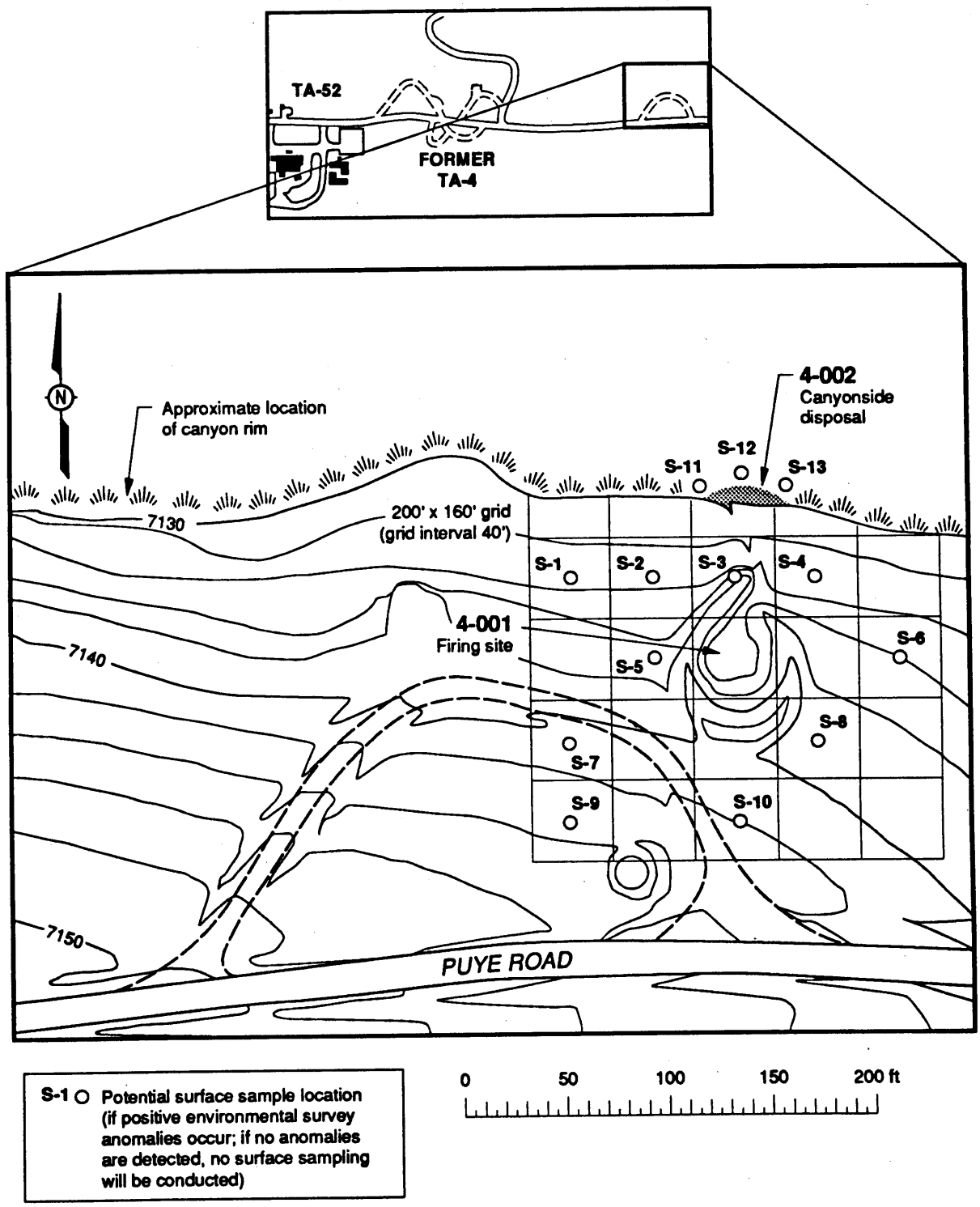


Figure 7-4. Schematic sample location map for SWMU Aggregate A.

nated objects) which in the future represent potential contaminant release points.

3) What is the potential for surface migration of contaminants.

Decision logic for Phase I field investigation activities to be conducted at SWMU Aggregate A is presented in Figure 7.5.

7.5.2 Phase I Field Activities Investigation

The Phase I investigation of Aggregate A consists of the engineering survey and environmental survey that were discussed earlier. If point sources are identified during these surveys, voluntary corrective action (VCA) to remove point sources, and surface sampling will be implemented.

The surface areas of SWMU Aggregate A will be surveyed for radiological contamination using hand-held or tripod-mounted detectors for field gamma spectroscopy systems. A geophysical survey will cover the same area proposed for the radiological survey. This survey will be conducted to locate artifacts and subsurface features. This investigation primarily addresses questions listed in section 7.1.1 (Sampling Rational and Objectives). The area encompassed by the SWMU Aggregate A plus a 25 ft margin and any erosional cuts leading from the disposal site SWMU No. 4-002 will be surveyed.

If hot spots are detected, hand-held detectors will be used to define precisely the hot spot locations and the lateral distributions of contaminants and the hot spot will be sampled. The distribution of spatial contaminants will be determined by collection of one soil sample at a depth of 6 to 12 in below the hot spot and another sample 3 ft away at the same depth at which the hot spot was located. A VCA will be conducted to remove the hot spot artifact. Soil samples will be characterized using Level III gross-alpha, -beta, -gamma; gamma spectroscopy, and alpha spectroscopy.

The drainage area from the canyonside disposal area (SWMU No. 4-002) will be undergo a radiological survey. If hot spots are located in any of the erosional cuts, they will be characterized. The survey will be extended down the erosional cuts until radioactivity levels are no longer detected.

The radiological survey of Aggregate A will be followed by geophysical survey. This investigation will focus on the following objectives:

- detect and locate near-surface artifacts and debris at the canyonside disposal site that are potential sources of contamination.
- provide confirmatory information on the location the firing site (SWMU No. 4-001).

Any artifacts or debris at or near the surface will be treated as a potential source of contamination. Therefore, when feasible, the recommendation will be made to remove such near-surface artifacts and debris will be removed as a VCA and screened for contamination. Soil samples will be characterized that are in contact with any contaminated debris or artifacts.

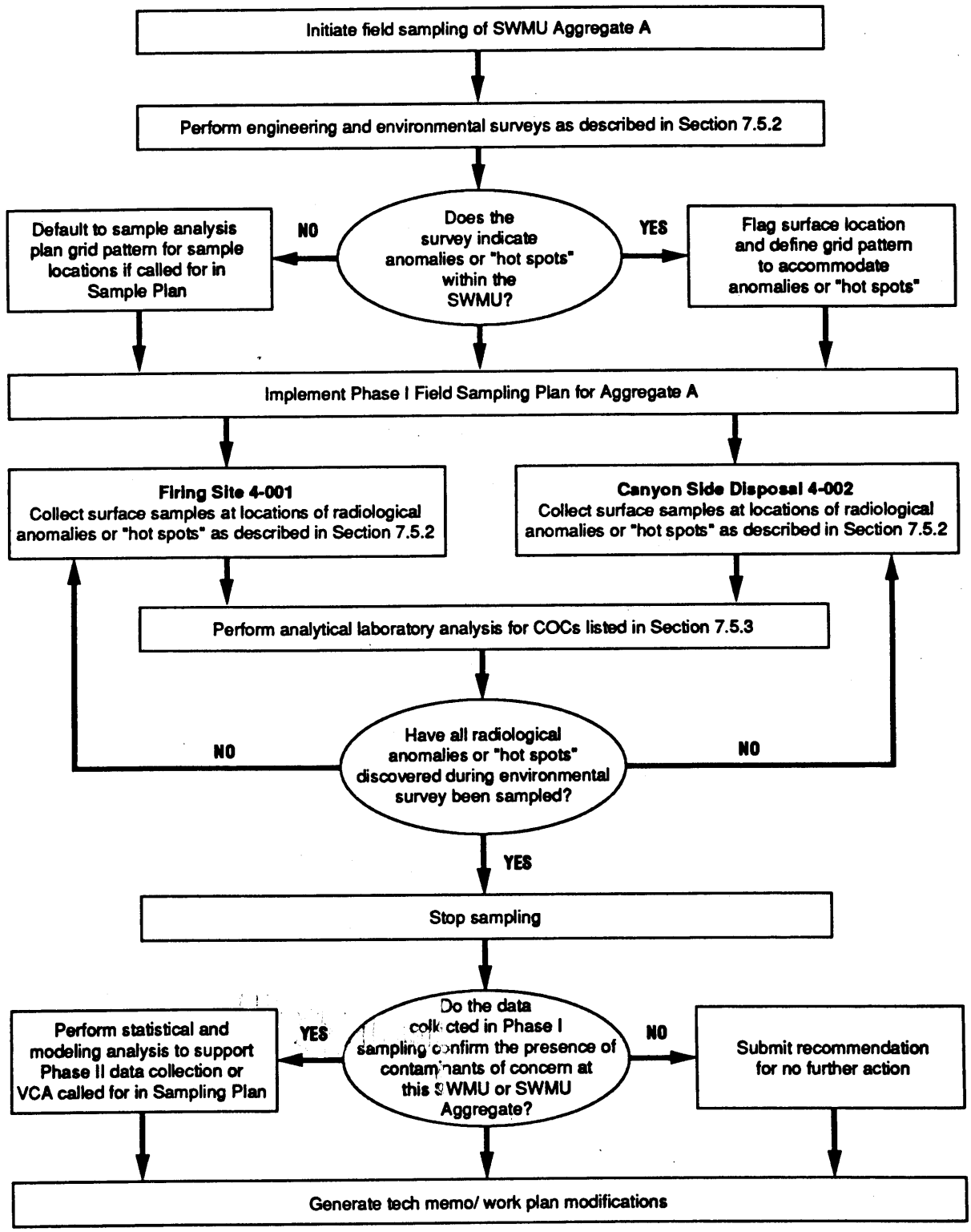


Figure 7-5. Decision logic for the sampling and analysis of SWMU Aggregate A.

7.5.3 Sample Screening and Analysis

Each soil sample will be screened for radiation using a scintillation detector for contact radiation. All sample packages must be screened for surface level of contamination and radiation. The soil samples will be analyzed at Level III for metals, gross-alpha, -beta, -gamma; gamma spectroscopy, and alpha spectroscopy.

7.6 SWMU Aggregate B, Phase I

SWMU Aggregate B consists of SWMU Nos. 5-001(a and b) and 5-002, located on the north side of Puye Road near the edge of Mortandad Canyon. All of these SWMUs are listed in the HSWA Module VIII (EPA 1990, 0306) (See Table 1-1). SWMU Nos. 5-001(a and b) represent former steel barricade Firing Pits No. 1 and No. 2, and SWMU No. 5-002 is a canyonside disposal area associated with the firing sites. Figure 7-6 depicts the location of the SWMUs. A detailed description of the site activities and history of these SWMUs is found in Section 3.2 of this Work Plan.

7.6.1 Sampling Plan Rationale and Objectives

LASCP D&D activities at TA-5 were conducted in 1985. During the LASCP site cleanup, depleted and/or natural uranium was detected as discrete spots of yellow uranium oxide. Uranium-contaminated surface soil was removed, monitored for radioactivity levels, and disposed. In areas for which contaminated soils were removed, remaining native soils were sampled to ensure that all above background radioactivity was removed (Scholl 1989, 0485). Most of the contamination at TA-5 was detected within the top 2 ft of soil. A sample of the uranium collected on site was analyzed to determine the type of uranium found at TA-5. The sample was determined to be depleted uranium.

Test shots probably dispersed contaminants in some form of a radial pattern around the firing site, and because of this dispersive release mechanism, concentrations of COCs are expected to be very low and primarily limited to near-surface soils. Contamination has been detected to a depth of 15 ft at a firing pit at TA-5. Contamination found at such depth probably occurred because multiple shots in the same area loosened the tuff and created fractures. Soil samples were collected and monitored for radioactivity at varying depths in the pit and the pit bottom. When decontamination of the area was completed, the pit was backfilled with clean soil from TA-5-1, TA-5-2, and TA-5-3 (Montoya 1985, 04-0158; Scholl 1989, 0485). While very small amounts of contaminants may remain as isolated point sources at the surface and at depths, no viable pathway to the environment can be determined within current land use scenarios.

The objective of this Phase I sampling plan is to determine the presence or absence of soil contamination at the former firing site and surface disposal site. Sampling activities are biased toward areas in which residual contamination is most likely to be present on the basis of the following conceptual model for a release at this site:

- Previous D&D activities have removed vast majority of contaminants.
- Any remaining contaminants should be found as point sources.
- Erosion of soils containing point sources is the only likely transport mechanism.

The surface investigation at Aggregate B is designed primarily to answer the following questions:

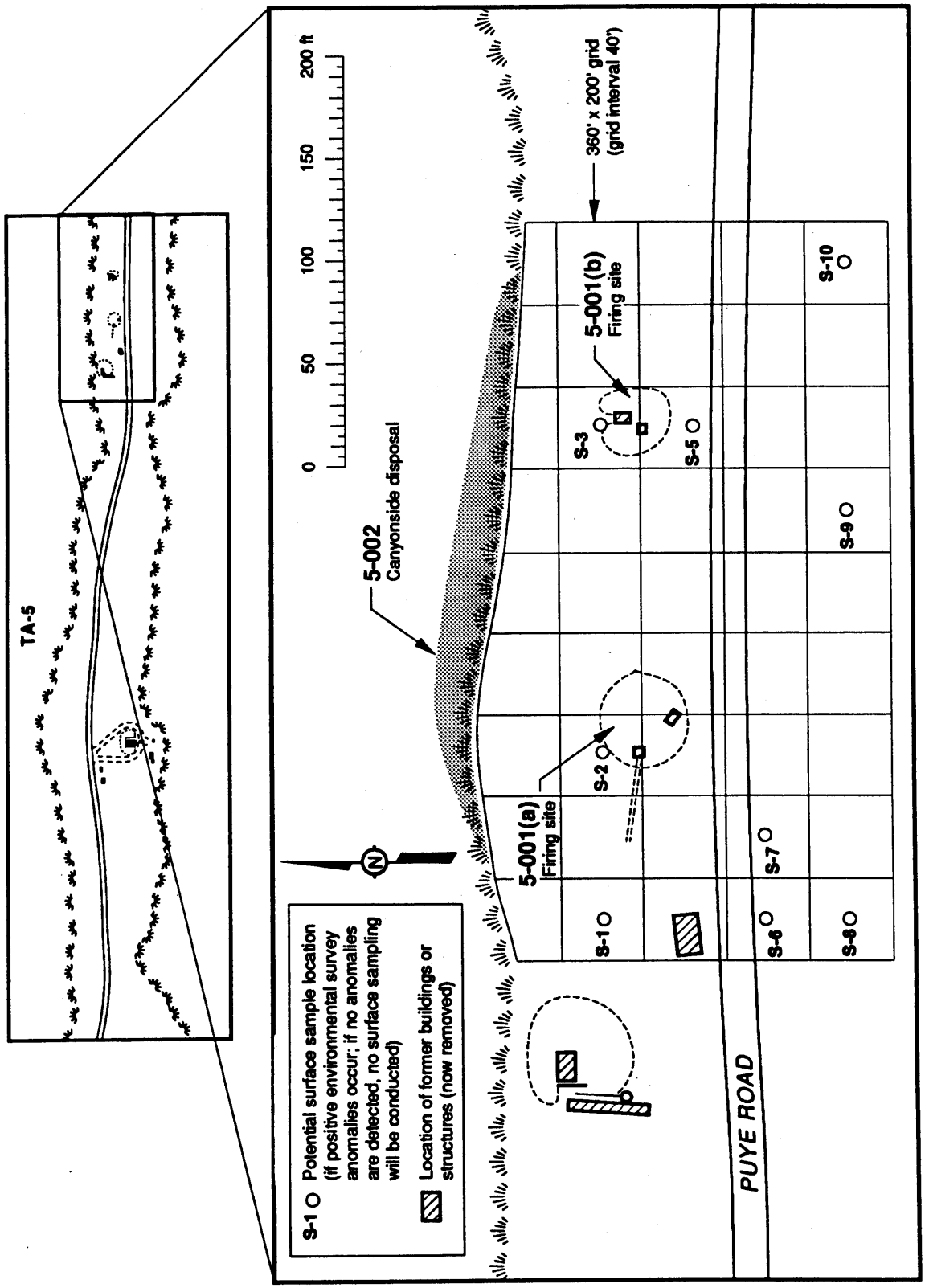


Figure 7-6. Schematic sample location map for SWMU Aggregate B.

1) Does surface soil contamination currently exist in Aggregate B?

2) Where and how extensive are the surface and near-surface artifacts (projectiles,shrapnel, and other potentially contaminated objects).

3) What is the potential for surface migration of contaminants?

Decision logic for Phase I field investigation activities to be conducted at SWMU Aggregate B is presented in Figure 7-7 and is discussed in the following text.

7.6.2 Phase I Field Investigation Activities

After the preliminary engineering survey of the SWMUs is conducted, the surface areas of SWMU Aggregate B will be surveyed for radiological contamination using hand-held or tripod-mounted detectors. A geophysical survey will be conducted to locate artifacts and subsurface features. This investigation primarily addresses questions listed in section 7.6.1 (Sampling Rationale and Objectives). The area encompassed by the SWMU Aggregate B plus a 25-ft margin and any erosional cuts leading from the disposal site SWMU No. 5-002 will be surveyed.

If hot spots are detected, hand-held detectors will be used to define precisely the hot spot locations and the lateral distributions of contaminants and the hot spot will be sampled. The distribution of spatial contaminants will be determined by collection of one soil sample at a depth of 6 to 12 in. below the hot spot and another sample 3 ft away at the same depth at which the hot spot was located. A VCA will be conducted to remove the artifact or hot spot. Soil samples will be characterized using Level III gross-alpha, -beta, -gamma; gamma spectrometry; and alpha spectroscopy analytical techniques.

The drainage area from the canyonside disposal area (SWMU No. 5-002) will undergo a radiological survey. If hot spots are located in any of the erosional cuts, they will be characterized. The survey will be extended down the erosional cuts until radioactivity levels are no longer detected.

The radiological survey of Aggregate B will be followed by geophysical survey. This investigation will focus on the following objectives:

- Detect and locate near-surface artifacts and debris at the canyonside disposal site that are potential sources of contamination.

- Provide confirmatory information on the location the firing site (SWMU No. 5-001 [a and b]).

Any artifacts or debris at or near the surface will be treated as a potential source of contamination. Therefore, when feasible, such near-surface artifacts and debris will be removed as a VCA and screened for contamination. Soil samples that are in contact with any contaminated debris or artifact will be characterized.

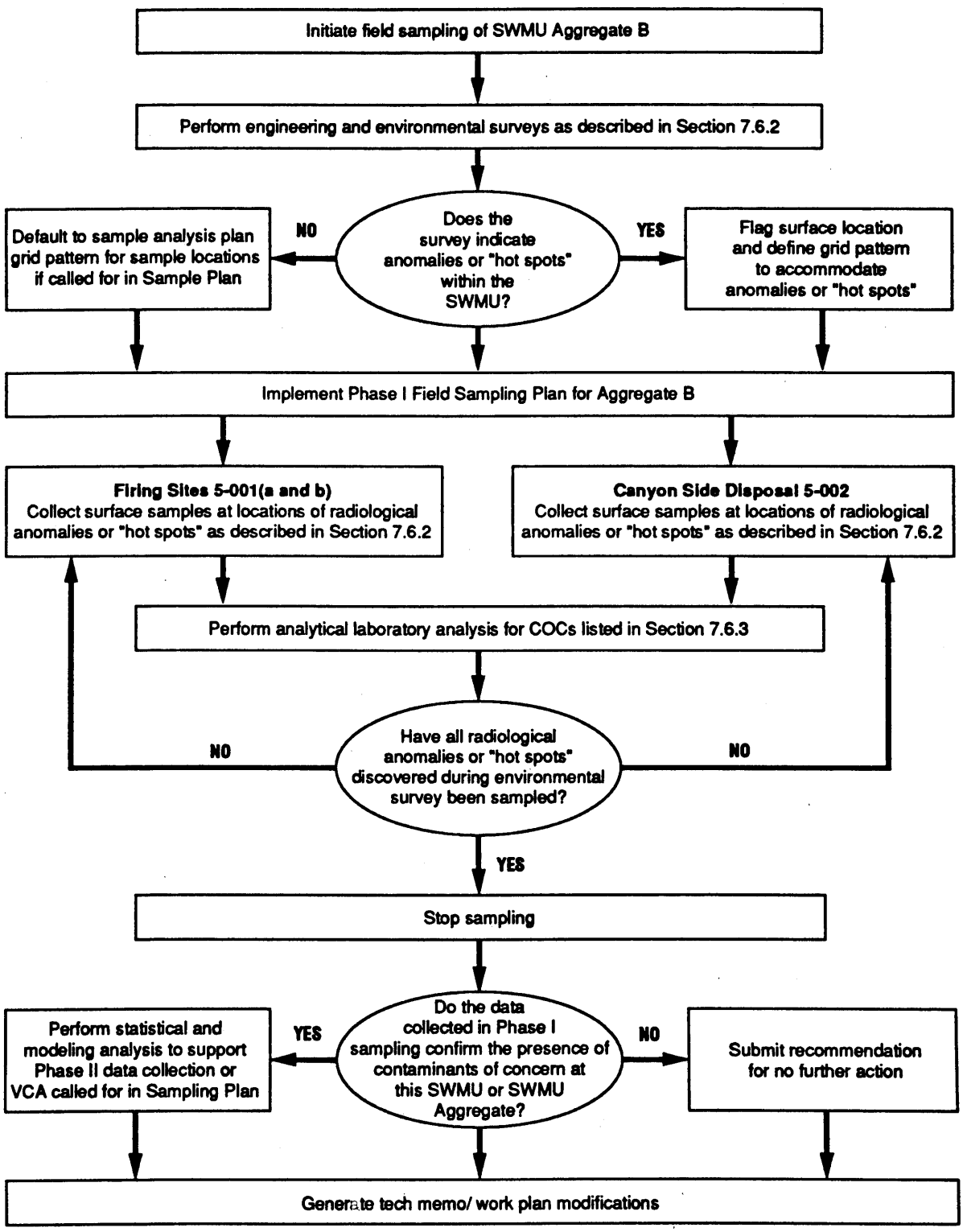


Figure 7-7. Decision logic for the sampling and analysis of SWMU Aggregate B.

7.6.3 Sample Screening and Analysis

Each soil sample will be screened for radiation using a scintillation detector for contact radiation. All sample packages must be screened for surface level of contamination and radiation. The soil samples will be analyzed at Level III for metals, gross-alpha, -beta, -gamma; gamma spectrometry; and alpha spectroscopy.

7.7 SWMU Aggregate C, Phase I

Aggregate C consists of SWMU No. 5-004, the former location of a septic tank, and SWMU No. 5-005(a), (formerly SWMU No. 5-005; see Table 1-1), a former French drain. Both SWMUs are listed in the HSWA Module VIII (EPA 1990, 0306). Both sites are located on a finger of Pajarito Mesa off of Puye Drive. The septic tank location (SWMU No. 5-004) is near the canyon edge on the south side of Puye Road, approximately 900 ft east of Pajarito Well #5, and 50 ft east of the calibration chamber (TA-5-20). SWMU No. 5-004 is the only Beta Site structure remaining at TA-5 (Figure 7-8). The former French drain (SWMU No. 5-005[a]) is located on the north side of Puye Road at the edge of Mortandad Canyon, just west of the former TA-5 firing sites of Aggregate A (Figure 7-9). A detailed description of the site activities and history for these SWMUs are presented in Section 3.2 of this Work Plan.

7.7.1 Sampling Plan Rationale and Objectives

Archival information indicates that the potential contaminants that may be present at the former septic tank, SWMU No. 5-004, include radioactive and unknown chemical constituents (Section 3.2). During site operations, liquid wastes from the laboratory building (TA-5-1) were discharged to the septic tank. Effluent from the tank was discharged to Cañada del Buey (Figure 7-8). The septic tank and lines were removed in 1960, and the site was surveyed for radioactivity in the 1985 D&D activities, but the site has not been characterized for the presence of hazardous chemical contamination. Also, a 1988 survey detected slightly above-background gamma activity. Subsurface contamination may be present beneath the former tank location, and surface contamination may be present downslope from the drain line discharge point.

Archival data indicates that the potential contaminants that may be present at the French drain, SWMU No. 5-005(a), include radioactive and unknown chemical constituents (Section 3.2). During site operations, liquid wastes from the control building (TA-5-4) passed through the French drain and discharged into the canyon. Contaminants were released to the shallow subsurface through perforations in the drain. Surface contamination may have also resulted down the slope from the drain's discharge point. D&D activities conducted in 1985 concluded that contamination found in the area of the control building was released to the environment through the French drain that serviced the building (SWMU No. 5-005[a]). The French drain and underlying "affected" soils were removed as part of the LASCP D&D program in 1985. That effort focused on radioactive contamination, and the site was not characterized for hazardous chemical contamination.

The objective of this Phase I sampling plan is to determine the presence or absence of surface and subsurface contamination at the locations of the SWMUs. If contamination is confirmed to be present after the Phase I investigation, a Phase II investigation will be conducted to determine the nature and extent of contamination at the site. Sampling activities are biased toward areas in which residual contamination is most likely to be present based on the following conceptual model for this site:

- Previous D&D activities have removed most of the COCs although, in some cases, only radiological wastes were characterized and therefore some chemical contamination was potentially missed.

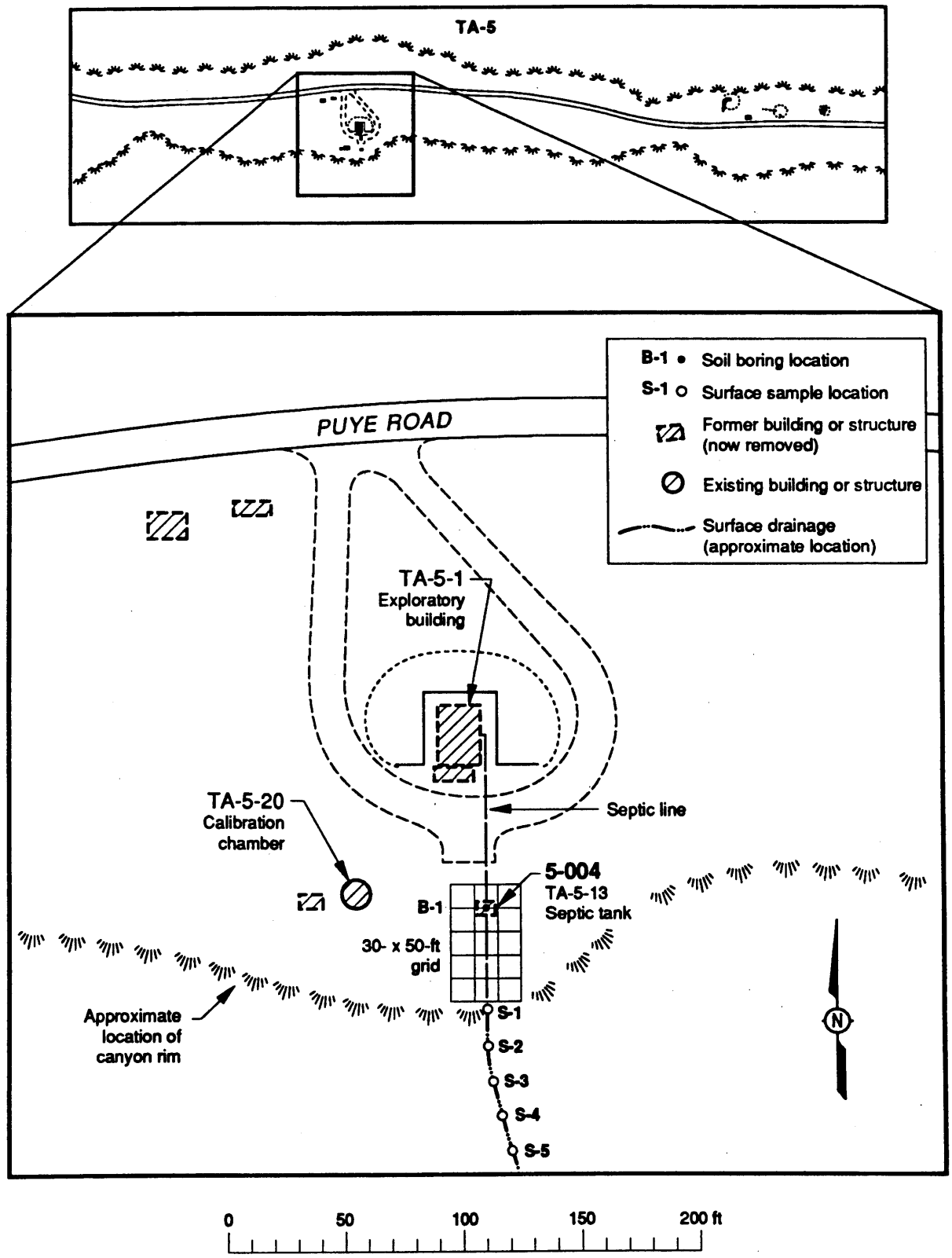


Figure 7-8. Schematic sample location map for SWMU 5-004.

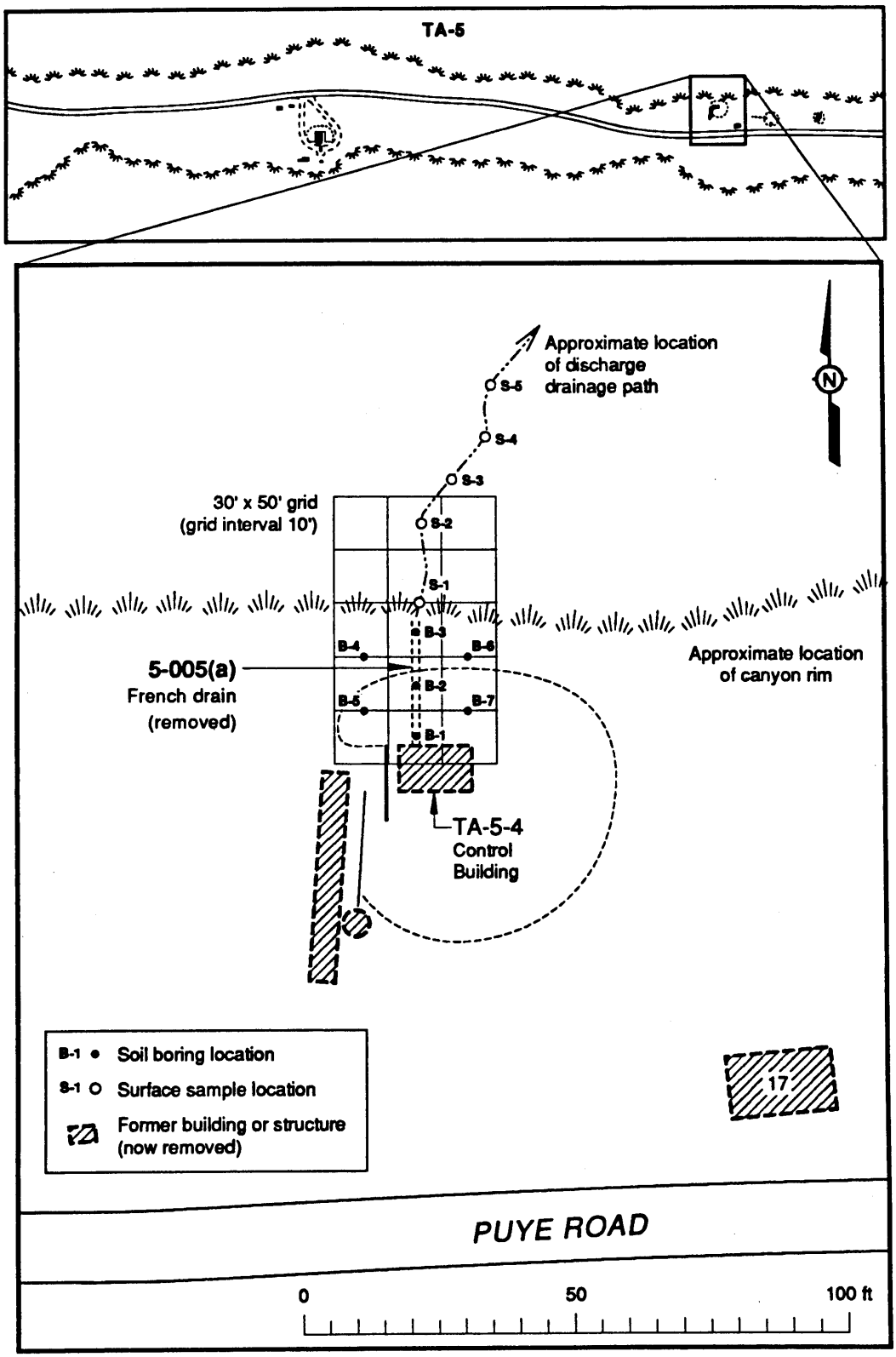


Figure 7-9. Schematic sample location map for SWMU 5-005(a).

- Any remaining contaminant plumes may have moved because the liquid associated with the contaminants provided a transportation mechanism.

The surface investigation at Aggregate C is designed primarily to answer the following :

1) Does surface and subsurface contamination currently exist in Aggregate C?

2) Are there any near-surface artifacts remaining which represent potential contaminant release points?

3) What is the potential for surface and subsurface migration of contaminants?

Decision logic for Phase I field investigation activities to be conducted at SWMU Aggregate C is represented in Figure 7-10 and is discussed in the following text.

7.7.2 Phase I Field Investigation Activities

The land engineering survey will locate the former French drain (SWMU No. 5-005[a]) and its discharge point, and the former septic tank location (SWMU No. 5-004) and its drain line discharge point. This data will be recorded on base maps of the areas. A 30-ft-wide (east-west) by 50-ft-long (north-south) grid will be surveyed at each site to encompass the area potentially impacted by the French drain and septic tank. Individual grid blocks will be 10 ft by 10 ft. The grid for SWMU No. 5-004 will include the former location of the septic tank and the discharge point of the drain line (Figure 7-8). The grid for SWMU No. 5-005(a) will include the former location of the French drain and will extend beyond the canyon edge to include the drain line outfall (Figure 7-9).

Following the engineering survey, a radiation survey will be conducted at each site to identify potential radiological anomalies within the grid areas. At each site, a scintillation detector will be used to survey the entire grid area. The location and activities of radiological anomalies above natural background within the corresponding grid block will be recorded on the field log. Along with the grid radiation survey, a walkover survey of the discharge drainage channel below each outfall will be performed. The survey will be conducted in the erosional channels of the outfalls to measure radioactivity. These surveys will continue until no contaminants can be found using a scintillation detector. The locations of radiation anomalies detected in the channel will be flagged and the corresponding activities will be recorded on the field log.

The radiological survey of Aggregate C will be followed by a geophysical survey. This investigation will focus on the following objectives:

- Detect and locate near-surface artifacts and debris that are potential sources of contamination.

- Confirm the location of the French drain and septic tank (SWMU Nos. 5-004 and 5-005 [a]).

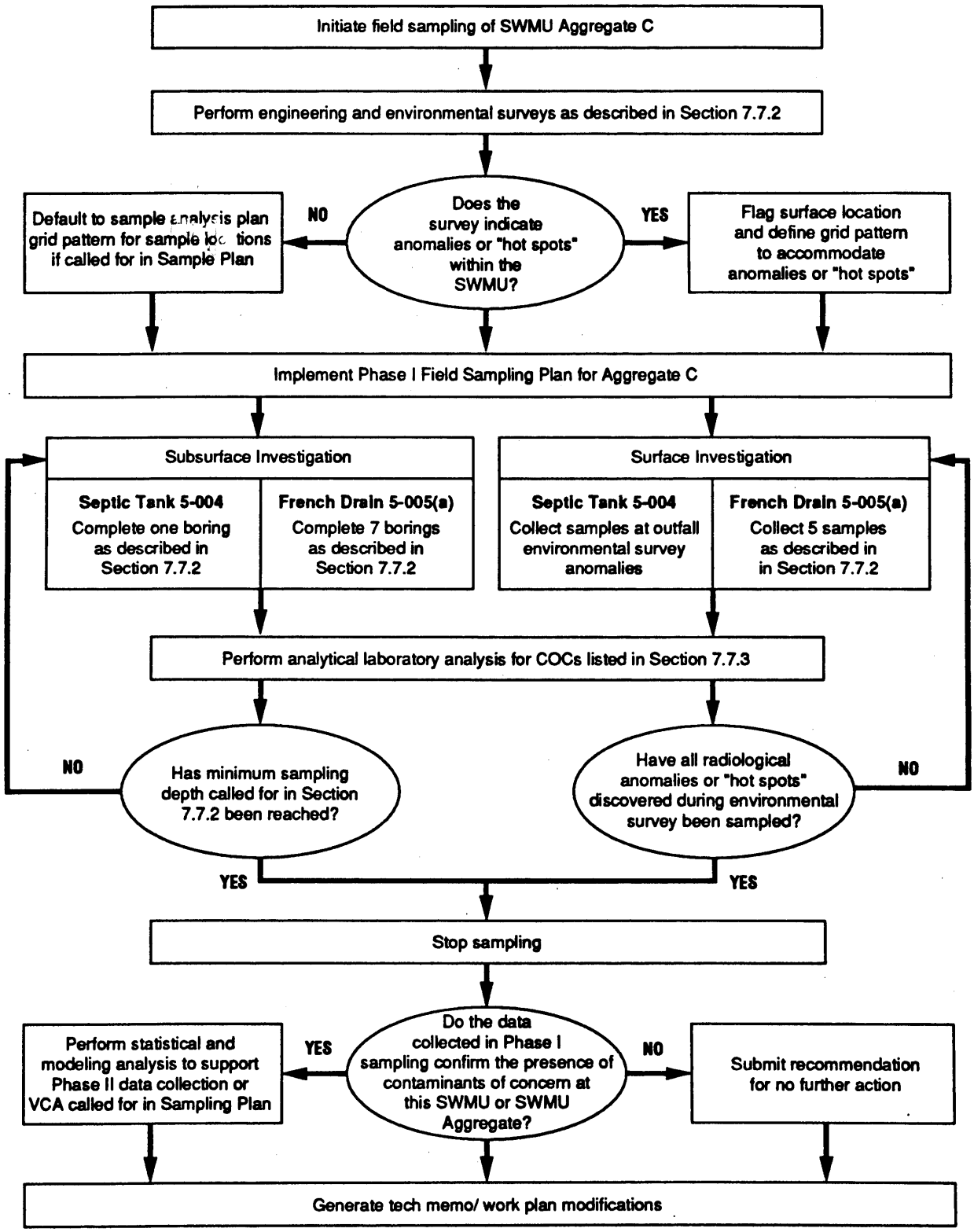


Figure 7-10. Decision logic for the sampling and analysis of SWMU Aggregate C.

Any artifacts or debris on or near the surface will be treated as a potential source of contamination. Therefore, when feasible, such near-surface artifacts and debris will be removed as a VCA and screened for contamination. Soil samples that are in contact with any contaminated debris or artifact will be characterized.

SWMU No. 5-004, Septic Tank - Subsurface Investigation

The septic tank, TA-5-13, was used between 1948 and 1959 to handle wastes from the laboratory building, TA-5-1. No information is available regarding the wastes that were discharged to the tank. However, a 1959 survey indicated that the tank was free of HE and radioactive contamination, but was contaminated with unspecified "acid". Hazardous chemical contamination is suspected at the site of the septic tank and beneath the outfall from the discharge line. The tank and all piping were removed in 1960, and removal was confirmed in 1985. No radioactive contamination was detected at the site during the 1985 D&D, but a 1988 survey detected slightly above-background gamma activity (Table 3-8). For this reason, radiation surveys will be conducted for the presence of radionuclides. Because more than 30 years has elapsed since the site operated, VOC surveys will not be conducted.

Subsurface soil samples will be collected from one boring at the site. The purpose of the borehole is to determine the presence or absence of soil contamination at the site of the former septic tank (Figure 7-8). The borehole will be placed at the former septic tank location. If radiological anomalies are detected during the environmental survey, boreholes will default to these locations. If contamination is located, a Phase II program will be developed.

The borings will be drilled to a minimum depth of 15 ft using a hollow-stem auger. Sampling will begin at a depth of 5 ft in order to avoid sampling soils above the level of the septic tank. A 5-ft-long split-barrel core sampler will be used to collect soil/rock samples in 5-ft intervals. Upon each retrieval, the entire length of the core sample will be screened for radiation (see Section 7.7.3, Sample Screening and Analysis). One sample for each required analytical method will be collected at the section of core with the highest observed radioactivity. If no above-background radioactivity is detected, the samples will be collected from a random core interval. The exact depth of each sample collected will be recorded on the field log. Drilling will stop when field screening determines that two consecutive core intervals are below background for radiation.

Samples will be analyzed for Level III gross-alpha, -beta, -gamma; gamma spectrometry; alpha spectroscopy; SVOCs; metals; and miscellaneous analytes.

SWMU No. 5-004, Septic Tank - Surface Investigation

Because canyon sides were not investigated during the 1985 LASCP D&D, the discharge channel needs to be characterized for the presence of hazardous chemical and radiological contamination. Surface soil/rock samples will be collected from any locations in the erosional drainage that show anomalies from the field environmental surveys or from 5 locations along the erosional axis at 15 ft intervals where topography allows (Figure 7-8).

Each soil sample will be collected with a clean stainless-steel trowel. If soil is not present at the sample location, a hammer and chisel will be used to collect a rock chip sample. Each sample will be screened for radiation (see Section 7.3.3) before submittal to the laboratory for analysis.

Samples will be analyzed for Level III gross-alpha, -beta, -gamma; gamma spectrometry; alpha spectroscopy; SVOCs, metals, and miscellaneous analytes.

SWMU No. 5-005(a), French Drain - Subsurface Investigation

The French drain was constructed in 1945 and abandoned in 1959, and was used for the discharge of liquid wastes from the control building, TA-5-4. The type of wastes introduced into the drain are unknown, but are suspected to have included radioactive and chemical constituents (see Section 3.2, Description of TA-5, Beta Site). Although the drain and affected soils were removed in 1985 during site D&D activities, the site was not characterized for the extent of hazardous constituents. The D&D effort focused solely on the removal of radioactive contamination.

Subsurface soil samples will be collected from seven soil borings installed at the site. The purpose of these boreholes is to determine the presence or absence of soil contamination at the site of the former French drain. Boring locations will be placed at radiological anomalies identified along the length of the former drain location. If radiological anomalies are not present, borings will be placed at the default grid locations. Figure 7-9 shows the locations of samples that will be collected at SWMU No. 5-005(a).

Borings at the French drain will be installed, screened, and sampled in the same manner employed at the septic tank site, SWMU No. 5-004.

Samples will be analyzed for Level III gross-alpha, -beta, -gamma; gamma spectrometry; alpha spectroscopy; SVOCs; and metals.

SWMU No. 5-005(a), French Drain - Surface Investigation

Available archival information indicates that the discharge channel at the former French drain was not investigated during 1985 D&D activities conducted at TA-5. Therefore, surface soil/rock samples will be collected from five locations at 15 ft intervals at which topography allows along the axis of the drainage pathways down the slope from the former French drain outfall that indicates positive results from radiological environmental surveys. Surface sample collection will follow the methods described for the septic tank surface investigation.

Samples will be analyzed for Level III gross-alpha, -beta, -gamma; gamma spectrometry; alpha spectroscopy; SVOCs; and metals.

7.7.3 Sample Screening and Analysis

Each core and soil/rock sample collected will be screened for contact radiation. All sample packages must be screened for surface level of contamination and contact radiation. All samples from the former septic tank location (SWMU No. 5-004) will be analyzed at Level III for gross-alpha, -beta, -gamma; gamma spectrometry; alpha spectroscopy; SVOCs; metals; and miscellaneous analytes. All samples from the French drain (SWMU No. 5-005[a]) will be analyzed at Level III for gross-alpha, -beta, -gamma; gamma spectrometry; alpha spectroscopy; SVOCs; and metals. Table 7-2 outlines the total number of matrix and quality assurance/quality control (QA/QC) samples required for this field investigation, the corresponding analyses, and sample requirements.

Appendix B should be consulted for procedures regarding the use of specified field sampling equipment, sample handling, packaging, and shipping; equipment decontamination, and Level I and II field instruments.

TABLE 7-2

Phase I Sampling Summary
for
OU 1129 SWMU Aggregate C
(SWMV No. 5-004 and 5-005[a])

SWMU	LOCATION	DEPTH	TYPE OF ANALYSIS REQUIRED[1]								
			A	B	C	D	E	F	G	H	I
5-004	B-1	5-10 ft.	x	x	x	x		x			x
		10-15 ft.	x	x	x	x		x			x
	S-1	Surface	x	x	x	x		x			x
	S-2	Surface	x	x	x	x		x			x
	S-3	Surface	x	x	x	x		x			x
	S-4	Surface	x	x	x	x		x			x
	S-5	Surface	x	x	x	x		x			x
5-005(a)	B-1	5-10 ft.	x	x	x	x		x			
		10-15 ft.	x	x	x	x		x			
	B-2	5-10 ft.	x	x	x	x		x			
		10-15 ft.	x	x	x	x		x			
	B-3	5-10 ft.	x	x	x	x		x			
		10-15 ft.	x	x	x	x		x			
	B-4	5-10 ft.	x	x	x	x		x			
		10-15 ft.	x	x	x	x		x			
	B-5	5-10 ft.	x	x	x	x		x			
		10-15 ft.	x	x	x	x		x			
	B-6	5-10 ft.	x	x	x	x		x			
		10-15 ft.	x	x	x	x		x			
	B-7	5-10 ft.	x	x	x	x		x			
		10-15 ft.	x	x	x	x		x			
	S-1	Surface	x	x	x	x		x			
	S-2	Surface	x	x	x	x		x			
	S-3	Surface	x	x	x	x		x			
	S-4	Surface	x	x	x	x		x			
	S-5	Surface	x	x	x	x		x			
		Rinsate Blanks	2	2	2	2		2			1
		Bottle Blanks	2	2	2	2		2			1
		Trip Blanks									
		Duplicates	2	2	2	2		2			1
		TOTALS	32	32	32	32		32			10

[1] A = gross X, B, V; B = V spectroscopy; C = X spectroscopy; D = metals by ICPES; E = VOCs; F = SVOCs; G = PCBs; H = ^{3}H in soil; I = miscellaneous analytes

7.8 SWMU Aggregate D, Phase I

Aggregate D includes five sites associated with TA-35. All of these SWMUs are listed in the HSWA Module VIII (EPA, 1990, 0306; see Table 1-1. SWMU Nos. 35-003(a-q) include the location of a former waste water treatment plant and related facilities, including outfalls, and SWMU No. 35-003(h) includes a canyon disposal area. SWMU No. 35-003(j and k) are not associated with the waste water treatment plant and are discussed in Aggregate I. SWMU No. 35-003 (i) includes tanks that were incorrectly identified as part of the waste water treatment plan in the 1988 and 1990 SWMU reports (International Technology Corp. 1988, 0329; LANL 1990, 0145). The SWMU has been analyzed under criteria found in Section 6 and was subsequently recommended for no further action. These are Phase I characterization areas according to the process outlined in Chapter 5.0. The following SWMUs are included in this plan:

- 35-003(a, b, c, and n), holding tanks and associated piping
- 35-003(d, l, and q), holding tanks and associated piping
- 35-003(e, f, g, m, and o) surge tanks and associated piping
- 35-003(misc.) piping and retention tank (SWMU No. 35-003[h])
- 35-003(r) canyon disposal area
- 35-0039(p) recommended for NFA

Archival information (Section 3.3.2.3, Past Waste Spills, Releases, and Incidents) provides many references to spills and leaks of radiological waste; however, very little information is provided on other hazardous materials in the waste stream or associated with the radiological waste. A list of potential waste materials is located in Section 3.3.2.2, A Summary of Potential Waste Materials. Documentation of radionuclides released is consistent while associated chemicals are not documented with any congruity. One of the larger documented spills occurred in 1956 when 21,200 gal. of waste water and sludge were accidentally leaked into the canyon to SWMU No. 35-003(r) from SWMU No. 35-003(d) holding tanks. Other releases occurred from 1951 to 1963 (Section 3.3.2.3)

Documentation indicates that most of the associated structures and lines of the waste water treatment plant were removed and or decontaminated between 1980 and 1985 (Table 3-11, Description of Structures at TA-35). Because of the numerous spills that occurred in the area of SWMU Nos. 35-003(a-q) and 35-003(r), results from health and safety/environmental monitoring following D&D activity indicate radioactive contamination still is present.

7.8.1 Sampling Plan Rationale and Objectives

The objective of this Phase I sampling plan is to determine the presence or absence of surface and subsurface contamination at SWMU Aggregate D within TA-35. If contamination is confirmed to be present after the Phase I investigation, a Phase II investigation will be conducted to determine the nature and extent of contamination

at the site. Sampling activities are biased toward areas in which residual contamination is most likely to be present on the basis of the following conceptual model for a release at this site:

- Previous D&D activities have removed most of the COCs although, in some cases, archival information indicates some contaminants were missed.

- Because of the volume and the regularity of the spills, any remaining contaminant could be at depth and widespread. This could be true in the SWMU No. 35-003(d, l, and m) and SWMU No. 35-003(r). As a result, random sampling across some SWMUs is planned. Material was spilled on the surface at SWMU No. 35-003(d) and washed into SWMU No. 35-003(r), which feeds into Ten Site Canyon. Surface water could provide a major transport mechanism.

- Liquids and sludge have leaked from holding tanks into surrounding soils and tuff. D&D information, while sketchy, provides insight into depths at which contaminants were found. The locations at which contaminants were found during D&D activities have been backfilled with fill material. These locations are assumed to be near the interface with bedrock tuff. Because fill material may contain a higher moisture content than the indigenous soils, transport near the tuff interface may be accelerated. Surface water in erosional cuts is a likely transport mechanism. An erosional channel now transects the area in which fill material was placed, indicating that surface transport is likely.

- Subsurface leakage from underground waste lines into surrounding soils is suspected. D&D information indicates that some pipes leaked contaminants into the surrounding soils. In some cases these soils were removed; in other cases the piping was removed and the trenches backfilled. The majority of these trenches are now covered with asphalt. The transport of contaminants in these trenches is considered to be localized within the vicinity of the trenches.

- The grid patterns planned for this aggregate are thought to cover the extent of the SWMUs. The grids vary in size and configuration to cover the projected extent of the SWMUs. The extent of the grids will be adjusted during field examination as needed.

- Models have been applied to SWMU Nos. 35-003(d and r) to estimate migration of previously spilled COCs.

The surface investigation at Aggregate D is designed to answer the following questions:

1) Does surface and subsurface contamination currently exist in Aggregate D?

2) Are there any near-surface artifacts remaining that represent potential contaminant release points?

3) What is the potential for surface and subsurface migration of contaminants?

Geologic data will be collected from Aggregate D to support transport model calculations.

A decision logic diagram for Phase I field investigation activities to be conducted at SWMU Aggregate D is presented in Figure 7-11 and discussed in the following text.

7.8.2 Phase I Field Investigation Activities

The Phase I investigation of Aggregate D consists of the engineering survey and environmental survey discussed in Section 7.4, and surface and subsurface sampling indicated in Figure 7-11 through 7-16.

The radiological survey discussed in Section 7.4.2 will use a scintillation detector on traverses spaced 20 ft apart at all sites except for SWMU No. 35-003(r) at which traverses spaced 100 ft apart will be conducted when topography allows. Surface sampling locations will be selected depending on the results of these traverses or will default to grid points. At SWMU No. 35-003 (r), the focus of the surveys will be on the erosional channels and the more widely spaced traverses will be surveyed to gather data across a large area. Subsurface sampling will be conducted when the radiological survey of SWMU No. 35-003 (r) indicates an anomaly at locations at which samples can be obtained. The majority of other SWMUs have undergone extensive D&D and have been backfilled with clean soils; therefore, the environmental surveys are expected to yield limited results.

A characterization borehole will be drilled on the east end of TA-35. Geologic record logs will be kept that describe lithologic changes, stratigraphic contacts, and welding characteristics of the tuff. The logs will note fracture frequency, fracture coating, and dip of fractures. Data from coring will be incorporated into the frameworks studies.

Fracture mapping of the two adjacent canyon walls will be conducted. The logs will include data on the fracture frequency along a measured section, fracture coating, and strike and dip of fractures. Data from fracture mapping will be incorporated into the framework studies.

SWMU Nos. 35-003(a, b, c, and n) Surface and Subsurface Investigations

This site consists of the phase separator pit (SWMU No. 35-003[n]) and three 600 gal. reinforced-concrete underground storage tanks (USTs) (SWMU No. 35-003 a, b, and c) (Figure 7-12). Liquids in these tanks were caustic-treated for acidity . The phase separator pit and holding tanks were scheduled for removal in late 1991 (Gonzales 1991, 04-0088). The sample plan for this site is developed on the assumption that the physical plants have been removed. Sampling will be conducted by drilling boreholes at three locations using a random number generator from a 20-ft by 20-ft grid pattern. Boreholes will be drilled to a maximum depth of 30 ft. Boring will be accomplished using a hollow-stem auger while a 5-ft split-barrel core sampler will continuously collect soil samples. Two sampling intervals (Table 7-3) from the boreholes will be determined using a random number generator. In addition, samples will be taken from the first 2 ft near the surface, and the last interval will be

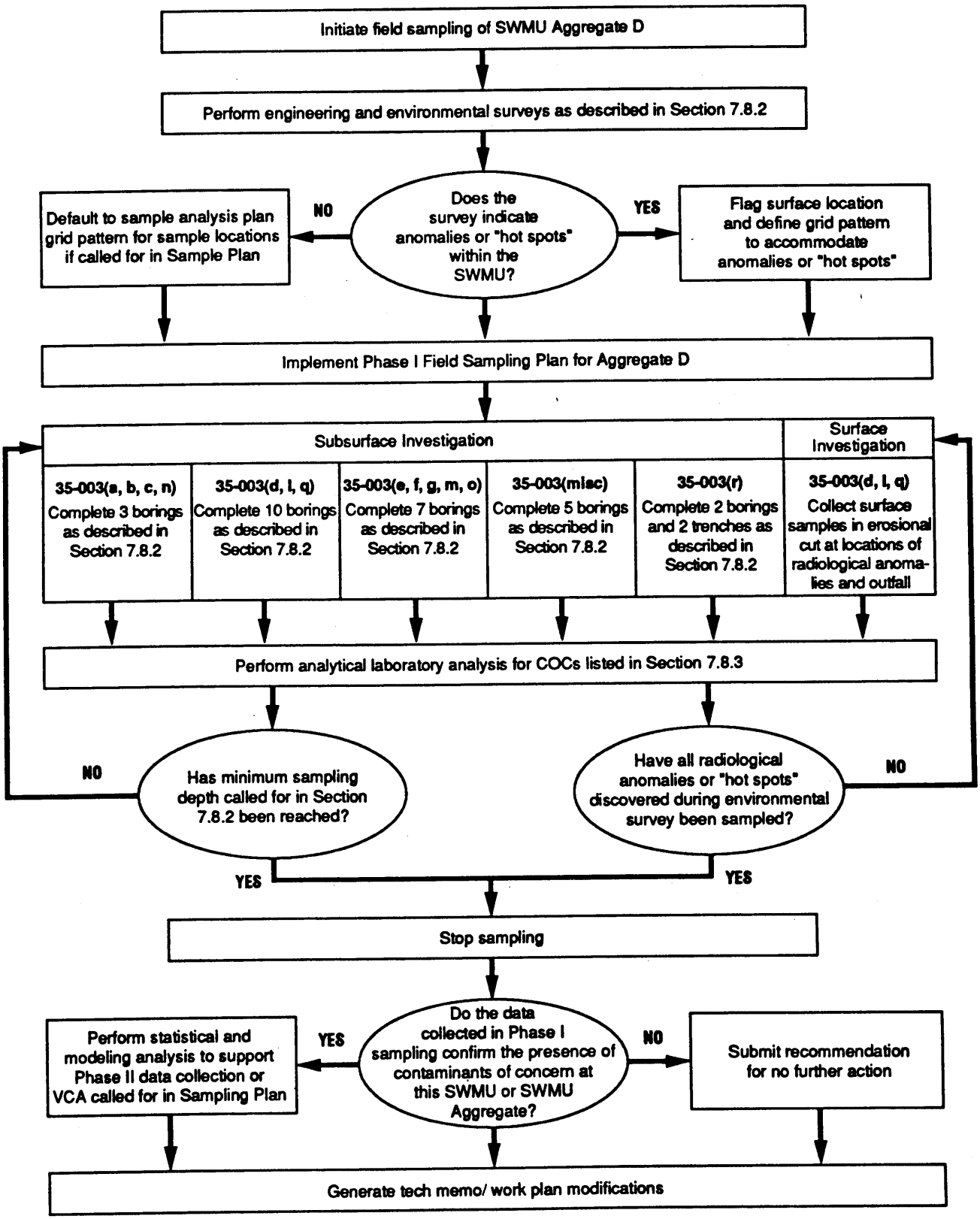


Figure 7-11. Decision logic for the sampling and analysis of SWMU Aggregate D.

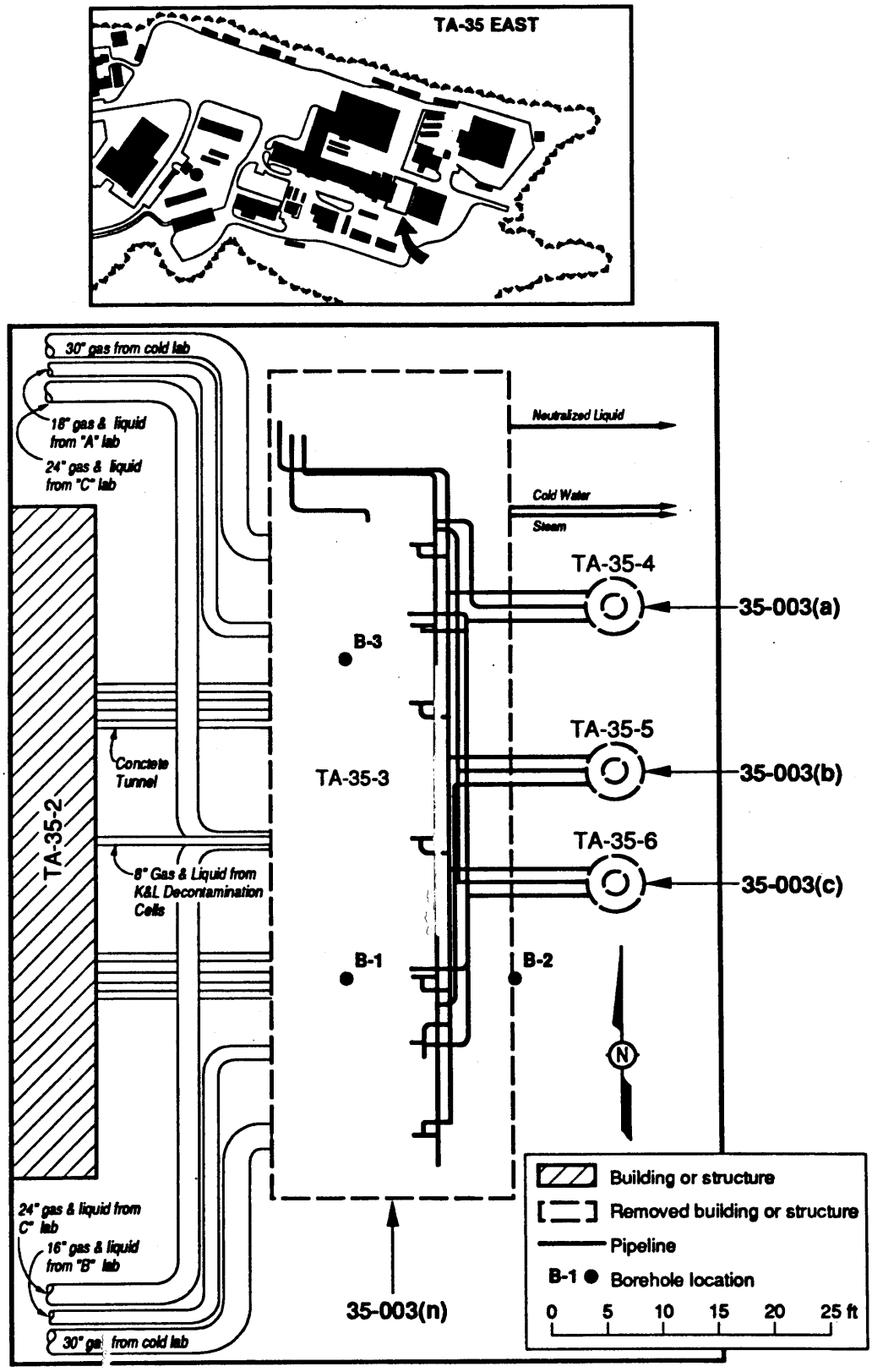


Figure 7-12. Schematic sample location map for SWMU Aggregate D [(SWMUs 35-003(a, b, c, n)].

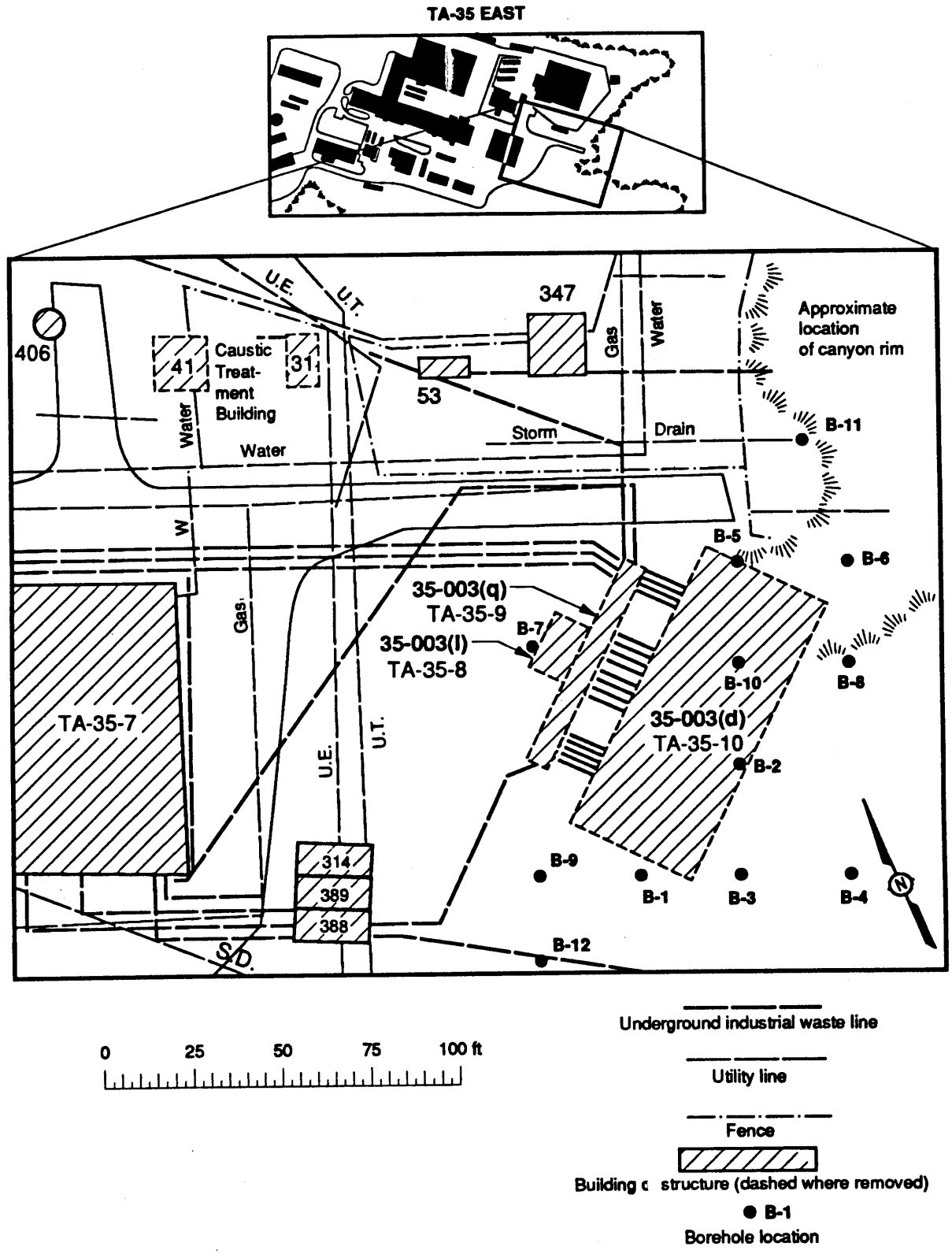


Figure 7-13. Schematic sample location map for SWMU Aggregate D [SWMUs 35-003(d, l, q)].

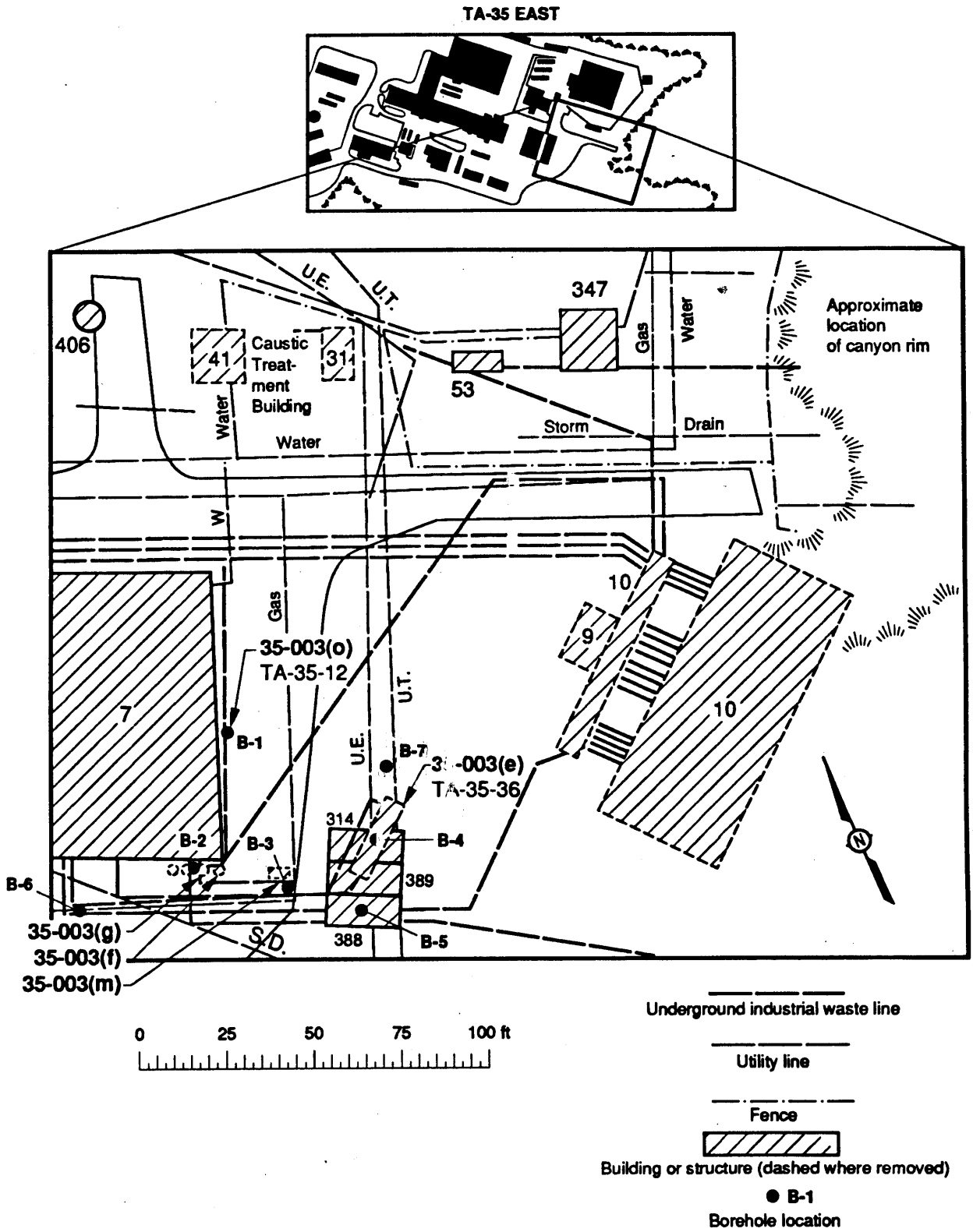


Figure 7-14. Schematic sample location map for SWMU Aggregate D [SWMUs 35-003(e, f, g, m, and o)].

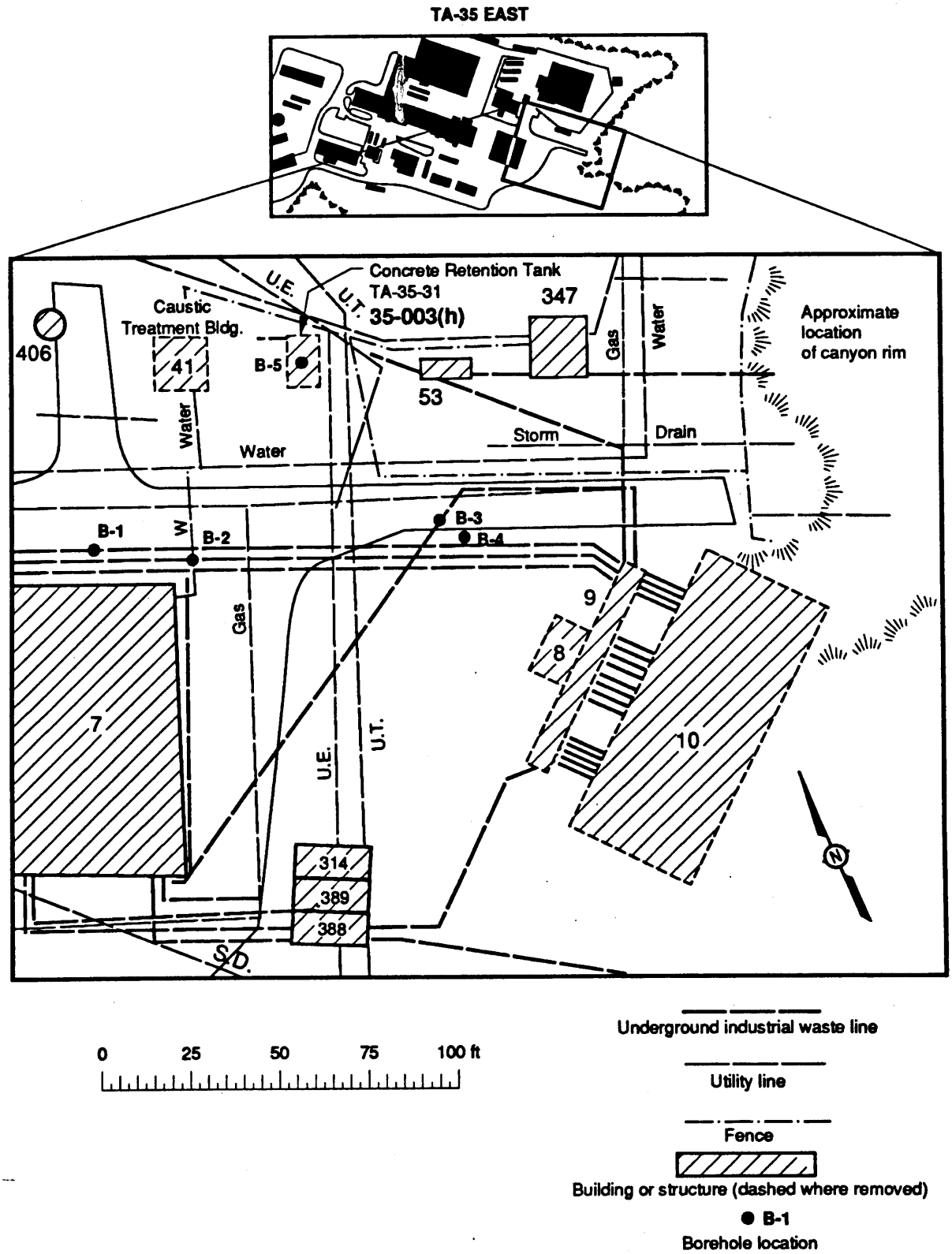


Figure 7-15. Schematic sample location map for SWMU Aggregate D [SWMUs 35-003 (misc)].

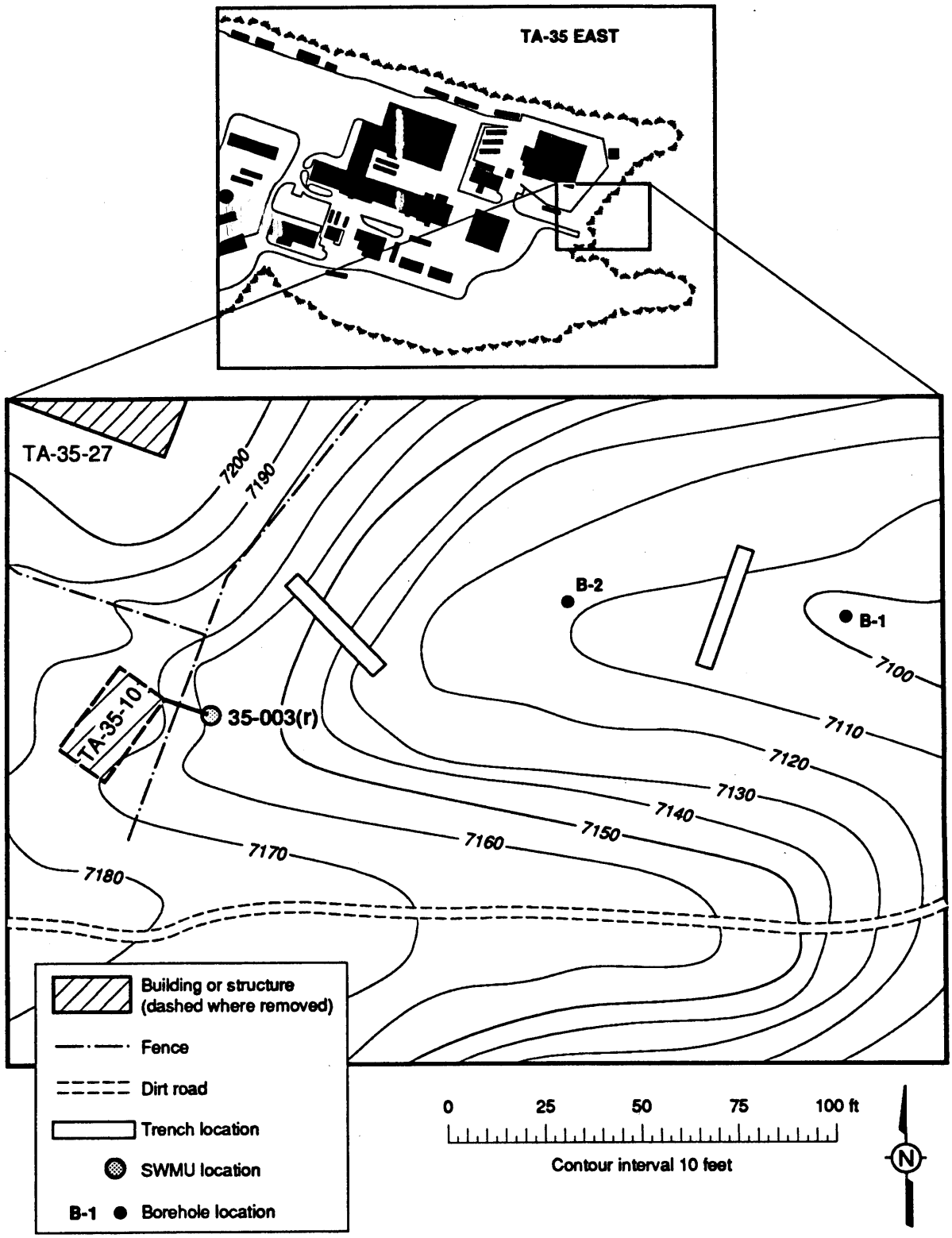


Figure 7-16. Schematic sample location map for SWMU Aggregate D [(SWMU 35-003(r)].

TABLE 7-3

PHASE I SAMPLING SUMMARY FOR OU 1129 SWMU AGGREGATE D
(SWMU Nos. 35-003[a,b,c, and n])

SWMU	LOCATION	DEPTH	TYPE OF ANALYSIS REQUIRED[1] A	B	C	D	E	F	G	H	I
35-003 (a,b,c,and n)	B-1	0-2 ft	X	X	X	X	X	X	X		
		15-20 ft	X	X	X	X	X	X	X		
		20-25 ft	X	X	X	X	X	X	X		
		25-30 ft	X	X	X	X	X	X	X		
	B-2	0-2 ft	X	X	X	X	X	X	X		
		15-20 ft	X	X	X	X	X	X	X		
		20-25 ft	X	X	X	X	X	X	X		
		25-30 ft	X	X	X	X	X	X	X		
	B-3	0-2 ft	X	X	X	X	X	X	X		
		15-20 ft	X	X	X	X	X	X	X		
		20-25 ft	X	X	X	X	X	X	X		
		25-30 ft	X	X	X	X	X	X	X		
		Rinsate Blanks	1	1	1	1	1	1	1		
		Bottle Blanks				1	1	1	1		
		Trip Blanks					1				
		Duplicates	1	1	1	1	1	1	1		
		TOTALS	14	14	14	15	16	15	15		

[1] A = gross α, β, γ; B = γ spectrometry; C = α spectroscopy; D = metals by ICPES; E = VOCs; F = SVOCs; G = PCBs; H = ^{3}H in soil; I = miscellaneous analytes

taken at maximum depth. A sample from the recovered intervals that shows the highest contamination from radioactive field screening will be selected for analysis (Level III). If no contamination is detected from field screening, a sample from the recovered section's midpoint will be collected for analytical testing. To complement the selected intervals for sampling, all recovered sections that indicate contamination from radioactive field screening will be sent to the analytical laboratory for Level III analysis.

SWMU Nos. 35-003 (d, l, and q) Surface and Subsurface Investigations

This site once included four 50,000-gal. tanks (SWMU No. 35-003[d]), a pump pit(SWMU No. 35-003 [l]), and a pipe trench (SWMU No. 35-003[q]). This area was beset with numerous spills of large volumes of highly contaminated materials. The physical structures were removed during previous D&D operations and the entire area has been backfilled. At SWMU Nos. 35-003(d, l, and q), the grid pattern is 30 ft by 30 ft and is projected to cover the extent of this Phase I investigation (Figure 7-13 and Table 7-4). To complement the grid pattern sampling, up to 3 surface specimens will be obtained from a erosional channel that cuts through the site. This erosional channel is a potential site transport mechanism for surface contaminants. Locations along erosion channels in which contamination is detected during radiation surveys will be sampled. Surface soil samples in the channels will be obtained in the first 6 in. of soil using a stainless-steel or Teflon scoop. Boring will be accomplished using a hollow-stem auger while a 5-ft split-barrel core sampler will continuously collect soil samples. Two sampling intervals (see Table 7-4) will be determined using a random number generator. In addition, samples will be taken

TABLE 7-4

PHASE I SAMPLING SUMMARY FOR OU 1129 SWMU AGGREGATE D
(SWMU Nos. 35-003[d,l and q])

SWMU	LOCATION	DEPTH	TYPE OF ANALYSIS REQUIRED[1] A	B	C	D	E	F	G	H	I
35-003 (d, l, and q)	BH-1	0-2 ft	X	X	X	X	X	X	X		
		5-10 ft	X	X	X	X	X	X	X		
		60-65 ft	X	X	X	X	X	X	X		
		95-100 ft	X	X	X	X	X	X	X		
	BH-2	0-2 ft	X	X	X	X	X	X	X		
		30-35 ft	X	X	X	X	X	X	X		
		45-50 ft	X	X	X	X	X	X	X		
		95-100 ft	X	X	X	X	X	X	X		
	BH-3	0-2 ft	X	X	X	X	X	X	X		
		50-55 ft	X	X	X	X	X	X	X		
		65-70 ft	X	X	X	X	X	X	X		
		95-100 ft	X	X	X	X	X	X	X		
	BH-4	0-2 ft	X	X	X	X	X	X	X		
		35-40 ft	X	X	X	X	X	X	X		
		60-65 ft	X	X	X	X	X	X	X		
		95-100 ft	X	X	X	X	X	X	X		
	BH-5	0-2	X	X	X	X	X	X	X		
		60-65 ft	X	X	X	X	X	X	X		
		70-75 ft	X	X	X	X	X	X	X		
		95-100 ft	X	X	X	X	X	X	X		
	BH-6	0-2 ft	X	X	X	X	X	X	X		
		80-85 ft	X	X	X	X	X	X	X		
		90-95 ft	X	X	X	X	X	X	X		
		95-100 ft	X	X	X	X	X	X	X		
	BH-7	0-2 ft	X	X	X	X	X	X	X		
		35-40 ft	X	X	X	X	X	X	X		
		90-95 ft	X	X	X	X	X	X	X		
		95-100 ft	X	X	X	X	X	X	X		
	BH-8	0-2 ft	X	X	X	X	X	X	X		
		20-25 ft	X	X	X	X	X	X	X		
		60-65 ft	X	X	X	X	X	X	X		
		95-100 ft	X	X	X	X	X	X	X		
	BH-9	0-2 ft	X	X	X	X	X	X	X		
		20-25 ft	X	X	X	X	X	X	X		
		30-35 ft	X	X	X	X	X	X	X		
		95-100 ft	X	X	X	X	X	X	X		
	BH-10	0-2 ft	X	X	X	X	X	X	X		
		30-35 ft	X	X	X	X	X	X	X		
		60-65 ft	X	X	X	X	X	X	X		
		95-100 ft	X	X	X	X	X	X	X		
	BH-11	0-2 ft	X	X	X	X	X	X	X		
	BH-12	0-2 ft	X	X	X	X	X	X	X		
		Rinsate Blanks	2	2	2	2	2	2	2		
		Bottle Blanks				2	2	2	2		
		Trip Blanks					1				
		Duplicates	2	2	2	2	2	2	2		
		TOTALS	46	46	46	48	49	48	48		

[1] A = gross α, β, γ
B = γ spectrometry
C = α spectroscopy
E = VOCs
D = metals by ICPES
F = SVOCs
G = PCBs
H = ^{3}H in soil
I = miscellaneous analytes

from the first 2 ft of borehole below the surface, and from the last interval at maximum depth. Once boreholes reach the bedrock, a wireline coring technique will be used with the same sample interval as the hollow-stem auger. Modeling information indicates borings should reach maximum depths of approximately 100 ft. The first 2 ft at all locations will be sampled using the 2-ft split barrel and the remaining samples will be taken from the 5-ft split barrel. Samples will be taken from two intervals using a random number generator and will be taken at maximum depth. At each 5-ft interval selected for sampling (Table 7-4), one sample, which indicates the highest field screening for radioactivity, will be collected. If screening results from any selected interval are negative , a sample from the recovered section's midpoint will be collected. To complement the random sequence samples, a soil/rock sample from all recovered intervals that indicate contamination from field screening will be sent to the laboratory for further analysis.

At SWMU Nos. 35-003 (d, l, and q), 10 subsurface sample locations were selected for borings and samples will be sent to the laboratory (Level III) for analysis (Figure 7-13). Surface sampling (borehole locations 11 and 12), where topography allows, will also be gathered at outfalls from Lines 71 and 95 (Figure 7-13).

SWMU Nos. 35-003 (e, f, g, m, and o) Surface and Subsurface Investigation

SWMU Nos. 35-003(e, f, g, m, and o), are also associated with the waste water treatment plant. Sampling will be conducted on varying grid patterns. At SWMU Nos. 35-003(e, g, f, m, and o), the grid pattern will be 20 ft by 20 ft, which is anticipated to cover the extent of the site (Figure 7-14 and Table 7-5). SWMU Nos. 35-003 (g, f, m, and o) have asphalt pavement covering the potentially contaminated soil/tuff. Sampling will begin once the asphalt is completely penetrated. Removed asphalt will be analyzed through a field radiological survey . Boreholes will be drilled to a maximum depth of 30 ft using a hollow-stem auger while a 5-ft split-barrel core sampler will continuously collect soil samples. Two sampling intervals (Table 7-5) will be determined using a random number generator. Additionally, samples will be taken from the first 2 ft of hole beneath the surface and will be taken from the last interval at the maximum depth of 30 ft. Once sampling boreholes reach the bedrock, a wireline coring technique will be used with the same sample interval as described using the hollow-stem auger. The first 2-ft beneath the surface at all locations will be sampled using the 2-ft split barrel and the remaining samples will be taken from the 5-ft split barrel. Samples will be taken from two intervals using a random number generator and will be taken at maximum depth. At each 5 ft interval selected for sampling (Table 7-5), one sample, which indicates the highest field screening for radioactivity, will be collected. If screening results are negative from any selected interval, a sample from the recovered section's midpoint will be collected. To complement the random sequence samples, soil/rocks samples which are from the recovered intervals and indicate contamination from field screening will be sent to the analytical laboratory for further analysis. At SWMU Nos. 35-003 (e, f, g, m, and o), seven borehole locations were selected and samples from those borings will be sent to the laboratory (Level III) for analysis (Figure 7-14).

SWMU No. 35-003 (Misc.) Surface and Subsurface Investigations

At SWMU No. 35-003(misc.), three boreholes will be drilled at locations over removed waste lines, selected using a random number generator with a 3-ft grid pattern (Figure 7-15 and Table 7-6). Information gathered from D&D activities will be used to locate the first set of holes at which contamination was previously found. These locations will be analyzed. Once asphalt is removed from selected locations, boring will be accomplished using a hollow-stem auger while a 5-ft split-barrel core

TABLE 7-5

PHASE I SAMPLING SUMMARY FOR OU 1129 SWMU AGGREGATE D
(SWMU Nos. 35-003[e,f,g,m,and o])

SWMU	LOCATION	DEPTH	TYPE OF ANALYSIS REQUIRED[1] A	B	C	D	E	F	G	H	I
35-003 (e,f,g,m, and o)	B-1	0-2 ft	X	X	X	X	X	X	X		
		15-20 ft	X	X	X	X	X	X	X		
		20-25 ft	X	X	X	X	X	X	X		
		25-30 ft	X	X	X	X	X	X	X		
	B-2	0-2 ft	X	X	X	X	X	X	X		
		15-20 ft	X	X	X	X	X	X	X		
		20-25 ft	X	X	X	X	X	X	X		
		25-30 ft	X	X	X	X	X	X	X		
	B-3	0-2 ft	X	X	X	X	X	X	X		
		15-20 ft	X	X	X	X	X	X	X		
		20-25 ft	X	X	X	X	X	X	X		
		25-30 ft	X	X	X	X	X	X	X		
	B-4	0-2 ft	X	X	X	X	X	X	X		
		15-20 ft	X	X	X	X	X	X	X		
		20-25 ft	X	X	X	X	X	X	X		
		25-30 ft	X	X	X	X	X	X	X		
	B-5	0-2 ft	X	X	X	X	X	X	X		
		15-20 ft	X	X	X	X	X	X	X		
		20-25 ft	X	X	X	X	X	X	X		
		25-30 ft	X	X	X	X	X	X	X		
	B-6	0-2 ft	X	X	X	X	X	X	X		
		15-20 ft	X	X	X	X	X	X	X		
		20-25 ft	X	X	X	X	X	X	X		
		25-30 ft	X	X	X	X	X	X	X		
	B-7	0-2 ft	X	X	X	X	X	X	X		
		15-20 ft	X	X	X	X	X	X	X		
		20-25 ft	X	X	X	X	X	X	X		
		25-30 ft	X	X	X	X	X	X	X		
		Rinsate Blanks	2	2	2	2	2	2	2		
		Bottle Blanks				2	2	2	2		
		Trip Blanks					1				
		Duplicates	2	2	2	2	2	2	2		
		TOTALS	32	32	32	34	35	32	32		

[1] A = gross α, β, γ
E = VOCs
G = PCBs

B = γ spectrometry
D = metals by ICPES
H = ^{3}H in soil

C = α spectroscopy
F = SVOCs
I = miscellaneous analytes

- The waste stream is not known because a source for COCs has not been defined and significant amounts of contaminants are not expected at the site. Therefore, only 10% of the sample analyses will be conducted for a wide range of potential COCs. Results from these initial samples will then be used to structure the analytical suite for remaining sample locations. Table 7-9 indicates all anticipated analyses.

- Any remaining contaminant plumes may have moved vertically (along fracture planes that are in contact with the leach fields and outfalls).

TABLE 7-6

PHASE I SAMPLING SUMMARY FOR OU 1129 SWMU AGGREGATE D
(SWMU Nos. 35-003[Misc.])

SWMU	LOCATION	DEPTH	TYPE OF ANALYSIS REQUIRED[1] A	B	C	D	E	F	G	H	I
35-003 (Misc.)	BH-1	0-2 ft	X	X	X	X	X	X	X		
		5-10 ft	X	X	X	X	X	X	X		
		20-25 ft	X	X	X	X	X	X	X		
		25-30 ft	X	X	X	X	X	X	X		
	BH-2	0-2 ft	X	X	X	X	X	X	X		
		5-10 ft	X	X	X	X	X	X	X		
		20-25 ft	X	X	X	X	X	X	X		
		25-30 ft	X	X	X	X	X	X	X		
	BH-3	0-2 ft	X	X	X	X	X	X	X		
		5-10 ft	X	X	X	X	X	X	X		
		20-25 ft	X	X	X	X	X	X	X		
		25-30 ft	X	X	X	X	X	X	X		
	BH-4	0-2 ft	X	X	X	X	X	X	X		
		5-10 ft	X	X	X	X	X	X	X		
		20-25 ft	X	X	X	X	X	X	X		
		25-30 ft	X	X	X	X	X	X	X		
	BH-5	0-2 ft	X	X	X	X	X	X	X		
		5-10 ft	X	X	X	X	X	X	X		
		20-25 ft	X	X	X	X	X	X	X		
		25-30 ft	X	X	X	X	X	X	X		
		Rinsate Blanks	1	1	1	1	1	1	1		
		Bottle Blanks				1	1	1	1		
		Trip Blanks					1				
		Duplicates	1	1	1	1	1	1	1		
		TOTALS	22	22	22	22	24	23	23		

[1] A = gross α, β, γ B = γ spectrometry C = α spectroscopy
E = VOCs D = metals by ICPES F = SVOCs
G = PCBs H = ^{3}H in soil I = miscellaneous analytes

sampler will continuously collect soil samples. At SWMU No. 35-003(h), a single sampling location will be developed (Figure 7-15). Samples will be taken from the boreholes at 2 locations (using a random number generator) plus in the first 2 ft of hole beneath the surface and at the last interval at maximum depth. The maximum depth for boreholes in SWMU No. 35-003(misc.) is 30 ft. Samples showing the highest contamination from radioactive field screening in recovered sections will be selected for analysis. If recovered sections indicate no contamination from field screening, a sample will be selected from the recovered section's midpoint. To complement the random samples, specimens which indicate the highest contamination from field screening from the recovered section will be sent to the laboratory for analysis.

SWMU No. 35-003(r) Surface and Subsurface Investigations

A detailed map of SWMU No. 35-003(r) will be developed during the engineering/geodetic survey to show the major drainage channels, rills, gullies, seeps or wetlands, and rock falls. Where topography allows, surface samples will be gathered on a 100-ft by 100-ft grid. Detailed sampling of the sediment along drainage surfaces will be undertaken because these surfaces are the most likely transport pathways for contaminants. Radiation surveys using a scintillation detector will be conducted along the drainage surfaces to help locate potentially contaminated sources. Surface samples will be gathered to a depth of 6 in. using a stainless-steel or Teflon scoop. In addition, trenches across the drainage channels will be excavated at points in which sediments are deposited and topography allows. Trenches will be excavated using a decontaminated back hoe to approximately 18 in. and will be

approximately 10 ft in length. A minimum of 3 grab samples will be gathered from each 6 in. of trench excavated using a Teflon or stainless-steel scoop.

If topography allows, two boreholes will be drilled in stream channels using methodology described for the preceding 35-003 sites (Figure 7-16). The results from the surface studies and topography will dictate the exact location. Modeling data indicate that COC plume maximum depths could be 650 ft. Five sampling intervals will be selected using a random number generator (Table 7-7). Samples will also be taken in the first 2 ft of each hole and at the total depth. In recovered sections, samples showing the highest contamination from field radioactive screening will be selected for analytical analysis (Level III). If no positive results are obtained from field screening, a sample will be collected from the recovered section's midpoint. To complement the samples taken at the prescribed intervals, samples will be collected from any sections indicating contamination from field screening techniques. Samples will taken using wireline coring with a 5-ft barrel. Contaminant testing analysis will include the entire group of potential contaminants.

7.8.3 Sample Screening and Analysis

Each sample will be screened for radiation with a scintillation detector for contact radiation. All samples packages will be screened for surface contamination and contact radiation . Samples will be analyzed for volatile organics (except surface samples), semivolatile organics, metals, gross-alpha, -beta, -gamma; gamma spectrometry; alpha spectroscopy; and polychlorinated biphenyls (PCBs) (Tables 7-3 through 7-7).

TABLE 7-7

Phase I Sampling Summary for OU 1129 SWMU Aggregate D (SWMU No. 35-003(r))

SWMU	LOCATION	DEPTH	TYPE OF ANALYSIS REQUIRED[1] A	B	C	D	E	F	G	H	I
35-003 (r)	B-1	5-10	x	x	x	x	x	x	x		
		10-15 ft.	x	x	x	x	x	x	x		
		50-55 ft.	x	x	x	x	x	x	x		
		130-135 ft.	x	x	x	x	x	x	x		
		475-480 ft.	x	x	x	x	x	x	x		
		515-520 ft.	x	x	x	x	x	x	x		
		645-650 ft.	x	x	x	x	x	x	x		
	B-2	0-2	x	x	x	x	x	x	x		
		365-370 ft.	x	x	x	x	x	x	x		
		375-380 ft.	x	x	x	x	x	x	x		
		405-410 ft.	x	x	x	x	x	x	x		
		420-425 ft.	x	x	x	x	x	x	x		
		505-510 ft.	x	x	x	x	x	x	x		
		645-650 ft.	x	x	x	x	x	x	x		
	Trench	0-6	x	x	x	x	x	x	x		
		6-12 in.	x	x	x	x	x	x	x		
		12-18 in.	x	x	x	x	x	x	x		
	Trench	0-6	x	x	x	x	x	x	x		
		6-12 in.	x	x	x	x	x	x	x		
		12-18 in	x	x	x	x	x	x	x		
		Rinsate Blanks	2	2	2	2	2	2	2		
		Bottle Blanks				2	2	2	2		
		Trip Blanks					1				
		Duplicates	2	2	2	2	2	2	2		
		TOTALS	24	24	24	26	27	26	26		

[1] A = gross X, B, V; B = V spectrometry; C = X spectroscopy; D = metals by ICPES; E = VOCs; F = SVOCs; G = PCBs; H = ^{3}H in soil; I = miscellaneous analytes

7.9 SWMU Aggregate E, Phase I

SWMU No. 35-008 is a canyonside disposal area and is in the HSWA Module VIII(EPA 1990, 0306) (Table 1-1). The SWMU is located along the rim of Mortandad Canyon, north of the center portion of TA-35-85 (Figure 7-17). The debris in the disposal area is thought to include scrap metal and pipe, paint cans, a 55-gal drum, and miscellaneous building materials. Other debris includes concrete, asphalt, pipe reinforcing rods and soil. No documentation of any hazardous materials exists from this surface disposal area (LANL 1990, 0145). The SWMU is thought to extend from the canyon rim to the canyon floor.

7.9.1 Sampling Plan Rationale and Objectives

The objective of surface and subsurface characterization for SWMU No. 35-008 is to determine if contamination exists by collecting soil/rock data.

No evidence exists that D&D activity took place at SWMU No. 35-008. There is also no evidence that any hazardous materials were dumped at the site. If hazardous materials were dumped at this site, the most likely mechanism for movement is associated with hydrologic movement in the soil and vadose zone. Consistent with direction from the ER Program office, the most cost-effective and suitable way to address this type of SWMU is to remove debris and potentially contaminated soils through a VCA. Removal would then be followed by a Phase I investigation to confirm the presence or absence of contaminants.

A decision logic diagram for Phase I field investigation activity to be conducted at SWMU Aggregate E is presented in Figure 7-18 and discussed in the following text.

7.9.2 Phase I Field Investigation Activities

The Phase I sampling plans for SWMU No. 35-008 will include the engineering survey and environmental survey discussed in Section 7.4, geophysical surveys, surface and subsurface investigations (Figure 7-17). The geophysical survey will be conducted using electromagnetic and ground penetrating radar equipment to locate buried debris. A survey will also be conducted for potential VOCs.

The environmental and geophysical surveys will be conducted on a 10-ft grid to identify contaminated areas and debris. If contaminated areas are discovered during the environmental and geophysical surveys, near surface samples will be collected. Near surface sampling will be accomplished using a hand auger (power assisted if necessary) to collect samples to a depth of 2 ft. Samples will be collected at 6 in. intervals. In addition, two sampling locations will be selected at the toe of the debris slope (Figure 7-17). Samples will receive field screening for gross-alpha, -beta, -gamma; gamma spectrometry; alpha spectroscopy; and VOC contamination. If debris is identified by the geophysical survey, a recommendation for removal of the debris, through implementation of a VCA, will be made. When the Laboratory has provided guidance for a VCA, soil will be surveyed for radioactivity and hazardous chemical contamination before and after removal, and debris will be checked for radioactivity and hazardous chemicals after removal.

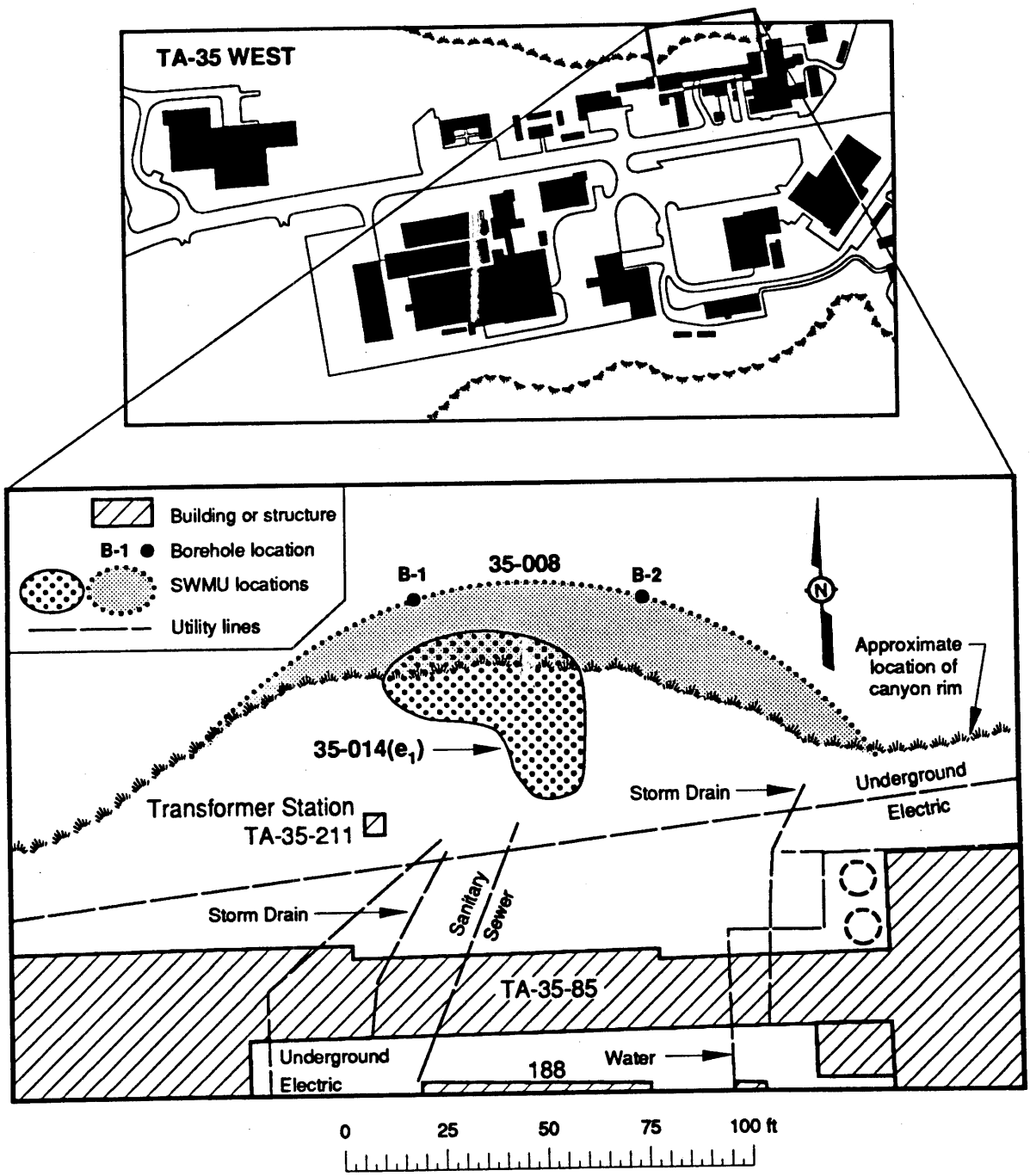


Figure 7-17. Schematic sample location map for SWMU Aggregate E.

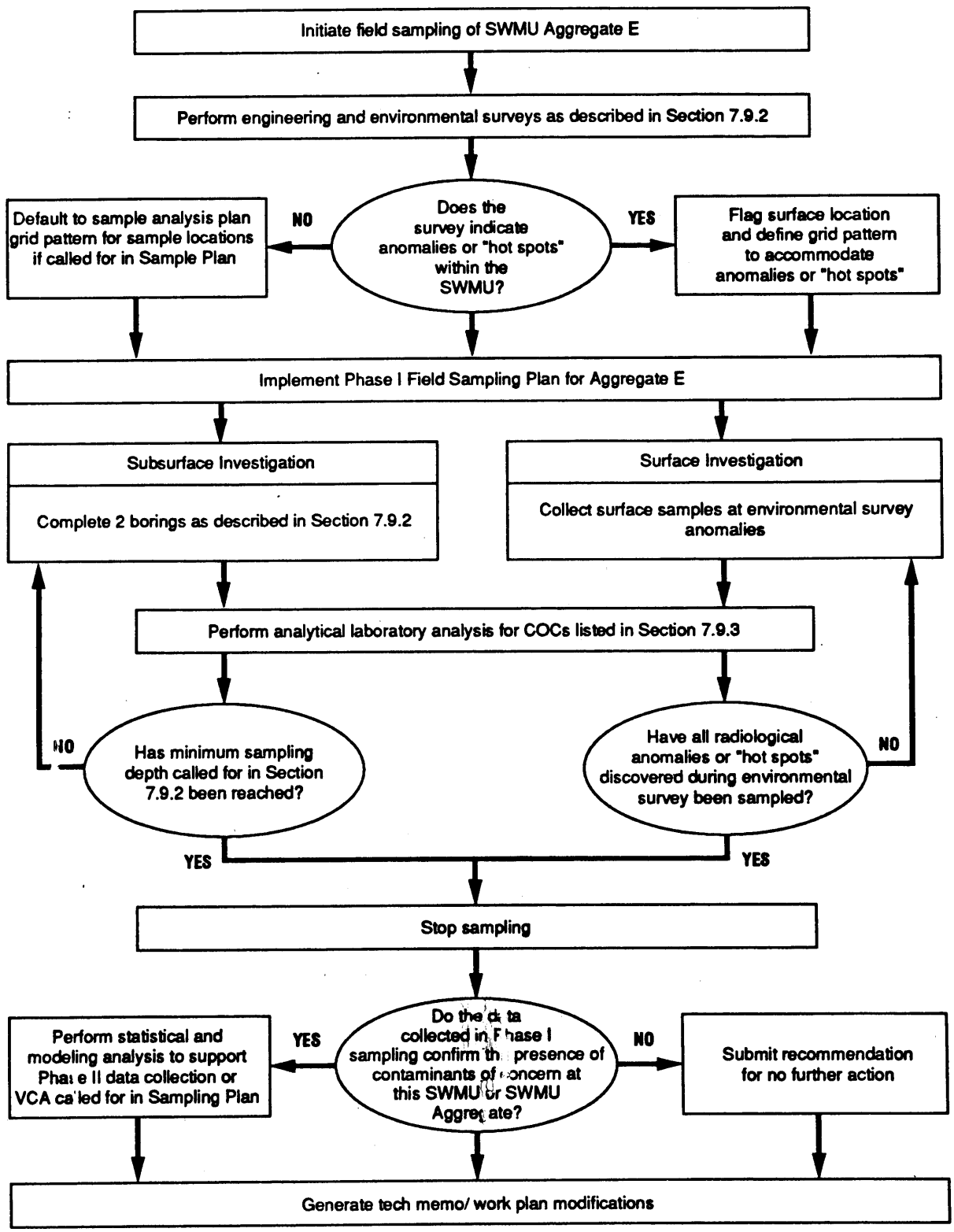


Figure 7-18. Decision logic for the sampling and analysis of SWMU Aggregate E.

7.9.3 Sample Screening and Analysis

Each sample collected will be screened for radiation using a scintillation detector. All sample packages will be screened for surface contamination and contact radiation. All samples will be analyzed for Level III VOCs; SVOCs; metals; gross-alpha, -beta, -gamma; gamma spectrometry; alpha spectroscopy; and PCBs (Table 7-8).

TABLE 7-8

PHASE I SAMPLING SUMMARY FOR OU 1129 SWMU AGGREGATE E
(SWMU Nos. 35-008)

SWMU	LOCATION	DEPTH	TYPE OF ANALYSIS REQUIRED[1] A	B	C	D	E	F	G	H	I
35-008	B-1	0-6 in	X	X	X	X	X	X	X		
		6-12 in	X	X	X	X	X	X	X		
		12-18 in	X	X	X	X	X	X	X		
		18-24 in	X	X	X	X	X	X	X		
	B-2	0-6 in	X	X	X	X	X	X	X		
		6-12 in	X	X	X	X	X	X	X		
		12-18 in	X	X	X	X	X	X	X		
		18-24 in	X	X	X	X	X	X	X		
		Rinsate Blanks	1	1	1	1	1	1	1		
		Bottle Blanks	0	0	0	1	1	1	1		
		Trip Blanks	0	0	0	0	1	0	0		
		Duplicates	1	1	1	1	1	1	1		
		TOTALS	10	10	10	11	12	11	11		

[1] A = gross α, β, γ
B = γ spectrometry
C = α spectroscopy
D = metals by ICPES
E = VOCs
F = SVOCs
G = PCBs
H = ^{3}H in soil
I = miscellaneous analytes

7.10 SWMU Aggregate F, Phase I

SWMU Aggregate F consists of SWMU Nos. 35-009 (a-d), which are four abandoned septic systems located around the perimeter of the eastern end of the mesa on which TA-35 is situated. All of these septic systems are listed in the HSWA Module VIII (Table 1-1) (in which they were formally designated SWMU Nos. 35-009[a-h]) (EPA 1990, 0306). The septic systems handled sanitary wastes from various laboratories at TA-35, and may have received, and released to the environment, a wide variety of industrial wastes, including radionuclides. Specific information concerning waste streams introduced to these septic systems is not available. Site characterizations or D&D activities have not been performed at these SWMUs. Figures 7-19 through 7-22 depict the location of these SWMUs. A detailed description of the site activities and history of these SWMUs within OU 1129 is found in Section 3.3, description of TA-35, Ten Site, of this Work Plan.

7.10.1 Sampling Plan Rationale and Objectives

The objective of this Phase I sampling plan is to determine the presence or absence of surface and subsurface soil contamination at four abandoned septic systems (SWMU Nos. 35-009[a-d]). This sampling plan uses a judgmental sampling approach to investigate the SWMUs in Aggregate F. The sampling activities are biased toward areas in which residual contamination may be expected on the basis of the conceptual model for a release at this site. If contamination is confirmed to be present after the Phase I investigations, a Phase II investigation will be conducted to determine the nature and extent of contamination at the site.

subsurface immediately beneath and down the slope from the tanks, drain fields, leach fields, or outfalls.

The Phase I sampling plans for Aggregate F are designed to be implemented independently of (i.e., either before or after) the recommended VCA. In this investigation, sampling of subsurface soils and/or tuff beneath the septic tanks and leach fields will be conducted. Surface sampling will be performed at outfall locations if they are located during the engineering survey. Surface areas overlying the septic systems will be surveyed for radioactivity. Because no information is available that might limit suspected contaminants, all samples will be analyzed for a wide variety of COCs, metals, SVOCs, as well as gross-alpha, -beta, -gamma; gamma spectroscopy; and alpha spectroscopy.

Decision logic for Phase I field investigation activities to be conducted at SWMU Aggregate F is presented in Figure 7-23 and discussed in the following text.

The objective of this Phase I sampling plan is to determine the presence or absence of surface and subsurface contamination at the locations of the SWMUs. If contamination is confirmed to be present after the Phase I investigation, a Phase II investigation will be conducted to determine the nature and extent of contamination at the site. Sampling activities are biased toward areas in which residual contamination is expected on the basis of the following conceptual model for a release at this site:

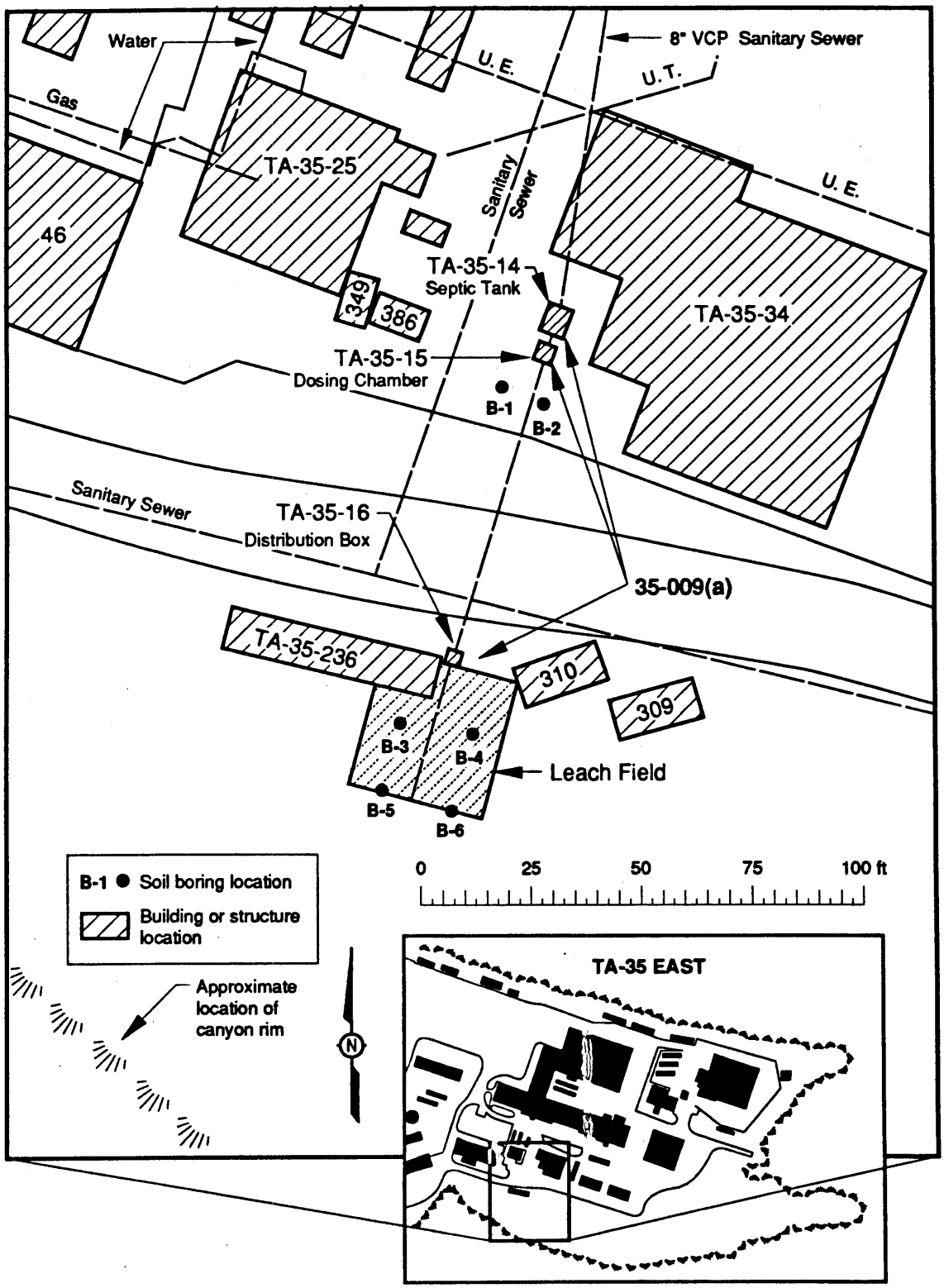


Figure 7-19. Schematic sample location map for SWMU 35-009(a).

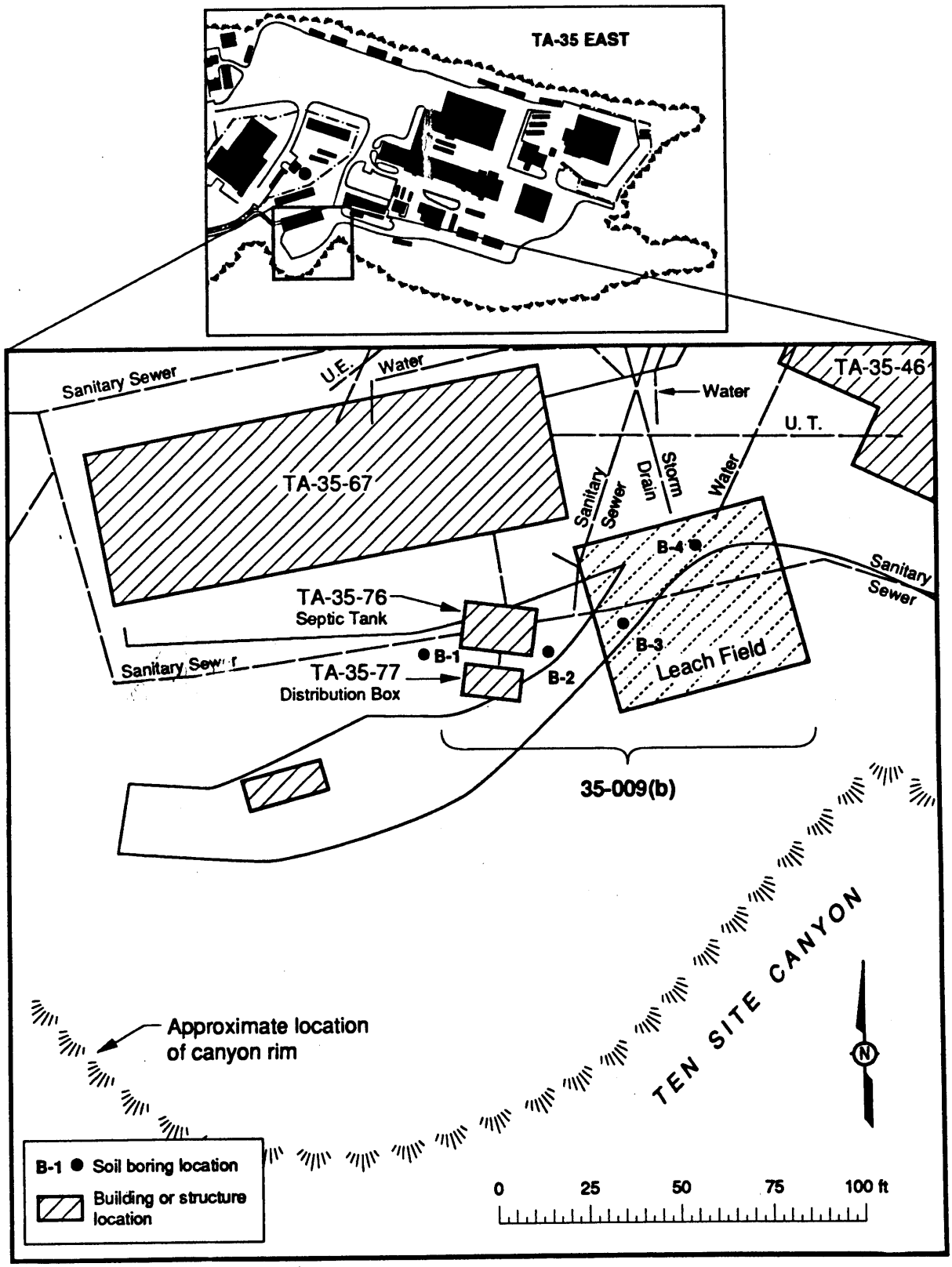


Figure 7-20. Schematic sample location map for SWMU 35-009(b).

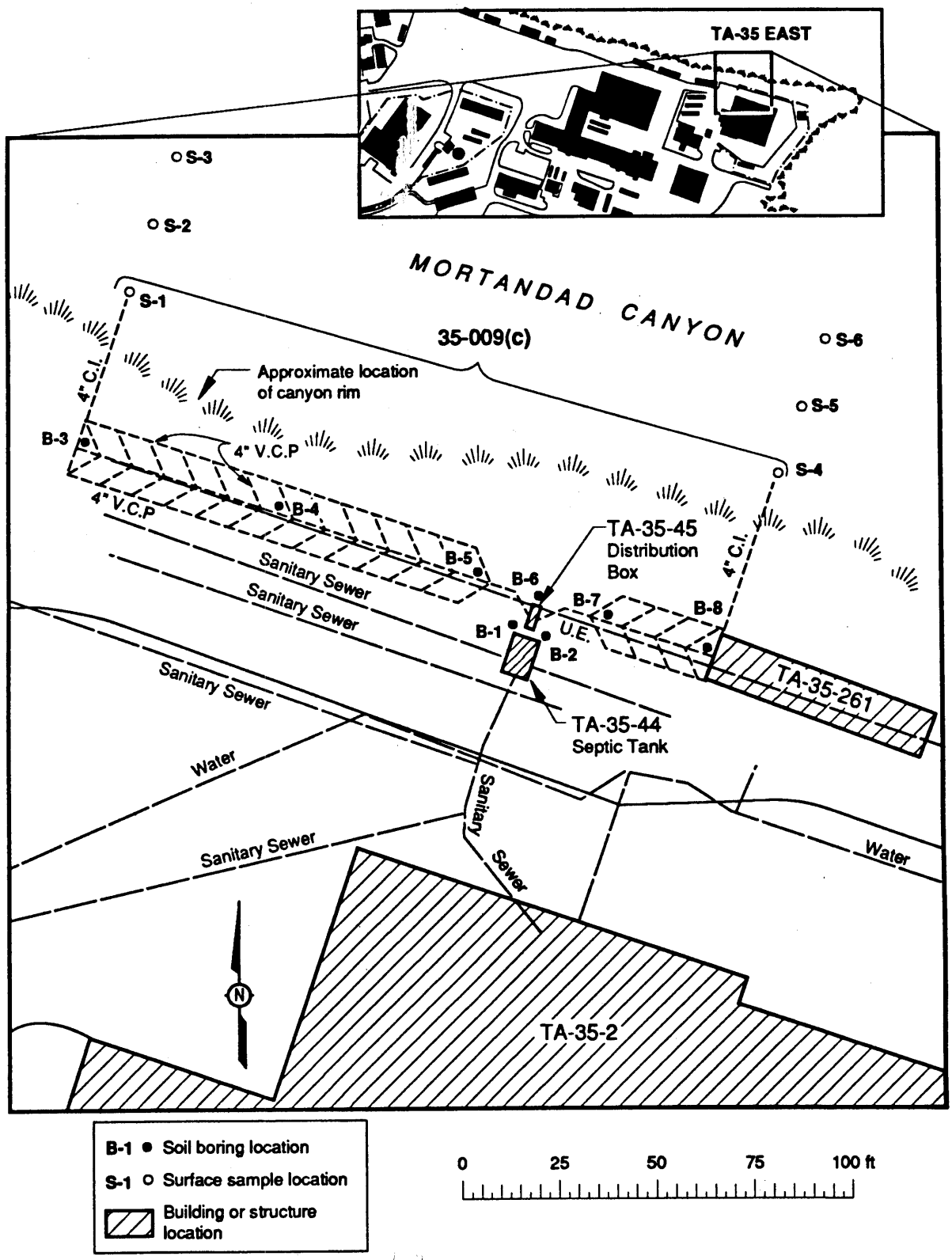


Figure 7-21. Schematic sample location map for SWMU 35-009(c).

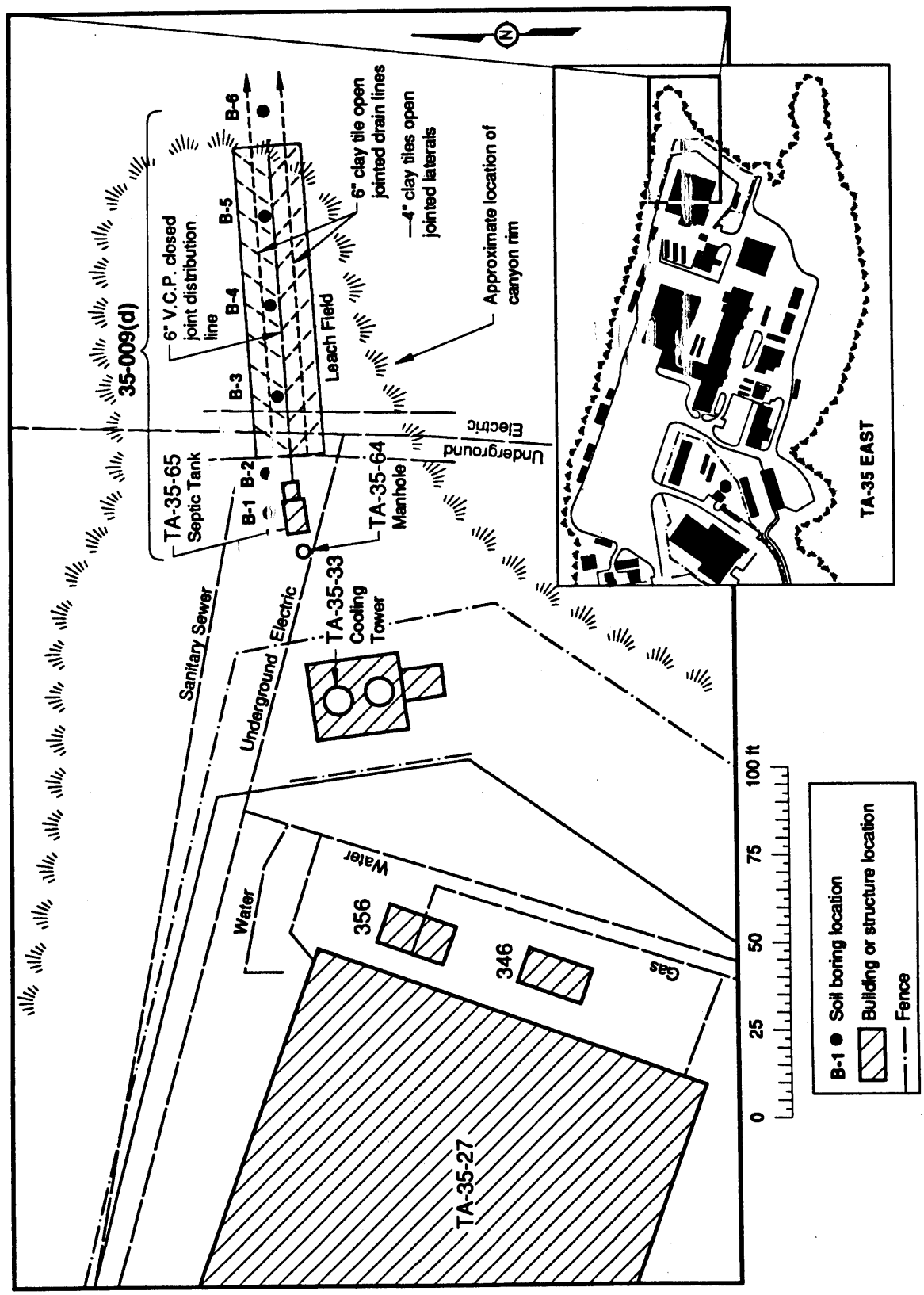


Figure 7-22. Schematic sample location map for SWMU 35-009(d).

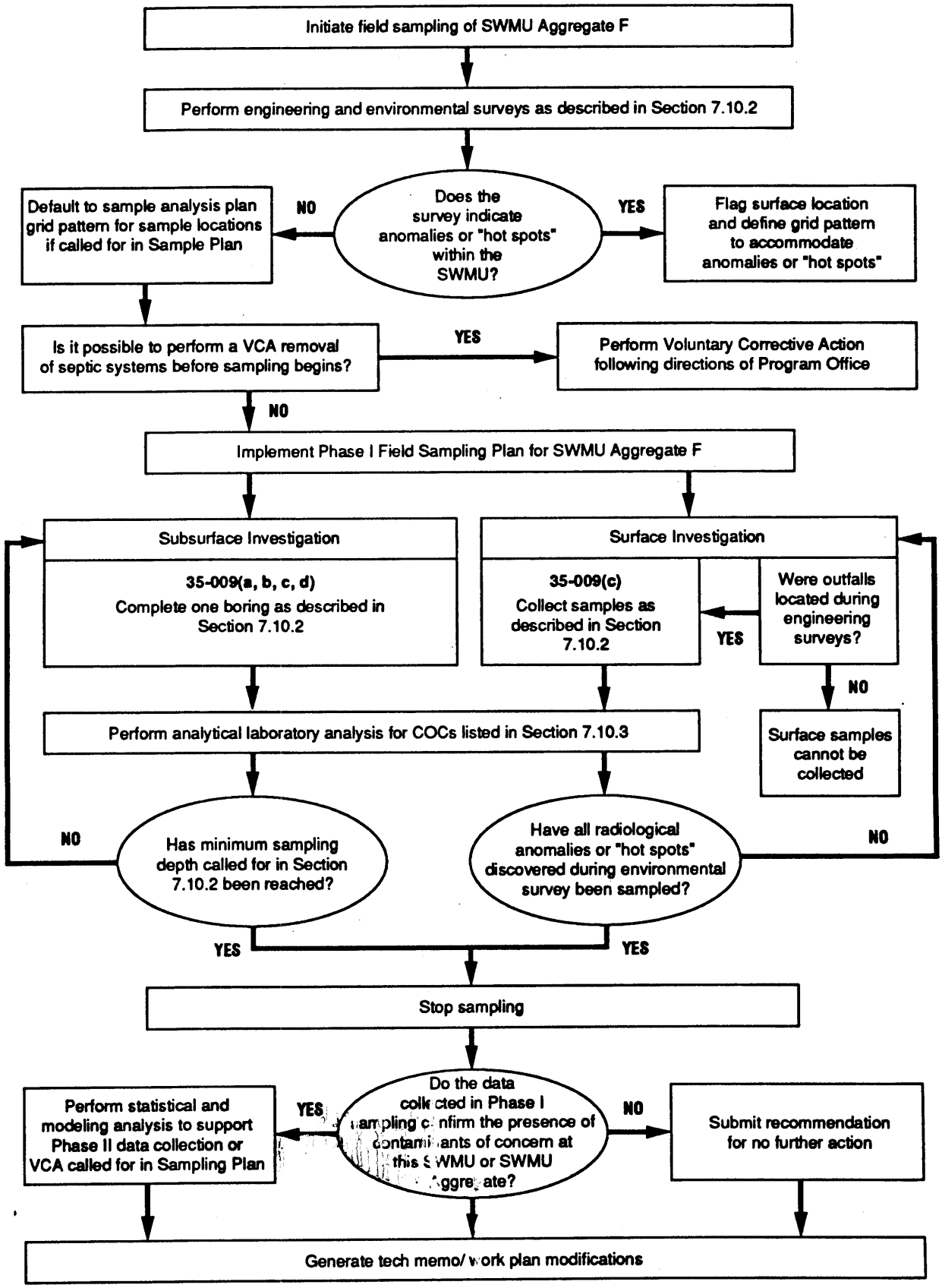


Figure 7-23. Decision logic for the sampling and analysis of SWMU Aggregate F.

- The grid patterns for outfall locations associated with this aggregate will be developed if contaminants are found during the environmental surveys and surface sampling.

The surface investigation at Aggregate F is designed primarily to answer the following decision points:

1) Does surface and subsurface contamination currently exist in Aggregate F?

2) Are there any near-surface artifacts remaining that represent potential contaminant release points?

3) What is the potential for surface and subsurface migration of contaminants?

4) What are the current waste stream constituents?

7.10.2 Phase 1 Field Investigation Activities

The technical approach for the Phase I investigation in Aggregate F will consist of four tasks at each site. These tasks include the engineering survey and environmental survey discussed earlier in Section 7.4; subsurface sampling of the septic tank drain field and leach field areas; and surface sampling of the outfall areas.

The engineering survey will locate septic tanks, dosing chambers, distribution boxes, leach fields, drain fields, and outfalls at each site. A sampling grid will not be established at these sites because most subsurface structure locations are well documented in as-built engineering drawings, and the areal extent of each site is minimal. Following the engineering survey, a radiation survey will be conducted at the septic tank locations to identify potential radiological anomalies in the area and to aid in health and safety protection of personnel. Stationary radiological counts for a duration of one minute will be measured with a FIDLER over each septic tank location, near the center of each leach or drain field, and at any areas determined to have radiological anomalies. Any anomalous areas will be flagged in the field and marked on the base maps as sites for additional sample collection.

Site assessment at each of these SWMUs should, if possible, be preceded by a VCA to remove all equipment associated with each septic system. Specific methods for removal are not described in this sampling plan but will be conducted in compliance with Laboratory guidance for VCAs. In general, however, the VCA should accomplish the following objectives:

- The areas should be surveyed for radioactivity and hazardous chemical contamination before, during, and after the removal procedure.

- Septic tanks, dosing chambers, distribution boxes, and all associated piping and equipment should be removed.

- Contaminated soils, as indicated by surveys or sampling, should be excavated.

- Soil samples should be collected at the bases of the excavated pits to confirm that removal of contaminated media is complete.

Collected data can be used to design further environmental investigations, if necessary, or to support recommendations of NFA required if COCs are not encountered during the VCA.

Regardless of whether VCAs have been implemented, Phase I investigations will be conducted at each site to determine if COCs have been released. The sampling effort will assess subsurface contamination beneath septic tanks and leach or drain fields, and collect surface soil samples along the discharge drainage flow paths beneath outfalls, when outfalls are located. The following discussion on subsurface and surface sampling procedures is applicable to septic systems at all four sites (SWMU Nos. 35-009[a-d]).

SWMU Nos. 35-009 (a-d) - Surface Investigations

For SWMU No. 35-009(c), engineering drawings indicate two outfalls, located at the west and east ends of the leach field (Figure 7-21). For the other sites addressed in this plan (SWMU Nos. 35-009[a, b, and d]), either outfalls do not exist or their locations are unknown. An attempt will be made to locate outfalls from these systems during initial engineering surveys. All outfall sites located during the engineering surveys will be screened with a scintillation detector to locate the drainage paths. The soil and rock in these areas will be investigated for evidence of drainage channeling. The objective of the Phase I surface investigation is to identify the former outfall locations and to ascertain the presence of residual contamination along the trace of the outfalls from the mesa top to the toe of the slope (Figure 7-21).

If a former outfall is located during the field surveys, three surface soil/rock samples will be collected from the drainage pathway immediately beneath the outfall. Surface sample locations will be selected in the field on the basis of detectable concentrations of above-background radioactivity measurements obtained during the environmental surveys. If no anomalies are found, sample locations will be located at 20 ft. intervals beginning at the outfall discharge point, as indicated in Figure 7-21. Samples will either be collected with a stainless-steel trowel for soil or with a hammer and chisel for rock chip samples (see Appendix B for sampling procedures). Collected surface samples will be analyzed for the Level III metals, SVOCs, gross-alpha, -beta, -gamma; gamma spectrometry, and alpha spectroscopy (Table 7-9). VOCs will not be analyzed because of rapid volatilization which occurs at the surface.

SWMU Nos. 35-009 (a-d) - Subsurface Investigations

Soil boring locations will be selected as shown in Figures 7-19 through 7-22. The purpose of the soil borings is to assess potential subsurface contamination beneath the septic tanks and leach or drain fields associated with SWMU Nos. 35-009(a-d). Additional boreholes will be installed at areas with anomalous radiological or VOC readings, as identified during the environmental surveys. If no anomalies are detected, a total of 24 soil borings will be installed to a minimum depth of 20 ft. using a decontaminated continuous 5-ft. core barrel. As the 5-ft. sections of core are retrieved from the borehole using a wire line, the soil and/or rock will be screened with a scintillation detector and photo ionization detector. Screening measurements will be recorded on the field log. Soil will be sampled from intervals with the greatest above-background contamination. Samples should be collected from each core interval (0-5 ft, 5-10 ft, 10-15 ft, and 15-20 ft) at boreholes in leach fields. For

boreholes near tanks, samples should be collected beginning with the second core interval (5-10 ft, 10-15 ft, and 15-20 ft). If surveys indicate the presence of VOCs or above-background radioactivity, samples will be collected from points of highest readings. If no above-background contamination is detected, the midpoint of each core interval will be sampled.

If contamination is found in the last core interval (15-20 ft.), the borings will continue in 5-ft. intervals until two intervals below which above-background measurements are no longer detected. Appendix B contains the procedures for decontaminating sampling and drilling equipment, and for collecting soil and rock samples with a split-barrel core.

Collected subsurface samples will be screened for radioactivity and submitted to the laboratory for analysis. The initial 10% of sample locations from each SWMU will be analyzed for Level III VOCs, SVOCs, gross-alpha, -beta, -gamma ; gamma spectrometry, alpha spectroscopy, and metals (Table 7-9). The analyses of the remaining locations will be refined as necessary from these results.

SWMU No. 35-009(a) - Subsurface Investigation

SWMU No. 35-009(a) is located on the southwest side of TA-35-34 and consists of a 1,500-gal. septic tank TA-35-14, dosing chamber TA-35-15, distribution box TA-35-16, and a leach field located near the mesa edge (Figure 7-19). The system may also have included an outfall on the south rim of the mesa to Ten Site Canyon (LANL 1990, 0145), but available engineering drawings and field walkovers have not confirmed its existence to date. The system served TA-35-2, the main laboratory and office building at TA-35, between 1951 and 1975.

Six boreholes will be drilled to investigate potential subsurface contamination at SWMU No. 35-009(a). To assess potential leakage from the septic tank and dosing chamber two soil borings (B-1 and B-2) will be drilled approximately 10 ft. apart and 10 ft. down the slope from the dosing chamber (Figure 7-19). (Note: If the tank and dosing chamber are removed as a VCA before sampling begins and no contaminated soils are encountered around the structures, borings B-1 and B-2 will not be drilled.) To assess potential contamination beneath the leach field, four soil borings (B-3 through B-6) will be drilled on the south side of trailer TA-35-236. Borings B-3 and B-4 will be drilled approximately 15 ft. apart and 10 ft. from the trailer; borings B-5 and B-6 will be drilled approximately 15 ft. apart and 25 ft. south of the trailer (Figure 7-19). Additional borings may be installed if areas with above-background radiation or detectable VOC concentrations are identified during the environmental surveys. The minimum number of matrix samples based on a minimum drilling depth of 20 ft. for the Phase I subsurface investigation at SWMU No. 35-009(a) is 22.

If an outfall from this septic system is located during the field surveys, three surface soil/rock samples will be collected from the discharge drainage pathway beneath the outfall either at locations of radiation or VOC anomalies; if no anomalies are found, the samples will be collected at 20 foot intervals measured from the outfall discharge point.

SWMU No. 35-009(b) - Subsurface Investigation

SWMU No. 35-009(b) is located on the southeast side of warehouse TA-35-67 and consists of septic tank TA-35-76, distribution box TA-35-77, and a leach field near the mesa edge (Figure 7-20). The exact location of the leach field is uncertain, but a 1965 aerial photograph shows a rectangular area of disturbed soil which is believed

TABLE 7-9

PHASE I SAMPLING SUMMARY FOR C U 1129 SWMU AGGREGATE F
(SWMU Nos. 35-(09[a-d])

SWMU	LOCATION	DEPTH	TYPE OF ANALYSIS REQUIRED[1] A	B	C	D	E	F	G	H	I
35-009(a)	B-1	5-10 ft	X	X	X	X	X	X			
		0-15 ft	X	X	X	X	X	X			
		5-20 ft	X	X	X	X	X	X			
	B-2	5-10 ft	X	X	X	X	X	X			
		10-15 ft	X	X	X	X	X	X			
		15-20 ft	X	X	X	X	X	X			
	B-3	0-5 ft	X	X	X	X	X	X			
		5-10 ft	X	X	X	X	X	X			
		10-15 ft	X	X	X	X	X	X			
		15-20 ft	X	X	X	X	X	X			
	B-4	0-5 ft	X	X	X	X	X	X			
		5-10 ft	X	X	X	X	X	X			
		10-15 ft	X	X	X	X	X	X			
		15-20 ft	X	X	X	X	X	X			
	B-5	0-5 ft	X	X	X	X	X	X			
		5-10 ft	X	X	X	X	X	X			
		10-15 ft	X	X	X	X	X	X			
		15-20 ft	X	X	X	X	X	X			
	B-6	0-5 ft	X	X	X	X	X	X			
		5-10 ft	X	X	X	X	X	X			
		10-15 ft	X	X	X	X	X	X			
		15-20 ft	X	X	X	X	X	X			
35-009(b)	B-1	5-10 ft	X	X	X	X	X	X			
		10-15 ft	X	X	X	X	X	X			
		15-20 ft	X	X	X	X	X	X			
	B-2	5-10 ft	X	X	X	X	X	X			
		10-15 ft	X	X	X	X	X	X			
		15-20 ft	X	X	X	X	X	X			
		5-10 ft	X	X	X	X	X	X			
		10-15 ft	X	X	X	X	X	X			
		15-20 ft	X	X	X	X	X	X			

Table 7-9, (continued)

SWMU	LOCATION	DEPTH	TYPE OF ANALYSIS REQUIRED[1] A	B	C	D	E	F	G	H	I
	B-4	0-5 ft	X		X	X	X	X			
		5-10 ft	X	X	X	X	X	X			
		10-15 ft	X	X	X	X	X	X			
		15-20 ft	X	X	X	X	X	X			
35-009 (c)	S-1		X	X	X	X	X	X			
	S-2		X	X	X	X	X	X			
	S-3		X	X	X	X	X	X			
	S-4		X	X	X	X	X	X			
	S-5		X	X	X	X	X	X			
	S-6		X	X	X	X		X			
	B-1	5-10 ft	X	X	X	X	X	X			
		10-15 ft	X	X	X	X	X	X			
		15-20 ft	X	X	X	X	X	X			
	B-2	5-10 ft	X	X	X	X	X	X			
		10-15 ft	X	X	X	X	X	X			
		15-20 ft	X	X	X	X	X	X			
	B-3	0-5 ft	X	X	X	X	X	X			
		5-10 ft	X	X	X	X	X	X			
		10-15 ft	X	X	X	X	X	X			
		15-20 ft	X	X	X	X	X	X			
	B-4	0-5 ft	X	X	X	X	X	X			
		5-10 ft	X	X	X	X	X	X			
		10-15 ft	X	X	X	X	X	X			
		15-20 ft	X	X	X	X	X	X			
35-009 (c)	B-5	0-5 ft	X	X	X	X	X	X			
		5-10 ft	X	X	X	X	X	X			
		10-15 ft	X	X	X	X	X	X			
		15-20 ft	X	X	X	X	X	X			
	B-6	0-5 ft	X	X	X	X	X	X			
		5-10 ft	X	X	X	X	X	X			
		10-15 ft	X	X	X	X	X	X			
		15-20 ft	X	X	X	X	X	X			
	B-7	0-5 ft	X	X	X	X	X	X			
		5-10 ft	X	X	X	X	X	X			

Table 7-9. (concluded)

SWMU	LOCATION	DEPTH	TYPE OF ANALYSIS REQUIRED[1] A	B	C	D	E	F	G	H	I
	B-7 cont	10-15 ft	X		X	X		X			
		15-20 ft	X	X	X	X	X	X			
	B-8	0-5 ft	X	X	X	X	X	X			
		5-10 ft	X	X	X	X	X	X			
		10-15 ft	X	X	X	X	X	X			
		15-20 ft	X	X	X	X	X	X			
35-009 (d)	B-1	5-10 ft	X	X	X	X	X	X			
		10-15 ft	X	X	X	X	X	X			
		15-20 ft	X	X	X	X	X	X			
	B-2	5-10 ft	X	X	X	X	X	X			
		10-15 ft	X	X	X	X	X	X			
		15-20 ft	X	X	X	X	X	X			
	B-3	0-5 ft	X	X	X	X	X	X			
		5-10 ft	X	X	X	X	X	X			
		10-15 ft	X	X	X	X	X	X			
		15-20 ft	X	X	X	X	X	X			
	B-4	0-5 ft	X	X	X	X	X	X			
		5-10 ft	X	X	X	X	X	X			
		10-15 ft	X	X	X	X	X	X			
		15-20 ft	X	X	X	X	X	X			
	B-5	0-5 ft	X	X	X	X	X	X			
		5-10 ft	X	X	X	X	X	X			
		10-15 ft	X	X	X	X	X	X			
		15-20 ft	X	X	X	X	X	X			
35-009 (d)	B-6	0-5 ft	X	X	X	X	X	X			
		5-10 ft	X	X	X	X	X	X			
		10-15 ft	X	X	X	X	X	X			
		15-20 ft	X	X	X	X	X	X			
		Rinsate Blanks	5	5	5	5	5	5			
		Bottle Blanks	5	5	5	5	5	5			
		Trip Blanks	0	0	0	0	1	0			
		Duplicates	5	5	5	5	5	5			
		TOTALS	109	109	109	109	104	109			

[1] A = gross α, β, γ
E = VOCs
G = PCBs

B = γ spectrometry
D = metals by ICPES
H = ^{3}H in soil

C = α spectroscopy
F = SVOCs
I = miscellaneous analytes

to represent the leach field on the east side of the septic tank (Figure 7-20). An outfall may have discharged overflow from the system into Ten Site Canyon, but the existence of the outfall has not been confirmed by engineering drawings or field walkovers. This septic system served TA-35-67 and possibly other buildings between 1966 and 1975. No documentation exists regarding the types of materials released to this system.

Four boreholes will be drilled at this site to assess potential subsurface contamination at SWMU No. 35-009(b). Two boreholes (B-1 and B-2) will be drilled on either side of the septic tank (TA-35-76) to assess potential leakage from the tank and distribution box (Figure 7-20). The exact locations of these holes will depend on rig access, which is limited because of the steep slope in the area. (Note: If the tank and distribution box are removed as a VCA before sampling begins and no contaminated soils are encountered around these structures, borings B-1 and B-2 will not be drilled.) To investigate possible contamination in the leach field area, two borings (B-3 and B-4) will be drilled beneath the asphalt near the guard rail at the canyon edge (Figure 7-20). Although most of the leach field is south of the guard rail, the steep slope and thick vegetation prevent drilling in that area. The minimum number of matrix samples based on a minimum drilling depth of 20 feet for the Phase I subsurface investigation at SWMU No. 35-009(b) () is 14.

If an outfall from this septic system is located during the field surveys, three surface soil/rock samples will be collected from the discharge drainage pathway beneath the outfall either at locations of radiation or VOC anomalies; if no anomalies are found, the samples will be collected at 20 foot intervals measured from the outfall discharge point, .

SWMU No. 35-009(c) - Subsurface Investigation

SWMU No. 35-009(c) is located on the north edge of the mesa near Mortandad Canyon on the north side of TA-35-2 (Figure 7-21). The system consists of a 1,290-gal. septic tank TA-35-44, distribution box TA-35-45, and an extensive leach field that underlies the dirt access road west of trailer TA-35-261 (Figure 7-21). Overflow from the system was discharged into Mortandad Canyon from two outfalls located at the east and west ends of the leach field (Figure 7-21). The system served TA-35-2 between 1961 and 1990.

Potential subsurface contamination at this site will be assessed by drilling eight soil borings. Two borings (B-1 and B-2) will be drilled to assess leakage from the tank; B-1 will be installed 5 ft. west of the distribution box and B-2 will be installed 5 ft. east of the distribution box (Figure 7-21). (Note: If the tank and distribution box are removed as a VCA before sampling begins and no contaminated soils are encountered around the structures, borings B-1 and B-2 will not be drilled.) Six boreholes (B-3 through B-8) will be drilled in the dirt road to assess possible contamination beneath the leach field. The locations of these borings are shown in Figure 7-21. Additional borings may be installed if areas with above-background radiation or detectable VOC concentrations are identified during the environmental surveys. The minimum number of matrix samples based on a minimum drilling depth of 20 feet for the Phase I subsurface investigation at SWMU No. 35-009(c) is 30.

Potential release of COCs from the two outfalls at SWMU No. 35-009(c) will be assessed by collecting three surface soil/rock samples from the discharge drainage pathway beneath each of the two outfalls for a total of six samples. These samples will be collected either at locations of radiation or VOC anomalies; if no anomalies

are found, the samples will be collected at 20-ft. intervals measured from the outfall discharge points (Figure 7-21).

SWMU No. 35-009(d) - Subsurface Investigation

SWMU No. 35-009(d) is located at the northeast corner of the mesa, east of cooling tower TA-35-33. This septic system served the Fast Reactor Core Test Building (TA-35-27) between 1966 and 1990. The system consists of a combination septic tank/dosing chamber (TA-35-65) and a leach field that underlies the dirt access road that extends eastward from the cooling tower into Ten Site Canyon (Figure 7-22). The 1990 SWMU report indicates that an outfall to Mortandad Canyon may be associated with this system (LANL 1990, 0145), but available engineering drawings and field walkovers have not confirmed its existence to date.

A total of six soil borings will be drilled at this site to investigate potential subsurface contamination. To assess possible leakage from the tank/dosing chamber, two borings (B-1 and B-2) will be drilled on the north side of TA-35-65 (Figure 7-22). Limited rig access space prevents borings from being drilled on the south side of this structure. (Note: If the tank/dosing chamber are removed as a VCA before sampling begins and no contaminated soils are encountered around the structure, borings B-1 and B-2 will not be drilled.) Four borings (B-3 through B-6) will be drilled in the dirt road to assess potential contamination beneath the leach field. The locations of these holes are shown in Figure 7-22. Additional boreholes may be installed areas with above-background radiation or detectable VOC concentrations are identified during the environmental surveys. The minimum number of matrix samples based on a minimum drilling depth of 20 feet for the Phase I subsurface investigation at SWMU No. 35-009(d) is 22.

If an outfall from this septic system is located during the field surveys three surface soil/rock samples will be collected from the discharge drainage pathway beneath the outfall either at locations of radiation or VOC anomalies; if no anomalies are found, the samples will be collected at 20-ft. intervals measured from the outfall discharge point.

7.10.3 Sample Screening and Analysis

Each sample collected will be screened for radiation with a scintillation detector for contact radiation. All sample packages must be screened for surface level of contamination and contact radiation. All samples will be analyzed for Level III VOCs; SVOCs; metals; gross-alpha, -beta, -gamma; gamma spectrometry; alpha spectroscopy, and ^{3}H (soil). The subsurface soil samples collected from each septic system will also be analyzed for Level III VOCs. Table 7-9 outlines the total number of matrix and QA/QC samples required for this field investigation, the corresponding analyses, and sample requirements.

7.11 SWMU Aggregate G, Phase I

The sampling study area for SWMU Nos. 35-010(a-d) is shown in Figure 7-24. All of these SWMUs are listed in the HSWA Module VIII (EPA 1990, 0306) (Table 1-1). Three lagoons, SWMU Nos. 35-010(a, b, and c) were installed in 1975 and are still active. These lagoons have concrete sides and bentonite-lined bottoms. The filter pit, SWMU No. 35-010(d), was constructed in 1980 and is lined with plastic. The lagoons are located in Ten Site Canyon near the confluence of the small feeder stream located in SWMU No. 35-003(r) and the Ten Site Canyon channel. The lagoons receive wastes which includes sanitary waste, small quantities of radionuclides, solvents, acids, bases, and photo-processing wastes from TAs-35, -48, -50, -55, and -54. It is not known if the lagoons and/or filters have released contaminants to the underlying soils/tuff or if possible hazardous substances have been released at the sand filter outfall. The outflows from the sand pits are monitored under an National Pollutant Discharge Elimination System (NPDES) permit. The lagoons are scheduled for decommissioning when the Laboratory-wide Sanitary WasteWater System Consolidation (SWSC) waste lines become operational. Therefore, a limited Phase I investigation will be implemented and a more comprehensive execution of the sample plan will be coordinated with D&D activities.

7.11.1 Sampling Plan Rationale and Objectives

The conceptual model for the SWMU No. 35-010 aggregate is potentially leaking lagoons containing an unknown variety of hazardous materials. The site could have been contaminated before the construction of the lagoons by discharges from SWMU No. 35-003(r). The previous contamination will be difficult to distinguish from contamination by the lagoons, therefore, a detailed search (in coordination with D&D activities) upstream in Ten Site canyon will be conducted. Data gathered from SWMU No. 35-003(r) (directly upstream from lagoons) will be used to supplement that collected from SWMU No. 35-010 for analysis.

The focus of Phase I will be the analysis of the material in the lagoons and drill samples collected from under the lagoons to see if the lagoons are discharging into soil/rock directly beneath the bentonite base.

A decision logic diagram for Phase I field investigation activities to be conducted at SWMU Aggregate G is presented in Figure 7-25 and discussed in the following text.

7.7.2 Phase I Field Investigation Activities

The technical approach for the Phase I investigation in Aggregate G will consist of four tasks. These tasks include the engineering survey and environmental surveys discussed in Section 7.4, liquid/sludge sampling, and subsurface investigation.

Liquid/Sludge Sample Collection

Two locations in each lagoon will be selected for collection of liquid/sludge samples. Each sample will be collected 38 ft from each end of the two lagoons on the south and 80 ft from each end along the axis of the lagoon on the north (Figure 7-24). Two samples will be collected at each location. Samples will be collected at 1 and 3 ft below the liquid surface by using a weighted bottle sampler. A second set of samples

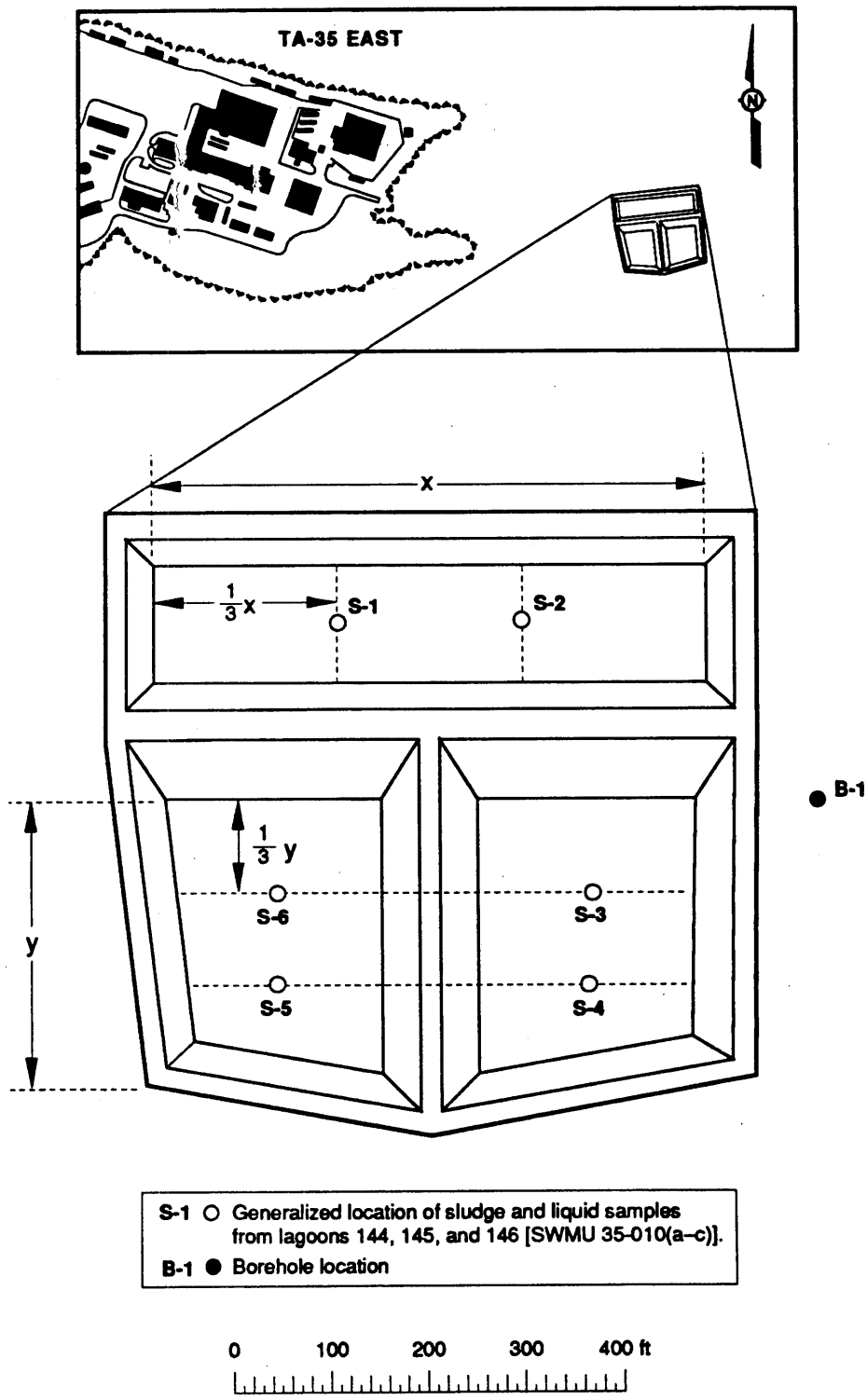


Figure 7-24. Schematic sample location map for SWMU Aggregate G.

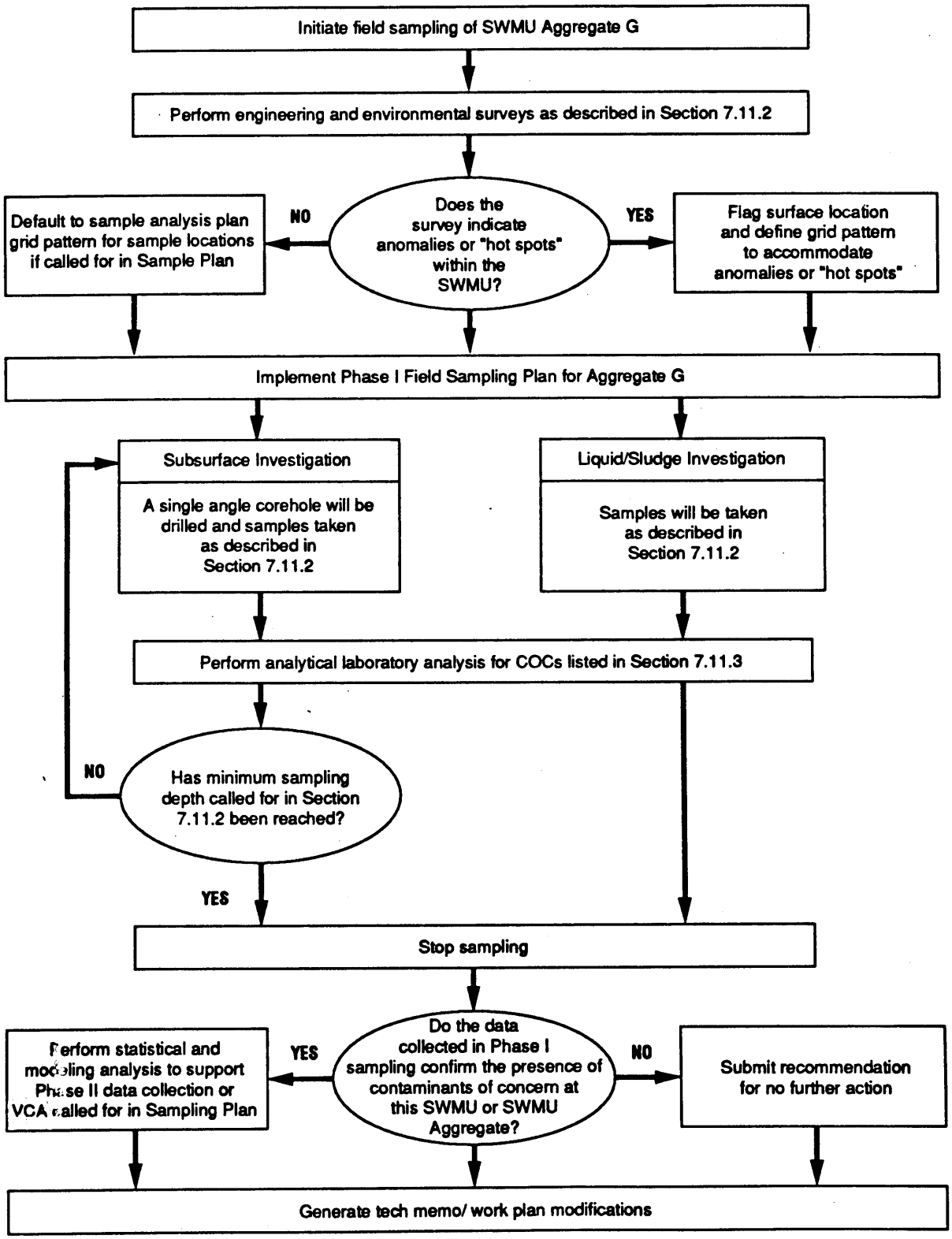


Figure 7-25. Decision logic for the sampling and analysis of SWMU Aggregate G.

will be collected from the top and base of the sludge using a grab sample. The liquid and sludge samples will be analyzed for VOCs, SVOCs, PCBs, metals, gross-alpha, -beta, -gamma ; gamma spectrometry, and alpha spectroscopy. (Table 7-10).

Subsurface Investigation

A single hole will be drilled using a wireline coring method at a 45 degree angle under the lagoons to try to intersect fractures and to determine if leakage is occurring. This hole will be continuously cored from the surface with samples being taken on 5-ft intervals. The hole will be a minimum depth of 50 ft. All samples will be field-screened for radioactive contaminants and VOCs. Samples indicating highest contamination will be sent to the laboratory for analysis. If no contamination is found, a random section of recovered material will be analyzed. Level III analysis will include testing for VOCs, SVOCs, PCBs, metals; gross-alpha, -beta, -gamma; gamma spectrometry, alpha spectroscopy, and soil/rock moisture content (Table 7-10). The location of the hole will be surveyed and recorded into the NMSP Coordinate System and recorded on the site base map.

7.11.3 Sample Screening and Analysis

Each sample collected will be screened with a scintillation detector for contact radiation. All sample packages must be screened for surface contamination and contact radiation.

TABLE 7-10

PHASE I SAMPLING SUMMARY FOR OU 1129 SWMU AGGREGATE G
(SWMU Nos 35-010[a,b, and c])

SWMU	LOCATION	DEPTH	TYPE OF ANALYSIS REQUIRED[1] A	B	C	D	E	F	G	H	I
35-010 (a)	S-1	Sludge (top)	X	X	X	X	X	X	X		X
		Sludge (bottom)	X	X	X	X	X	X	X		X
		Liquid (1 ft)	X	X	X	X	X	X	X		X
		Liquid (3 ft)	X	X	X	X	X	X	X		X
	S-2	Sludge (top)	X	X	X	X	X	X	X		X
		Sludge (bottom)	X	X	X	X	X	X	X		X
		Liquid (1 ft)	X	X	X	X	X	X	X		X
		Liquid (3 ft)	X	X	X	X	X	X	X		X
35-010 (b)	S-5	Sludge (top)	X	X	X	X	X	X	X		X
		Sludge (bottom)	X	X	X	X	X	X	X		X
		Liquid (1 ft)	X	X	X	X	X	X	X		X
		Liquid (3 ft)	X	X	X	X	X	X	X		X
	S-6	Sludge (top)	X	X	X	X	X	X	X		X
		Sludge (bottom)	X	X	X	X	X	X	X		X
		Liquid (1 ft)	X	X	X	X	X	X	X		X
		Liquid (3 ft)	X	X	X	X	X	X	X		X
35-010 (c)	S-3	Sludge (top)	X	X	X	X	X	X	X		X
		Sludge (bottom)	X	X	X	X	X	X	X		X
		Liquid (1 ft)	X	X	X	X	X	X	X		X
		Liquid (3 ft)	X	X	X	X	X	X	X		X
	S-4	Sludge (top)	X	X	X	X	X	X	X		X
		Sludge (bottom)	X	X	X	X	X	X	X		X
		Liquid (1 ft)	X	X	X	X	X	X	X		X
		Liquid (3 ft)	X	X	X	X	X	X	X		X
	B-1	0-5 ft	X	X	X	X	X	X	X		X
		5-10 ft	X	X	X	X	X	X	X		X
		10-15 ft	X	X	X	X	X	X	X		X
		15-20 ft	X	X	X	X	X	X	X		X
		20-25 ft	X	X	X	X	X	X	X		X

TABLE 7-10. (concluded)

SWMU	LOCATION	DEPTH	TYPE OF ANALYSIS REQUIRED[1] A	B	C	D	E	F	G	H	I
35-010(c) (continued)	B-1 (continued)	25-30 ft	X	X	X	X	X	X	X		X
		30-35 ft	X	X	X	X	X	X	X		X
		35-40 ft	X	X	X	X	X	X	X		X
		40-45 ft	X	X	X	X	X	X	X		X
		45-50 ft	X	X	X	X	X	X	X		X
		Rinsate Blanks	1	1	1	1	1	1	1		1
		Bottle Blanks	0	0	0	1	1	1	1		1
		Trip Blanks	0	0	0	0	1	0	0		0
		Duplicates	1	1	1	1	1	1	1		1
		TOTALS	36	36	36	37	38	37	37		37

[1] A = gross α, β, γ
B = γ spectrometry
C = α spectroscopy
D = metals by ICPES
E = VOCs
F = SVOCs
G = PCBs
H = ^{3}H in soil
I = miscellaneous analytes

7.12 SWMU Aggregate H, Phase I

The location of SWMU Nos. 35-014(a and b) at the east end of TA-35 are shown in Figure 7-26. Both of these SWMUs are listed in the HSWA Module VIII (EPA 1990, 0306) (Table 1-1), but were formally listed as 35-014. This section of TA-35 is located on a finger mesa between Mortandad and Ten Site canyons. SWMU No. 35-014(a) is the site of radionuclide-contaminated soils affected by deposition of stack emissions. Environmental monitoring of peach trees in the vicinity of the exhaust stack shows that they contain radionuclides. SWMU No. 35-014(b) is the approximate site of a leaking drum that reportedly contained oil with 50.4 µg/g of PCBs. The leaking drum was found near the southwest corner of the northwest wing of TA-35-2; the exact original location of the drum is unknown.

According to archival information in Chapter 3.0, the waste stream for this aggregate contains radionuclides from the exhaust stack and PCBs from the leaking drum. The stack was used to exhaust, among other things, a tritium glovebox facility that operated in the basement of TA-35-2. The releases of several thousand curies of tritium to the atmosphere annually were reported between 1954 and 1979. The leaking oil drum may have contained PCBs. The drum was removed, but it is not known if all the surrounding contaminated material was removed. The release of oil containing 50.4 µg/g PCBs is documented to have occurred in 1985 (Fritz and Scholl1985, 04-0083).

7.12.1 Sampling Plan Rationale and Objectives

The objective of surface/near-surface characterization for this aggregate is to determine if contamination exists. The characterization process will generate the following sampling activities:

- Collecting soil/rock data to determine if contaminants exist.
- Collecting soil/rock data to support transport model calculations.

The conceptual model for this aggregate is as follows:

- The area in which releases have occurred (SWMU No. 35-014[a]) is heavily industrialized, and most of the area was covered with an asphalt cap before any known releases.
- A grass-covered and soil area surrounds portions of building TA-35-2 and is a likely location for contaminants. Soils in the grass area around TA-35-2 will be analyzed.
- The asphalt cap allows rainfall to wash the potential contaminants to outfall gutters. The soils beneath the gutters will be analyzed. The soils that receive moisture from the roof of TA-35-2 will also be analyzed.
- Soil at SWMU No. 35-014(b) will be analyzed for PCBs, which are thought to be localized at the spill sight.

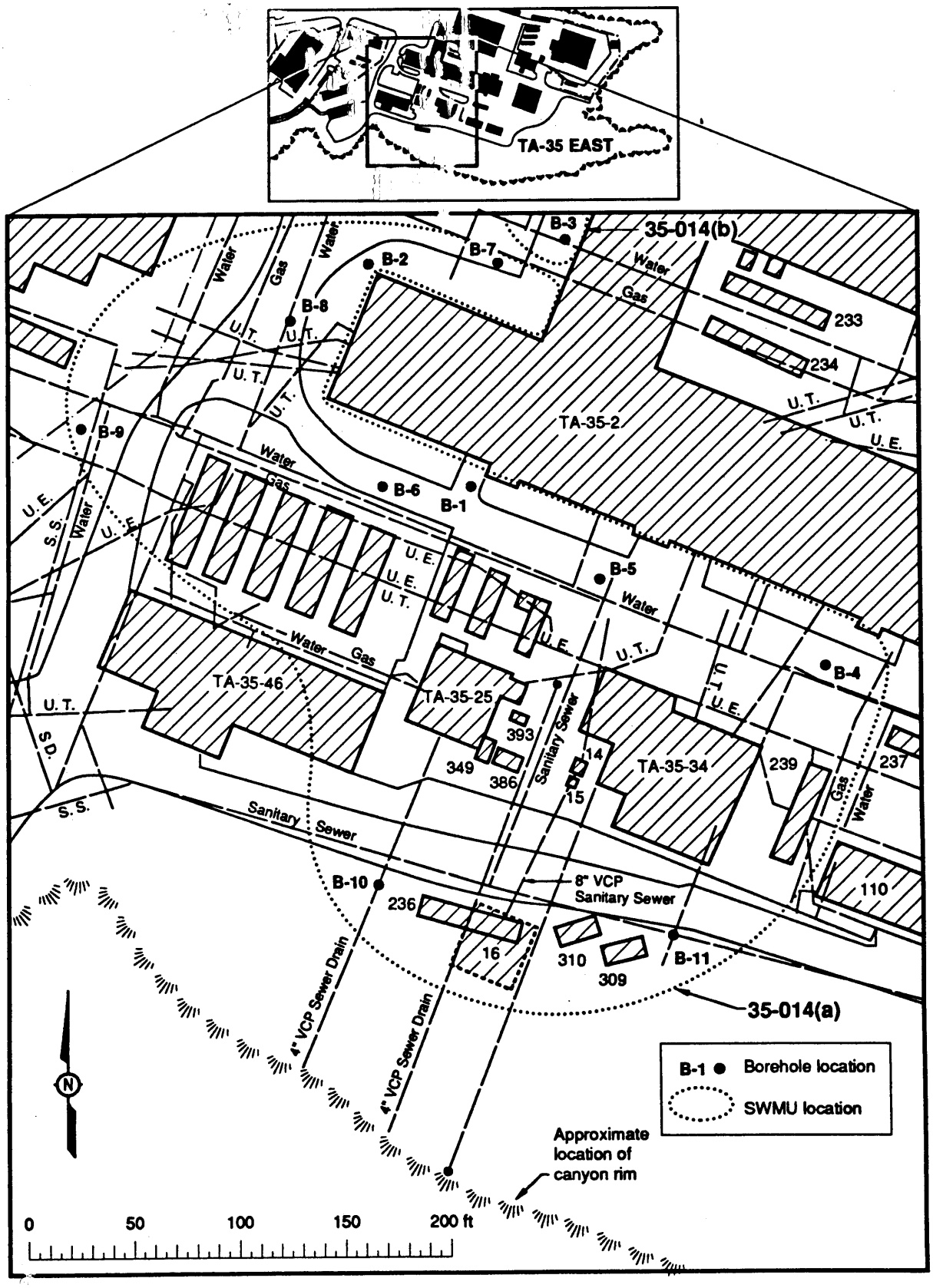


Figure 7-26. Schematic sample location map for SWMU Aggregate H.

A decision logic diagram for Phase I field investigation activities to be conducted at SWMU Aggregate H is presented in Figure 7-27 and discussed in the following text.

7.12.2 Phase I Field Investigation Activities

The sampling plan is designed to locate potential contaminants at their source (Figure 7-26). AIRDOS models will be used to assist in the characterization process (see Appendix C). The field activities will include the engineering survey and environmental survey discussed in Section 7.4, and surface sampling. The radiological survey will be conducted between established sample location points to help guide surface sampling locations between grid points.

Eleven boreholes will be drilled into the grassy area on the south and west sides of TA-35-2 to a depth of 3 ft by a hand auger (power-assisted if necessary). Upon the retrieval of soils, the entire recovered section will be screened for radiation. One sample for each planned analysis will be collected in the area of soil with the highest observed radioactivity. If no observed radioactivity is found, samples from random locations in the recovered interval will be analyzed for radionuclides (Table 7-11). At location B-3 (SWMU No. 35-014[b]),samples will be analyzed for radionuclides and PCBs (Table 7-11). Boring will stop when field screen and field laboratory analyses indicate no contamination. Two additional 1-ft samples will be collected to confirm that no contamination exists.

7.12.3 Sample Screening and Analysis

Each sample will be screened with a scintillation detector for contact radiation. All sample packages will be screened for surface contamination and contact radiation. Samples gathered will be analyzed at Level III for PCBs (SWMU No. 35-014 [b]); gross-alpha, -beta, -gamma; gamma spectrometry; alpha spectroscopy; and tritium (^{3}H soil).

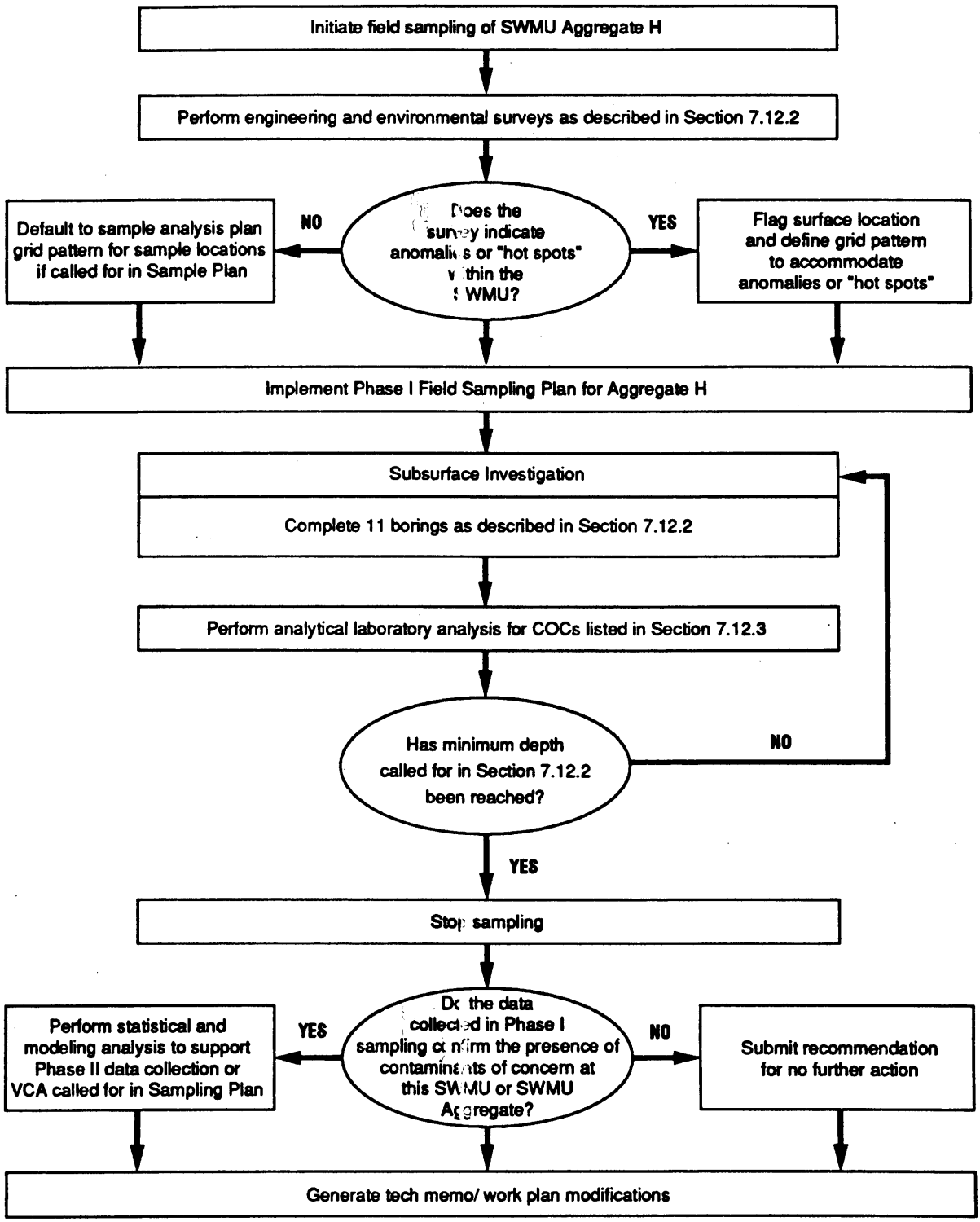


Figure 7-27 Decision logic for the sampling and analysis of SWMU Aggregate H.

TABLE 7-11

PHASE I SAMPLING FOR OU 1129 SWMU AGGREGATE H
(SWMU Nos. 35-014[a and b])

SWMU	LOCATION	DEPTH	TYPE OF ANALYSIS REQUIRED[1]								
			A	B	C	D	E	F	G	H	I
35-014 (a &b)	B-1	0-1 ft	X	X	X					X	
		1-2 ft	X	X	X					X	
		2-3 ft	X	X	X					X	
	B-2	0-1 ft	X	X	X					X	
		1-2 ft	X	X	X					X	
		2-3 ft	X	X	X					X	
	B-3	0-1 ft	X	X	X				X	X	
		1-2 ft	X	X	X				X	X	
		2-3 ft	X	X	X				X	X	
	B-4	0-1 ft	X	X	X					X	
		1-2 ft	X	X	X					X	
		2-3 ft	X	X	X					X	
	B-5	0-1 ft	X	X	X					X	
		1-2 ft	X	X	X					X	
		2-3 ft	X	X	X					X	
	B-6	0-1 ft	X	X	X					X	
		1-2 ft	X	X	X					X	
		2-3 ft	X	X	X					X	
	B-7	0-1 ft	X	X	X					X	
		1-2 ft	X	X	X					X	
		2-3 ft	X	X	X					X	
	B-8	0-1 ft	X	X	X					X	
		1-2 ft	X	X	X					X	
		2-3 ft	X	X	X					X	
	B-9	0-1 ft	X	X	X					X	
		1-2 ft	X	X	X					X	
		2-3 ft	X	X	X					X	
	B-10	0-1 ft	X	X	X					X	
		1-2 ft	X	X	X					X	
		2-3 ft	X	X	X					X	

Table 7-11. (concluded)

SWMU	LOCATION	DEPTH	TYPE OF ANALYSIS REQUIRED[1] A	B	C	D	E	F	G	H	I
	B-11	0-1 ft	X	X	X					X	
		1-2 ft	X	X	X					X	
		2-3 ft	X	X	X					X	
		Rinsate Blanks	1	1	1				1	1	
		Bottle Blanks	0	0	0				1	0	
		Trip Blanks	0	0	0				1	0	
		Duplicates	1	1	1				1	1	
		TOTALS	35	35	35				7	35	

[1] A = gross α, β, γ
B = γspectometry
C = αspectroscopy
E = VOCs
D = metals by ICPES
F = SVOCs
G = PCBs
H = ^{3}H in soil
I = miscellaneous analytes

7.13 SWMU Aggregate I, Phase I

SWMU No. 35-015(b), the location of a former waste oil treatment facility, is listed on the HSWA Module VIII (EPA 1990, 0306) (Table 1-1). Close to the former waste oil treatment facility, but not listed on the HSWA Module, is SWMU No. 35-014(d), which was the location of a dielectric oil spill. Also close to SWMU No. 35-015(b) are SWMU Nos. 35-003 (j and k), which are the location of oil storage tanks. Because of the proximity of SWMU Nos. 35-014(d) and 35-003(j and k) to SWMU No. 35-015(b), all four SWMUs will be aggregated into the Phase I investigation for SWMU No. 35-015(b), the waste oil treatment facility. SWMU No. 35-015(b) and aggregates are located on the east end of TA 35 (see Figure 7-28). This section of TA-35 is located on a finger mesa between Mortandad and Ten Site canyons. SWMU No. 35-015 and its aggregates will be characterized by a Phase I investigation according to the technical approach outlined in Chapter 5.0.

Archival information in Chapter 3.0 indicates that the waste stream from this SWMU aggregate is dominated by dielectric oil. While the amount of dielectric oil spilled has not been documented, archival photographs show discharges and soil stains. Significant releases that occurred between 1986 and 1988 have been documented.

7.13.1 Sampling Plan Rationale and Objectives

The objective of surface and subsurface characterization for this SWMU aggregate is to determine if contamination exists. The characterization process will generate the following sampling activities:

- Collecting soil/rock data to determine if contaminants exist.
- Collecting soil/rock data to support transport model calculations.

The conceptual model for this aggregate is as follows:

- No evidence exists that any D&D activity took place at Aggregate I other than capping the stained soils with asphalt.
- No evidence exists that any other constituent was spilled other than dielectric oil. With the asphalt capping of the area little evaporation/transpiration is likely to have occurred and transportation of contaminants will have been retarded. However, the proximity to other known contaminated sites requires a Phase I investigation of the area.
- The most likely transport mechanism for these areas is associated with hydrologic movement in the soil and vadose zone.
- If no D&D activity has occurred, the visual observation of soil stains will be the initial starting point for sample points. Archival information indicates the area detailed in the sampling plan is considered adequate for the Phase I investigation.

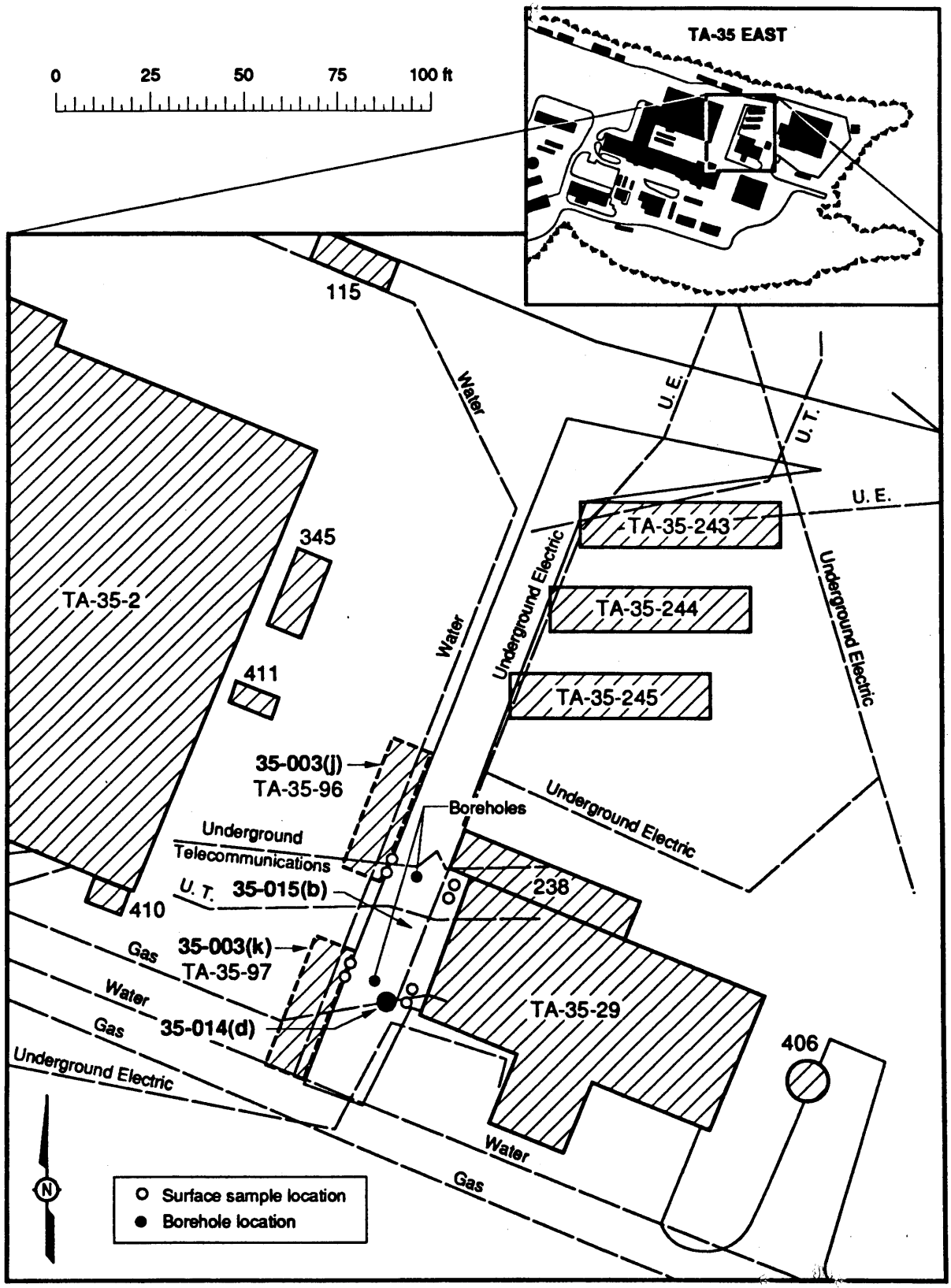


Figure 7-28. Schematic sample location map for SWMU Aggregate I [SWMU Nos. 35-003(j & k), 35-014(d), and 35-015(b)].

- Spills that have been washed down storm gutters are discussed in the SAP for SWMU No. 35-003(r) (the waste water treatment plant canyon disposal area). SWMU No. 35-003(r) is the location of these gutters' outfalls.

A decision logic diagram for Phase I field investigation activities to be conducted at SWMU Aggregate I is presented in Figure 7-29 and discussed in the following text.

7.13.2 Phase I Field Investigation Activities

Field activities in this investigation include the engineering survey and environmental survey discussed in Section 7.4, surface sampling, and subsurface sampling.

Following the engineering survey, a radiation survey will be conducted over the area. The survey will be conducted using a scintillation detector. Simultaneously with the radiation survey, the area will be surveyed for the presence of VOCs.

Surface Investigation

The sampling plan will be developed in phases. The first phase will locate the areas that are likely to be contaminated and the investigation will be expanded if contaminants are found. Two sections of asphalt surfacing, an area approximately 30 ft by 10 ft, will be removed at the northwest and southwest corners of building TA-35-29 (Figure 7-28). The asphalt will receive a radiological field screen using a scintillation meter. Surface samples will be gathered in the first 6 in. of soil at 8 random locations using a stainless-steel or Teflon scoop.

Subsurface Investigation

One borehole will be centered in each area in which the asphalt has been removed, and boring will extend to 6 ft. in depth. Boring will be conducted using a hollow-stem auger with a 2-ft split-barrel core sampler that will collect continuous core. Samples will be gathered from recovered sections indicating highest contamination (from field laboratory results). If no contamination is detected, random samples will be obtained from recovered sections.

7.13.3 Sample Screening and Analysis

Each sample collected will be screened with a scintillation detector for contact radiation. All sample packages will be screened for surface contamination and contact radiation. Samples will be analyzed at a Level III for Pest/PCBs; SVOCs (in boreholes only); VOCs; gross-alpha, -beta, -gamma; gamma spectrometry; and alpha spectroscopy (Table 7-12).

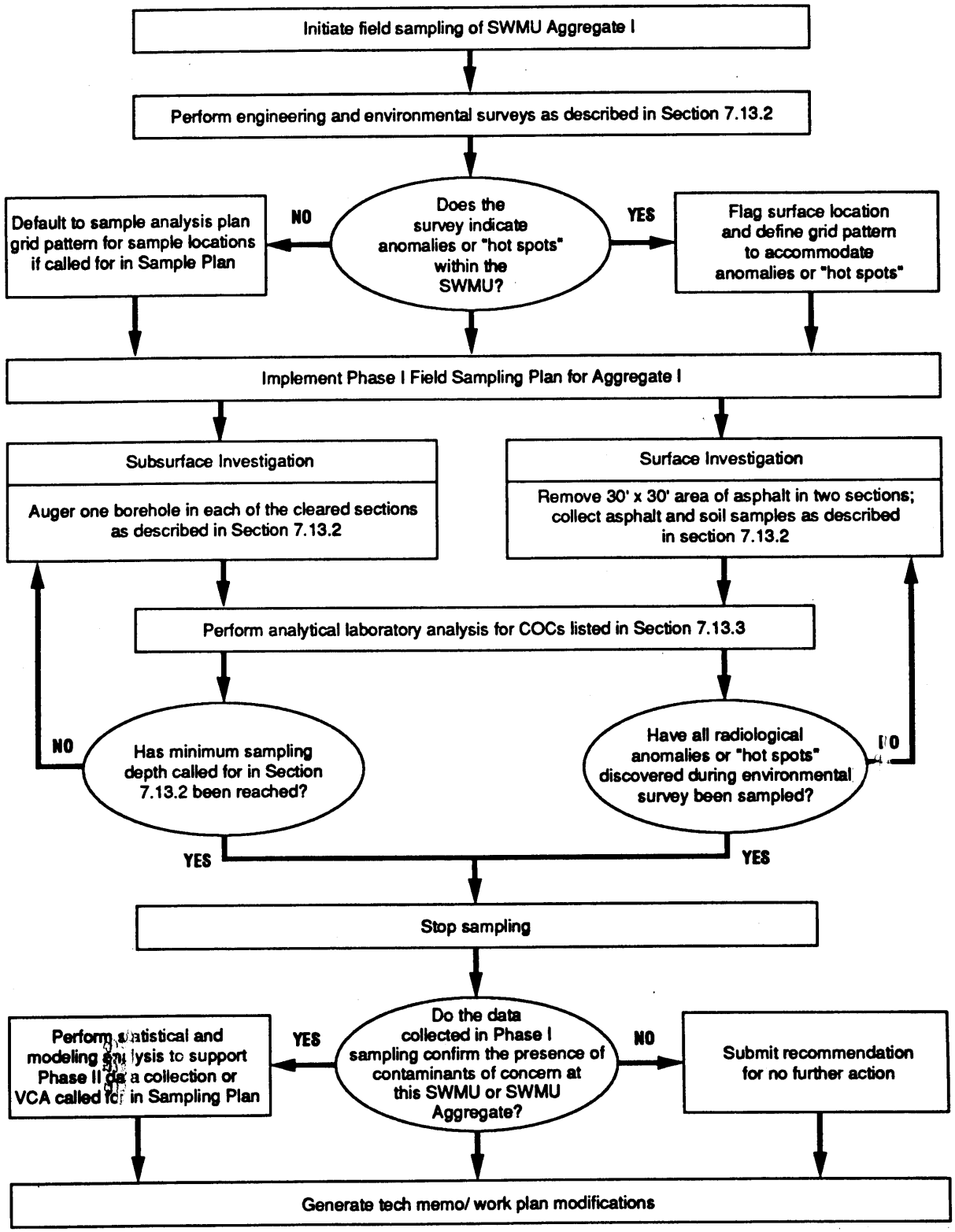


Figure 7-29. Decision logic for the sampling and analysis of SWMU Aggregate I.

TABLE 7-12

PHASE I SAMPLING SUMMARY FOR OU 1129 SWMU AGGREGATE I

WMU	LOCATION	DEPTH	TYPE OF ANALYSIS REQUIRED[1] A	B	C	D	E	F	G	H	I
3[illegible]-003 (l)	S-1		X	X	X		X		X		
	S-2		X	X	X		X		X		
3[illegible]-003 (k)	S-3		X	X	X		X		X		
	S-4		X	X	X		X		X		
3[illegible]-015 (b)	S-5		X	X	X		X		X		
	S-6		X	X	X		X		X		
	S-7		X	X	X		X		X		
	S-8		X	X	X		X		X		
	B-1	0-1 ft	X	X	X		X	X	X		
		1-2 ft	X	X	X		X	X	X		
		2-3 ft	X	X	X		X	X	X		
		3-4 ft	X	X	X		X	X	X		
		4-5 ft	X	X	X		X	X	X		
		5-6 ft	X	X	X		X	X	X		
	B-2	0-1 ft	X	X	X		X	X	X		
		1-2 ft	X	X	X		X	X	X		
		2-3 ft	X	X	X		X	X	X		
		3-4 ft	X	X	X		X	X	X		
		4-5 ft	X	X	X		X	X	X		
		5-6 ft	X	X	X		X	X	X		
		Rinsate Blanks	1	1	1		1	1	1		
		Bottle Blanks	0	0	0		1	1	1		
		Trip Blanks	0	0	0		1	0	0		
		Duplicates	1	1	1		1	1	1		
		TOTALS	22	22	22		24	15	23		

[1] A = gross α, β, γ
B = [illegible] spectrometry
C = α spectroscopy
E = VOCs
D = [illegible]etals by ICPES
F = SVOCs
G = PCBs
H = [illegible]H in soil
I = miscellaneous analytes

7.14 SWMU Aggregate J, Phase I

SWMU Aggregate J includes six sites that are associated with the former TA-42. All of these SWMUs are listed in the HSWA Module VIII (EPA 1990, 0306) (Table 1-1). SWMU 42-004 has been recommended for NFA and SWMU 42-002 has been renumbered to 42-002(a). The following SWMUs are included in this SAP:

- 42-001(a), an incinerator
- 42-001(b and c), two ash storage tanks
- 42-002(a), an indoor storage and decontamination area
- 42-002(b), an outdoor decontamination area
- 42-003, an inactive septic system

Former TA-42 was located within the current boundaries of TA-55, north of Pajarito Road and Pecos Drive. Figure 7-30 depicts the location of SWMU Aggregate J. A detailed description of the location, site activities, and history of Aggregate J SWMUs is presented in Section 3.4 of this Work Plan.

7.14.1 Sampling Plan Rationale and Objectives

The objective of this Phase I sampling plan is to determine the presence or absence of surface and subsurface contamination at SWMU Aggregate J within former TA-42. Sampling activities are biased toward areas in which residual contamination is most likely to be present on the basis of the following conceptual model for a release at this site:

- Previous D&D activities have removed most of the COCs although, in some cases, archival information indicates some contaminants were missed.
- Any remaining contaminant is considered to be localized within the vicinity of the SWMU and in the shallow subsurface. The one exception may be SWMU No. 42-002(b) because the equipment decontamination facility could have provided a liquid transport mechanism to fractures in the underlying tuff.
- Because of the limited incinerator operations and previous site D&D activities, assessment of local surface contamination was deemed unnecessary for all SWMUs except for the septic tank outfall and the outdoor decontamination area drainage channel.

The surface investigation at Aggregate J is designed primarily to answer the following decision points:

1) Does surface and subsurface contamination currently exist in Aggregate J?

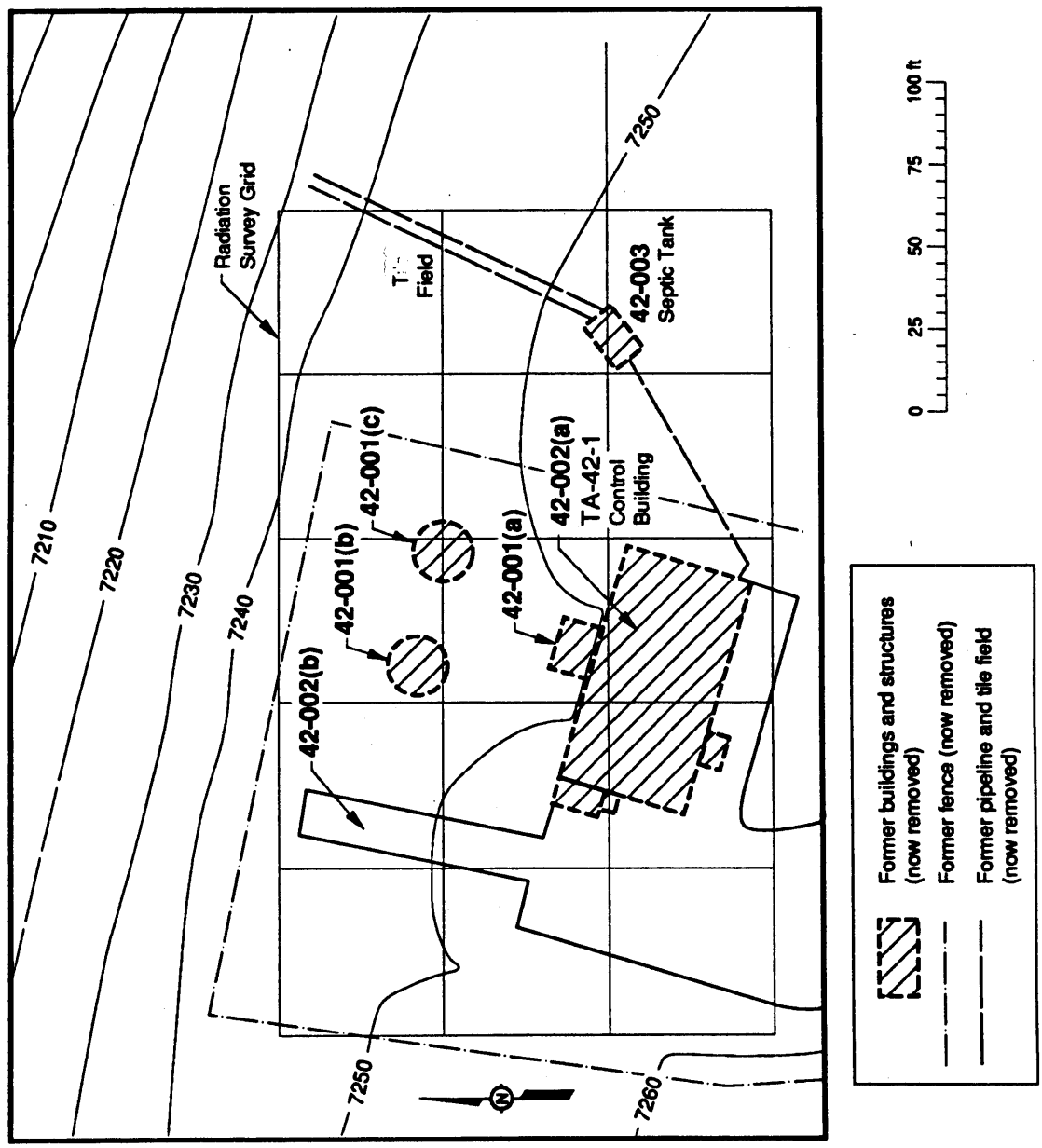


Figure 7-30. Location map and grid boundary for SWMU Aggregate J.

2) Are there any near-surface artifacts remaining that represent potential contaminant release points?

3) What is the potential for surface and subsurface migration of contaminants?

This sampling plan uses a judgmental sampling approach to investigate the SWMUs in Aggregate J. The sampling activities are biased toward areas of highest potential contamination. If contamination is confirmed to be present after the Phase I investigation, a Phase II investigation will be conducted to determine the nature and extent of contamination at the site.

TA-42 was the site of an incinerator, SWMU No. 42-001(a), and ash holding tanks, SWMU Nos. 42-001(b and c), that were used to burn radionuclide-contaminated waste. Archival information indicates that poor system performance caused incinerator operations to be shut down in 1952, after approximately one year of intermittent use. The facility was used as a radioactive equipment decontamination site from 1957 to 1969. During D&D activities in 1978, all structures were removed along with some contaminated soils. Samples collected during 1978 and 1991 surveys indicate soil contamination may still exist at ash holding tank, SWMU No. 42-001(c), the former septic system, SWMU No. 42-003, and at the former outdoor decontamination site, SWMU No. 42-002(b). These survey results suggest that previous D&D activities may not have been adequate and that remnant radioactive and hazardous contamination may be present at former TA-42.

A decision logic diagram for Phase I field investigation activities to be conducted at SWMU Aggregate J is presented in Figure 7-31 and discussed in the following text.

7.14.2 Phase I Field Investigation Activities

The technical approach for the Phase I assessments of SWMU Aggregate J will consist of four tasks on the basis of the conceptual model for the site. The four tasks include: the engineering survey an environmental survey discussed in Section 7.4, subsurface sampling in the vicinity of each SWMU, and surface sampling along the septic tank outfall and the discharge channel associated with the outdoor decontamination operations. For this investigation, soil contamination is assumed to be primarily localized in the vicinity of each SWMU within the shallow subsurface. Because of the limited incinerator operations and previous site D&D activities, assessment of local surface contamination was deemed unnecessary for all SWMUs except for the septic tank outfall and the outdoor decontamination area drainage channel. The conceptual model for Aggregate J is supported by surface sampling results from previous studies of the site.

The engineering survey will locate the former control building, both ash holding tanks, the septic tank and associated tile drain field and outfall, and the outdoor decontamination area and associated drainage channel. The areal extent of the SWMUs will be marked with stakes and the sampling grid and/or sampling points will be established before field work. A 250-ft (east-west) by 150-ft (north-south) grid will be established across the entire site and appropriately flagged (Figure 7-30). Individual grid blocks will be 50 ft by 50 ft.

Following the engineering survey, a radiation survey will be conducted across the TA-42 grid to identify potential radiological anomalies within the grid area. Scintilla-

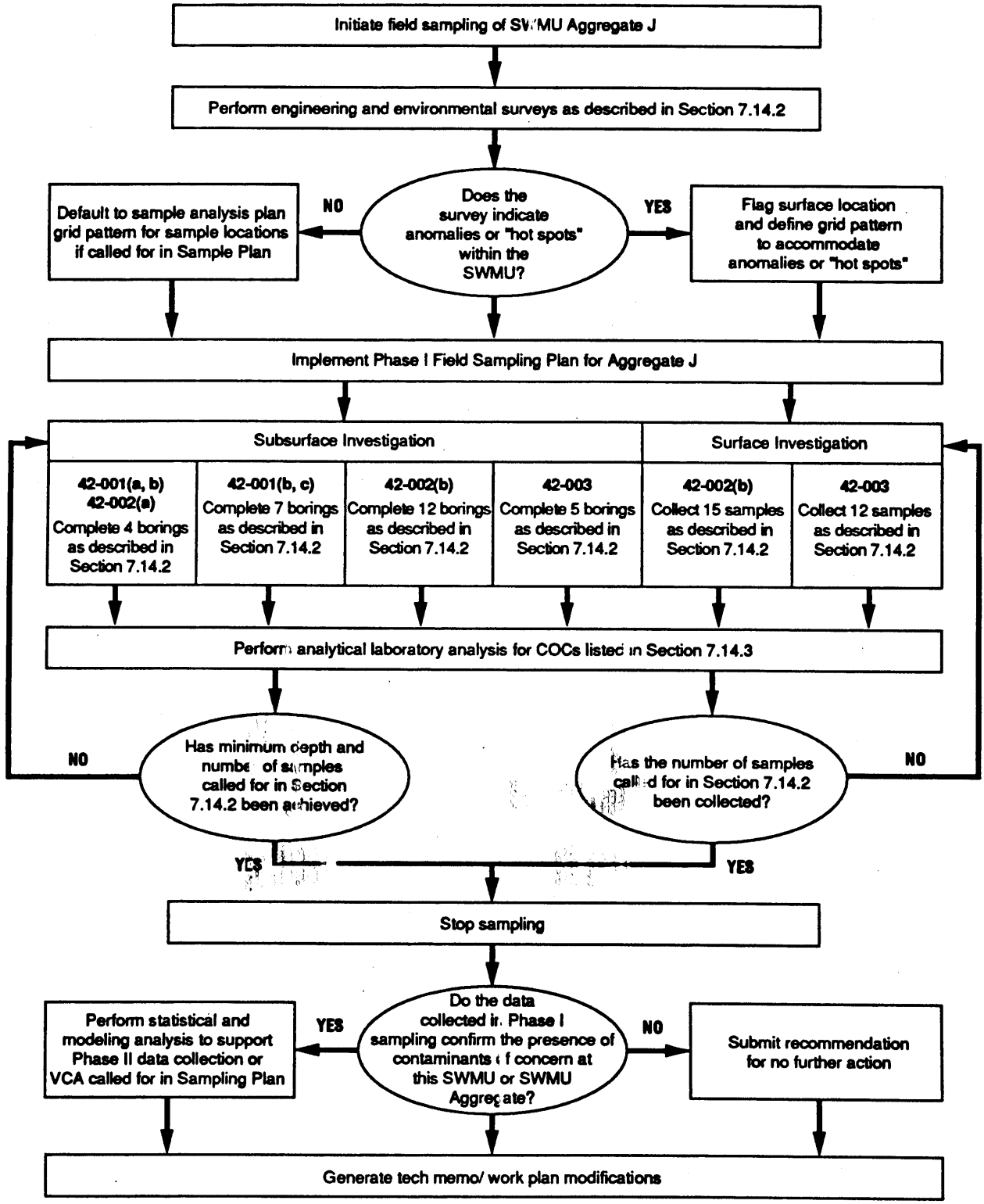


Figure 7-31. Decision logic for the sampling and analysis of SWMU Aggregate J.

tion detector surveys will be conducted across the first 100 ft of both the septic system outfall drainage channel and the outdoor decontamination area drainage channel, or until topographic limitations are reached. In addition, stationary radiological counts for a duration of one minute will be collected using a FIDLER in the center of each grid block.

Sampling Methodology

Each boring drilled during the Phase I field investigation at Aggregate J will be installed to the minimum depths specified in each sampling plan in this chapter. The extensive D&D work at TA-42, including the use of fill material and recontouring, has significantly altered the surface of the site. The boring depths presented in this plan were determined using an assumption that 5 ft or less of artificial fill is present at each boring location. If artificial fill exceeds this assumption, the field operations leader should adjust the boring depths and sample intervals to assure that only indigenous materials are sampled and submitted for laboratory analysis.

Each boring will be installed using a decontaminated continuous 5-ft core barrel. The boring will initially be advanced to a depth of 5 ft to drill below any artificial fill. The borehole will be advanced through the fill if it is in excess of 5 ft thick. Upon reaching 5 ft or the base of artificial fill, a 5-ft-long split-barrel core sampler will be used to collect soil/rock samples in 5-ft intervals. Upon core retrieval, the entire length of the core sample will be screened for radiation. One sample for each required analytical method will be collected at the section of core with the highest observed radioactivity. If no radioactivity above background is observed, the sample will be collected from the center of the core interval. The exact depth of each sample collected will be accurately recorded. Drilling will stop at the minimum designated boring depth when field screening determines that two consecutive core intervals measure at background radiation levels. If two consecutive background readings have not been observed, coring will continue until this criteria is reached. This method will ensure that the vertical extent of contamination is assessed in each boring. Health and safety monitoring for radiation and organic compounds will be performed during all site activities as specified in the site Health and Safety Project Plan (Annex III).

SWMU Nos. 42-001(a) and 42-002(a) - Subsurface Investigation

The incinerator, SWMU No. 42-001(a), and indoor storage and decontamination area, SWMU No. 42-002(a), were housed in the incinerator/control building, TA-42-1. Contamination from the incinerator that was not associated with off-gassing or waste ash was likely contained within the control building. Equipment decontamination conducted in the building from 1957 to 1969 generated solid residues that were bagged and sent to a material disposal area (MDA); liquid wastes were discharged to the septic system. The incinerator, associated equipment, and foundation were removed during D&D activities in 1978. Surface soil samples collected during the 1978 D&D activities contained less than 25 pCi/g gross-alpha in the area of the former incinerator/control building. In 1991, subsurface soil samples collected at the former incinerator site revealed background levels of gross-alpha, -beta, and -gamma activity. VOCs, SVOCs, and PCBs were not detected, and toxicity characteristic leaching procedure (TCLP) metals were below EPA guidelines (Section 3.4). In this investigation, additional soil samples will be collected at the former incinerator/control building site to determine the presence or absence of radiological contaminants that may remain in the subsurface. Surface samples will not be collected during this investigation because of the extensive D&D activities that have altered surface conditions at this site.

Four borings will be installed in the vicinity of the incinerator/control building (Figure 7-32). One boring, B-1, will be drilled at the former location of the incinerator to a minimum depth of 15 ft. Two borings, B-2 and B-3, will be installed in the area of the control building at a minimum depth of 15 ft. The borings at the incinerator and control building locations are intended to assess if soil contamination exists at shallow depth below these former structures. The 15-ft borings are the minimum depth required to define shallow subsurface contamination using the defined drilling and sampling criteria described under the Sampling Methodology subsection of this sampling plan. Boring B-4 is located at the southeast corner of the control building at the location of the influent line to the septic tank system. This borehole, drilled to a minimum depth of 25 ft, will assess residual subsurface contamination associated with the septic line. A deeper boring is recommended at this location as a result of potentially greater volumes of fluids that may have been released from the septic line. The minimum number of subsurface samples for the Phase I investigation at SWMU Nos. 42-001(a) and 42-002(a) is 10 per analytical method. Samples will be analyzed for Level III radionuclides (Table 7-13) listed in Table V.8 of the ER Program Generic Quality Assurance Project Plan (QAPjP) (Appendix T of the IWP [LANL 1991, 0553]). Sample analysis will be limited to radiological constituents because of the type of wastes generated at the site and soil analytical results obtained in the 1991 environmental survey. Each sample will be screened for radioactivity before submittal to the analytical laboratory.

SWMU Nos. 42-001(b and c) - Subsurface Investigation

Two ash holding tanks, SWMU Nos. 42-001(b and c), were used to store radioactive ashes generated during the incineration process. During a 1978 assay conducted before D&D activities, SWMU No. 42-001(b) was found to contain dry sludge, and SWMU No. 42-001(c) was found to contain wet sludge; both sludges were contaminated with plutonium (Section 3.4). The tanks were removed during D&D activities conducted in 1978. Drain lines that connected the tanks to the incinerator were filled with hot asphalt and either left in place or removed. After removal of the tanks, surface soil samples collected from the former ash tank locations measured less than 25 pCi/g for gross-alpha. Subsurface soil samples collected during a 1991 survey at the ash tanks measured background levels of beta and gamma activity. No VOCs or SVOCs were detected, and TCLP metals and PCBs were below EPA guidelines (see Section 3.4). In this survey soil samples from SWMU No. 42-001(b) had alpha activity ranging from background levels to <25 pCi/g. Alpha activity in surface soils from SWMU No. 42-001(c) ranged from 59 to 97 pCi/g for surface samples. Subsurface samples at this same SWMU measured alpha activity of >75 pCi/g. These results indicate that additional subsurface soil sampling is required to determine the presence or absence of radiological contaminants in the subsurface. Surface samples will not be collected during this investigation because of the extensive D&D activities that have altered surface conditions at this site.

Seven borings will be installed in the vicinity of the former ash holding tanks (Figure 7-32). Borings B-5 and B-6 will be located at each ash tank site. Boring B-7 is positioned between the tanks and borings B-8 through B-11 are located at a distance of 25 ft from the tanks in four compass directions (Figure 7-32). Each boring associated with this site will be drilled to a minimum depth of 25 ft. The distribution and depth of borings will allow confirmation of the presence or absence of local contamination resulting from operations at the ash holding tanks.

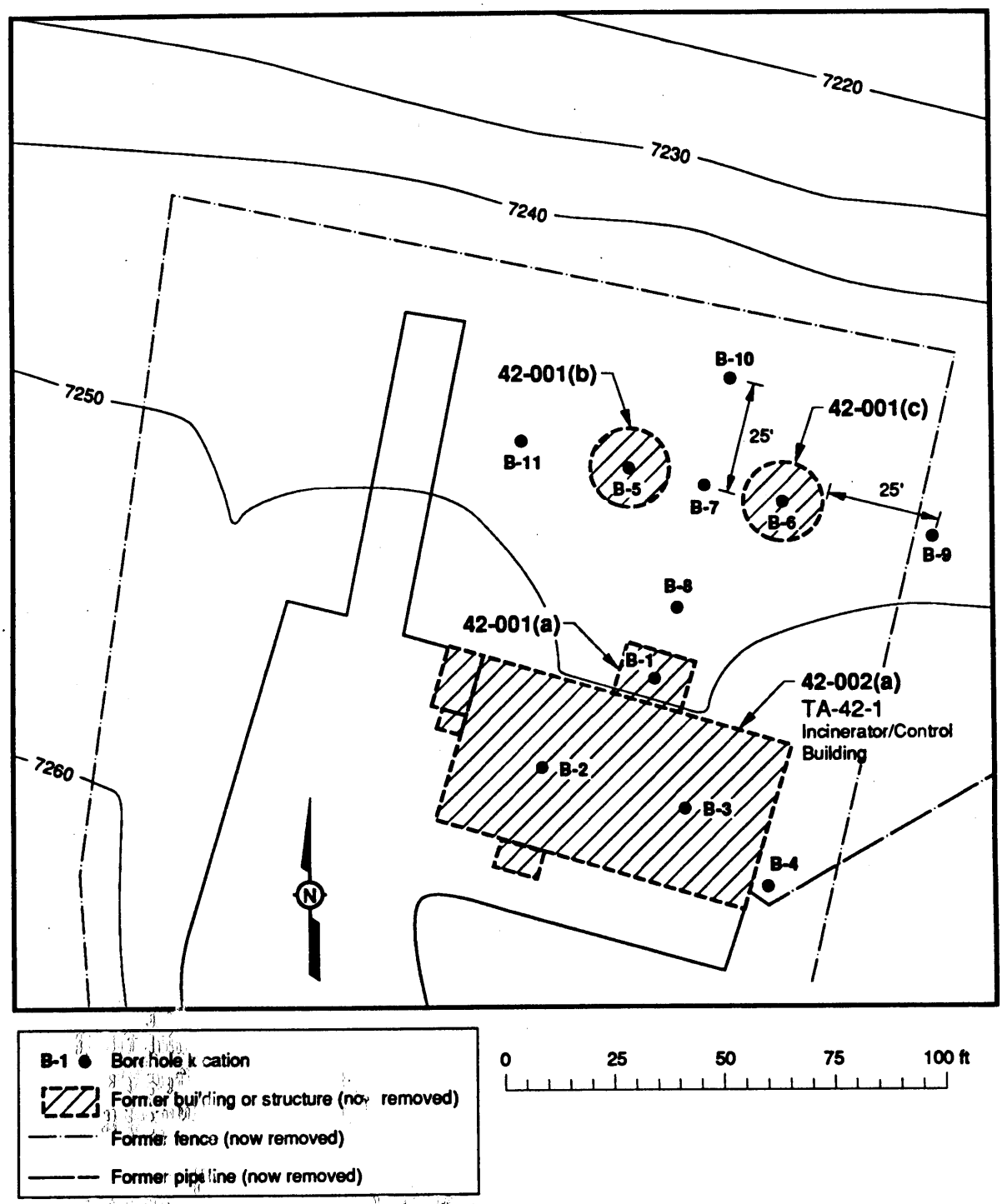


Figure 7-32. Schematic sample location map for SWMUS 42-001(a–c) and 42-002(a).

TABLE 7-13

Phase I Sampling Summary
for
OU 1129 SWMU Aggregate J
(SWMU Nos. 42-001[a, b, and c], 42-002[a and b], and 42-003)

SWMU	LOCATION	DEPTH	TYPE OF ANALYSIS REQUIRED[1]								
			A	B	C	D	E	F	G	H	I
42-001 (a)	B-1	5-10 ft	X	X	X	X	X	X			
		10-15 ft	X	X	X	X	X	X			
42-001 (b and c)	B-5	5-10 ft	X	X	X	X	X	X			
		10-15 ft	X	X	X	X	X	X			
		15-20 ft	X	X	X	X	X	X			
		20-25 ft	X	X	X	X	X	X			
	B-6	5-10 ft	X	X	X	X	X	X			
		10-15 ft	X	X	X	X	X	X			
		15-20 ft	X	X	X	X	X	X			
		20-25 ft	X	X	X	X	X	X			
	B-7	5-10 ft	X	X	X	X	X	X			
		10-15 ft	X	X	X	X	X	X			
		15-20 ft	X	X	X	X	X	X			
		20-25 ft	X	X	X	X	X	X			
	B-8	5-10 ft	X	X	X	X	X	X			
		10-15 ft	X	X	X	X	X	X			
		15-20 ft	X	X	X	X	X	X			
		20-25 ft	X	X	X	X	X	X			
	B-9	5-10 ft	X	X	X	X	X	X			
		10-15 ft	X	X	X	X	X	X			
		15-20 ft	X	X	X	X	X	X			
		20-25 ft	X	X	X	X	X	X			
	B-10	5-10 ft	X	X	X	X	X	X			
		10-15 ft	X	X	X	X	X	X			
		15-20 ft	X	X	X	X	X	X			
		20-25 ft	X	X	X	X	X	X			
	B-11	5-10 ft	X	X	X	X	X	X			
		10-15 ft	X	X	X	X	X	X			
		15-20 ft	X	X	X	X	X	X			
		20-25 ft	X	X	X	X	X	X			
42-003	B-12	5-10 ft	X	X	X	X	X	X			
		10-15 ft	X	X	X	X	X	X			
		15-20 ft	X	X	X	X	X	X			
		20-25 ft	X	X	X	X	X	X			

1 A = gross α, β, γ B = g spectrometry C = a spectroscopy
D = metals by ICPES E = VOCs F = SVOCs
G = PCBs H= ^{3}H in soil I = miscellaneous analytes

TABLE 7-13 (continued)

Phase I Sampling Summary
for
OU 1129 SWMU Aggregate J

(SWMU Nos. 42-001[a, b, and c], 42-002[a and b], and 42-003)

			TYPE OF ANALYSIS REQUIRED[1]								
SWMU	LOCATION	DEPTH	A	B	C	D	E	F	G	H	I
42-003	B-13	5-10 ft	X	X	X	X	X	X			
		10-15 ft	X	X	X	X	X	X			
		15-20 ft	X	X	X	X	X	X			
		20-25 ft	X	X	X	X	X	X			
	B-14	5-10 ft	X	X	X	X	X	X			
		10-15 ft	X	X	X	X	X	X			
		15-20 ft	X	X	X	X	X	X			
		20-25 ft	X	X	X	X	X	X			
	B-15	5-10 ft	X	X	X	X	X	X			
		10-15 ft	X	X	X	X	X	X			
		15-20 ft	X	X	X	X	X	X			
		20-25 ft	X	X	X	X	X	X			
	B-16	5-10 ft	X	X	X	X	X	X			
		10-15 ft	X	X	X	X	X	X			
		15-20 ft	X	X	X	X	X	X			
		20-25 ft	X	X	X	X	X	X			
42-002(b)	B-17	5-10 ft	X	X	X	X	X	X			
		10-15 ft	X	X	X	X	X	X			
		15-20 ft	X	X	X	X	X	X			
		20-25 ft	X	X	X	X	X	X			
	B-18	5-10 ft	X	X	X	X	X	X			
		10-15 ft	X	X	X	X	X	X			
		15-20 ft	X	X	X	X	X	X			
		20-25 ft	X	X	X	X	X	X			
	B-19	5-10 ft	X	X	X	X	X	X			
		10-15 ft	X	X	X	X	X	X			
		15-20 ft	X	X	X	X	X	X			
		20-25 ft	X	X	X	X	X	X			
	B-20	5-10 ft	X	X	X	X	X	X			
		10-15 ft	X	X	X	X	X	X			
		15-20 ft	X	X	X	X	X	X			
		20-25 ft	X	X	X	X	X	X			
	B-21	5-10 ft	X	X	X	X	X	X			
		10-15 ft	X	X	X	X	X	X			
		15-20 ft	X	X	X	X	X	X			
		20-25 ft	X	X	X	X	X	X			

[1] A = gross α, β, γ B = g spectrometry C = a spectroscopy
D = metals by ICPES E = VOCs F = SVOCs
G = PCBs H = ^{3}H in soil I = miscellaneous analytes

TABLE 7-13 (continued)

Phase I Sampling Summary
for
OU 1129 SWMU Aggregate J

(SWMU Nos. 42-001[a, b, and c], 42-002[a and b], and 42-003)

			TYPE OF ANALYSIS REQUIRED[1]								
SWMU	LOCATION	DEPTH	A	B	C	D	E	F	G	H	I
42-002 (a)	B-2	5-10 ft	X	X	X	X	X	X			
		10-15 ft	X	X	X	X	X	X			
	B-3	5-10 ft	X	X	X	X	X	X			
		10-15 ft	X	X	X	X	X	X			
	B-4	5-10 ft	X	X	X	X	X	X			
		10-15 ft	X	X	X	X	X	X			
		15-20 ft	X	X	X	X	X	X			
		20-25 ft	X	X	X	X	X	X			
42-002 (b)	B-22	5-10 ft	X	X	X	X	X	X			
		10-15 ft	X	X	X	X	X	X			
	B-23	5-10 ft	X	X	X	X	X	X			
		10-15 ft	X	X	X	X	X	X			
	B-24	5-10 ft	X	X	X	X	X	X			
		10-15 ft	X	X	X	X	X	X			
	B-25	5-10 ft	X	X	X	X	X	X			
		10-15 ft	X	X	X	X	X	X			
	B-26	5-10 ft	X	X	X	X	X	X			
		10-15 ft	X	X	X	X	X	X			
	B-27	5-10 ft	X	X	X	X	X	X			
		10-15 ft	X	X	X	X	X	X			
42-002(b)	S-13	Surface	X	X	X	X	X	X			
	S-14	Surface	X	X	X	X	X	X			
	S-15	Surface	X	X	X	X	X	X			
	S-16	Surface	X	X	X	X	X	X			
	S-17	Surface	X	X	X	X	X	X			
	S-18	Surface	X	X	X	X	X	X			
	S-19	Surface	X	X	X	X	X	X			
	S-20	Surface	X	X	X	X	X	X			
	S-21	Surface	X	X	X	X	X	X			
	S-22	Surface	X	X	X	X	X	X			
	S-23	Surface	X	X	X	X	X	X			
	S-24	Surface	X	X	X	X	X	X			
	S-25	Surface	X	X	X	X	X	X			
	S-26	Surface	X	X	X	X	X	X			
	S-27	Surface	X	X	X	X	X	X			

1 A = gross α, β, γ B = g spectrometry C = a spectroscopy
D = metals by ICPES E = VOCs F = SVOCs
G = PCBs H = ^{3}H in soil I = miscellaneous analytes

TABLE 7-13 (concluded)

Phase I Sampling Summary
for
OU 1129 SWMU Aggregate J

(SWMU Nos. 42-001[a, b, and c], 42-002[a and b], and 42-003)

			TYPE OF ANALYSIS REQUIRED[1]								
SWMU	**LOCATION**	**DEPTH**	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**
42-003	S-1	Surface	X	X	X	X	X	X			
	S-2	Surface	X	X	X	X	X	X			
	S-3	Surface	X	X	X	X	X	X			
	S-4	Surface	X	X	X	X	X	X			
	S-5	Surface	X	X	X	X	X	X			
	S-6	Surface	X	X	X	X	X	X			
	S-7	Surface	X	X	X	X	X	X			
42-003	S-8	Surface	X	X	X	X	X	X			
	S-9	Surface	X	X	X	X	X	X			
	S-10	Surface	X	X	X	X	X	X			
	S-11	Surface	X	X	X	X	X	X			
	S-12	Surface	X	X	X	X	X	X			
	Rinsate Blanks		8	8	8	3	2	3			
	Bottle Blanks		8	8	8	3	2	3			
	Trip Blanks		0	0	0	0	1	0			
	Duplicates		8	8	8	3	2	3			
	TOTALS		169	169	169	154	152	154			

[1] A = gross α, β, γ; B = g spectrometry; C = a spectroscopy; D = metals by ICPES; E = VOCs; F = SVOCs; G = PCBs; H = ^{3}H in soil; I = miscellaneous analytes

The minimum number of subsurface samples for the Phase I investigation at SWMU Nos. 42-001(b and c) is 28 per analytical method. Samples will be analyzed for Level III radionuclides (Table 7-13) listed in Table V.8 of the ER Program Generic QAPjP (Appendix T of the IWP [LANL 1991, 0553]). Sample analysis will be limited to radiological constituents based on the types of wastes generated at the site and soil analytical results obtained during the 1991 environmental survey. Each sample will be screened for radioactivity before submittal to the analytical laboratory.

SWMU No. 42-002(b) - Subsurface Investigation

SWMU No. 42-002(b) was an outdoor equipment decontamination area located at the end of the asphalt driveway northwest of TA-42-1 (Figure 7-33). Contaminated liquids generated from the decontamination process presumably flowed down the embankment on the northwest side of the driveway. This SWMU was not addressed during the 1978 D&D effort; however, subsurface soil samples collected from this area in 1991 revealed PCBs at <1 ppm and low levels of SVOCs. VOCs, gross-beta and gross-gamma were not detected in the samples collected. Gross-alpha activities ranged from 61 to 130 pCi/g in this area.

The elevated gross-alpha activities measured at the outdoor decontamination site in 1991 indicate that additional soil data is required to determine the presence or absence of radiological contaminants in the subsurface. A surface investigation to be conducted at this site is discussed later in this subsection.

Twelve borings will be installed in the vicinity of the outdoor decontamination site (Figure 7-33). Two borings, B-27 and B-28, will be located on the former location of the asphalt driveway with a 25-ft spacing between borings. Boring B-26 will be positioned north of the driveway near the former TA-42 fence line to determine if contamination exists from a northward flow of run-off. Twelve borings, B-17 through B-28, will be positioned in a 15-ft by 25-ft grid pattern west of the decontamination site in an effort to relocate the drainage channel through which waste fluids may have been transported. Each boring will be drilled to a minimum depth of 15 ft to define subsurface contamination for this investigation. The boring locations at this SWMU are purposely spaced over a wide area because the contaminated drainage channel is not well defined at this time.

The minimum number of subsurface samples for the Phase I investigation at SWMU No. 42-002(b) is 24 per analytical method. Samples will be analyzed for Level III radionuclides listed in Table V.8 of the ER Program Generic QAPjP (Appendix T of the IWP [LANL 1991, 0553]). VOCs, SVOCs, and metals (Table 7-13). Sample analysis is based on the types of wastes generated at the site and soil analytical results obtained during 1978 D&D sampling activities. Each sample will be screened for radioactivity before shipment to the analytical laboratory.

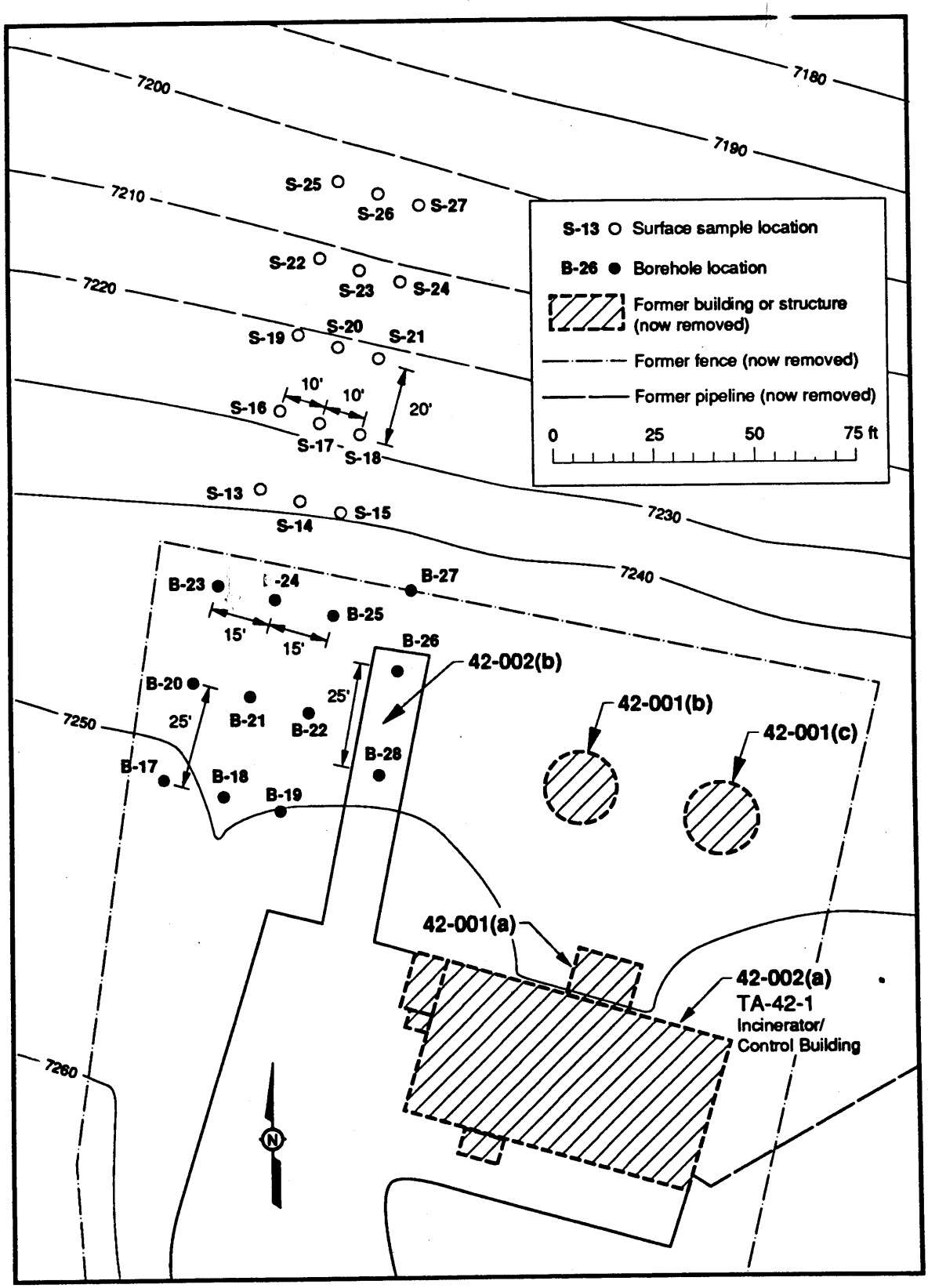


Figure 7-33. Schematic sample location map for SWMU 42-002(b).

SWMU No. 42-003 - Subsurface Investigation

The septic system that served the incinerator/control building consisted of a septic tank, filter trench, tile drain field, an outfall into Mortandad Canyon, and a drain line connecting to TA-42-1. The system received sanitary and industrial wastes from incineration and decontamination activities conducted in the building. The septic system and associated contaminated soils were removed during 1978 D&D activities. Soil samples collected from the septic tank in 1978 revealed gross-alpha of <25 pCi/g. In 1991, soil samples from a vertical boring installed at the former septic tank location contained gross-alpha activities ranging from 67 pCi/g at a depth of 10 ft to 18 pCi/g at a depth of 25 ft. Gross-beta and -gamma activity were measured at background, and no VOCs or PCBs were detected. Eight SVOCs detected at a depth of 15 ft were thought to be derived from asphalt or paving tar located at the base of the septic tank.

Surface soil samples collected from the tile drain field in 1978 had measurable gross-alpha readings ranging from <25 pCi/g to 99 pCi/g. Sample collection at the tile drain field was not documented during the 1991 environmental survey.

Soil samples collected in 1978 from a pit excavated in the immediate area in which the tile field drain pipe surfaced at the edge of Mortandad Canyon had measurable gross-alpha ranging from <25 pCi/g to 418 pCi/g. Samples collected down the canyonside drainage channel for gross-alpha readings were predominantly at levels <25 pCi/g. Two samples near the outfall trench and one sample located approximately 66 ft downslope of the trench had readings of 36, 40, and 29 pCi/g, respectively. Sample collection at the outfall or drainage channel area was not documented during the 1991 environmental survey.

Because of the presence of radioactive contamination in the septic tank, tile drain field, and outfall areas, additional soil data are required to determine the presence or absence of radiological contaminants in the subsurface. A surface investigation to be conducted at this site is discussed later in this subsection.

A total of 5 borings will be installed in the vicinity of the septic system, its tile drain field, and its outfall (Figure 7-34). One boring (B-42) will be drilled at the former location of the septic tank, and three along the tile drain field. Each will be drilled to a minimum depth of 25 ft because the septic tank may have released contaminants to the subsurface over an extended period of time.

One boring, B-25, will be positioned on the mesa top as near the former outfall daylight location as safety considerations will allow. Each boring will be drilled to a minimum depth of 25 ft. Boring depth justification follows that of the septic tank borings.

The minimum number of subsurface samples for the Phase I investigation at SWMU No. 42-003 is 21 per analytical method. Samples will be analyzed for Level III gross-alpha, -beta, -gamma; gamma spectrometry; and alpha spectroscopy, as listed in

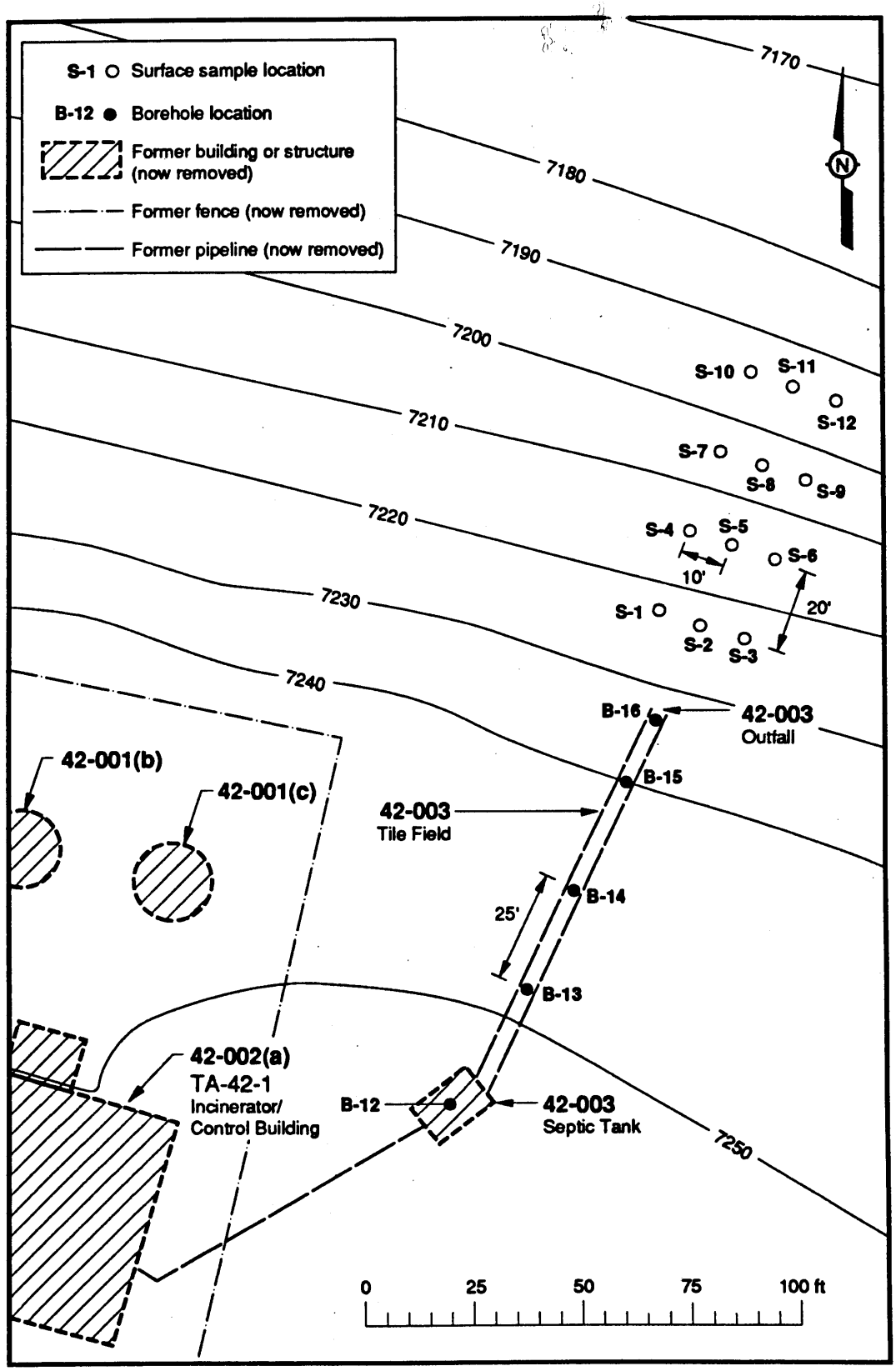


Figure 7-34. Schematic sample location map for SWMU 42-003.

Table V.8 of the ER Program Generic QAPjP (Appendix T of the IWP [LANL 1991, 0553]) (Table 7-13). Sample analysis will be limited to radiological constituents based on the types of wastes generated at the site and soil analytical results obtained during the 1991 environmental survey. Before shipment of the sample to the analytical laboratory, each sample will be screened in the field for radioactivity.

SWMU No. 42-002(b) - Surface Investigation

Surface soil/rock samples will be collected at 15 locations (S-13 through S-27) along the presumed drainage channel that carried waste water from outdoor decontamination operations to Mortandad Canyon. The purpose of these samples is to determine whether radioactive or hazardous constituents exist along the drainage channel and to assess the nature of the contamination. The samples will be taken from five transects of three samples each (Figure 7-33). The center sample of each transect will be collected in the drainage channel. One sample located a distance of 10 ft on either side of the channel will also be collected. Each transect will be separated by an interval of 20 ft down the canyonside. Soil samples will be collected with a stainless-steel trowel. If rock is present at the sample site, a clean hammer and chisel will be used to collect a rock chip sample. If topographic limitations are encountered, samples will be collected at the nearest accessible location. Sample locations depicted in Figure 7-33 are approximate. Actual locations will be based on field reconnaissance of the surface drainage pathway for the outdoor decontamination area.

The total number of surface samples for the Phase I investigation at SWMU No. 42-002(b) is 15 per analytical method. Samples will be analyzed for Level III radionuclides listed in Table V.8 of the ER Program Generic QAPjP (Appendix T of the IWP [LANL 1991, 0553]), metals, and SVOCs (Table 7-13).Sample analysis is based on the types of wastes generated at the site and soil analytical results obtained during 1978 D&D sampling activities. Each sample will be field- screened for radioactivity before shipment to the analytical laboratory.

SWMU No. 42-003 - Surface Investigation

Surface soil/rock samples will be collected at 12 locations (S-1 through S-12) along the drainage channel that carried waste water off the mesa top from the septic system outfall. The purpose of these samples is to determine if radioactive contamination exists along the canyonside drainage and to assess the nature of the contamination. The samples will be taken from four transects of three samples each (Figure 7-34). The center sample of each transect will be collected in the drainage channel. One sample located a distance of 10 ft on either side of the channel will also be collected. Each transect will be separated by an interval of 20 ft down the canyonside.

Soil samples will be collected with a clean, stainless-steel trowel. If rock is present at the sample site, a clean hammer and chisel will be used to collect a rock chip sample. If topographic limitations are encountered, samples will be collected at the nearest accessible location.

The total number of surface samples for the Phase I investigation at SWMU No. 42-003 is 12 per analytical method. Samples will be analyzed for Level III radionuclides listed in Table V.8 of the ER Program Generic QAPjP (Appendix T of the IWP [LANL 1991, 0553]), metals, and SVOCs (Table 7-13). Sample analysis is based on the types of wastes generated at the site and soil analytical results obtained during 1978

Soil samples will be collected with a clean, stainless-steel trowel. If rock is present at the sample site, a clean hammer and chisel will be used to collect a rock chip sample. If topographic limitations are encountered, samples will be collected at the nearest accessible location.

The total number of surface samples for the Phase I investigation at SWMU No. 42-003 is 12 per analytical method. Samples will be analyzed for Level III radionuclides listed in Table V.8 of the ER Program Generic QAPjP (Appendix T of the IWP [LANL 1991, 0553]), metals, and SVOCs (Table 7-13). Sample analysis is based on the types of wastes generated at the site and soil analytical results obtained during 1978 D&D sampling activities. Each sample will be field-screened for radioactivity before shipment to the analytical laboratory.

7.14.3 Sample Screening and Analysis

Each core sample collected will be screened with a FIDLER, a Geiger-Mueller meter and scintillation detector for contact radiation. All sample packages must be screened for surface contamination and contact radiation.

Table 7-13 outlines the total number of matrix and QA/AC samples required for this field investigation, the corresponding analyses, and sample requirements. Appendix B should be consulted for procedures regarding the use of specified field sampling equipment, sample handling, packaging, and shipping; equipment decontamination, and Level I and II field instruments.

7.15 SWMU / Aggregate K, Phase I

Aggregate K includes SWMU No. 48-001, an air exhaust system that is located on TA-48, north of Pajarito Road, on Mesita del Buey (the southern finger of South Mesa) between Mortandad Canyon on the north and Two Mile Canyon on the south (Figure 7-35). This SWMU is listed in the HSWA Module VIII (EPA 1990, 0306) (Table 1-1). The air exhaust system (SWMU No. 48-001) is part of building TA-48-1, the Radiochemistry Laboratory. There are nine exhaust stacks at SWMU No. 48-001 (Figure 7-35): three stacks exhaust chemical fume hoods, three stacks carry exhaust from combustion boilers, one stack carries filtered exhaust from the alpha wing gloveboxes, one stack carries filtered exhaust from the hot cell addition, and one stack carries exhaust from a welding and degreasing booth in the basement.

The alpha wing, located in the northeast end of the building, is used for processing high-level alpha and/or beta-gamma emitters and its stack carries exhaust from the gloveboxes. This air exhaust system (Stack FE54) is of concern as it carries radioactive particles into the atmosphere. Mixed fission products, uranium, and plutonium are in the airborne releases. Stack FE54 is currently permitted and monitored under National Emission Standards for Hazardous Air Pollutants (NESHAP), but its operational history is well documented and predates NESHAP. Because contaminated air has been vented to the atmosphere without proper filtration during the history of this facility, the soil surrounding TA-48 has likely become contaminated.

Reports covering the years 1967 to 1970 indicate routine airborne releases of plutonium, uranium, and mixed fission products from stacks. Total discharge of airborne radioactivity was documented for 1967 through 1970 and 1971, and is presented in Tables 7-14 and 7-15.

Average daily releases of alpha emitters were estimated to be less than 0.1 pCi/m3; releases for beta emitters ranged from 0.4 to 20 pCi/m^2 (LASL circa 1969, 04-0702). In 1984, measured airborne releases totaled 1,566 µCi of mixed fission products, 1.3 µCi of uranium, and 2.0 µCi of plutonium (Becker et al. 1985, 0029). The high-efficiency particulate air (HEPA) filter area for the exhaust system was monitored for radioactivity levels during a 1988 ER Program reconnaissance survey and was found to be 233 cpm (60 µR/hr) above background (Shafer circa 1989, 04-0187). Potential contamination at this area has existed from 1957 to the present.

In January 1991, five surface and five subsurface soil samples were collected from the site of a proposed parking lot immediately east of the security fence on the east side of TA-48 (Figure 7-35). The samples were "systematically collected over the entire area;" however, the exact locations from which samples were taken were not provided (Fresquez 1990, 04-0073; Fresquez 1991, 04-0077). The proposed parking lot area was suspected of being contaminated by fallout from improperly filtered air emissions. Gross-beta and -gamma activity in all surface and subsurface samples were at background levels. However, gross-alpha activity ranged from background to 45 pCi/g for surface soil samples and from background to 65 pCi/g for subsurface samples. Alpha activity was below the Department of Energy (DOE) guideline value of 75 pCi/g for subsurface samples, but surface soil samples from the western and northwestern half of the proposed parking area exceeded the DOE guideline of >25 pCi/g for surface alpha activity (Fresquez 1991, 04-0077).

In April 1991, five surface and five subsurface soil samples were collected north of TA-48 as part of an Environmental Restoration Interim Action (ERIA) reconnais-

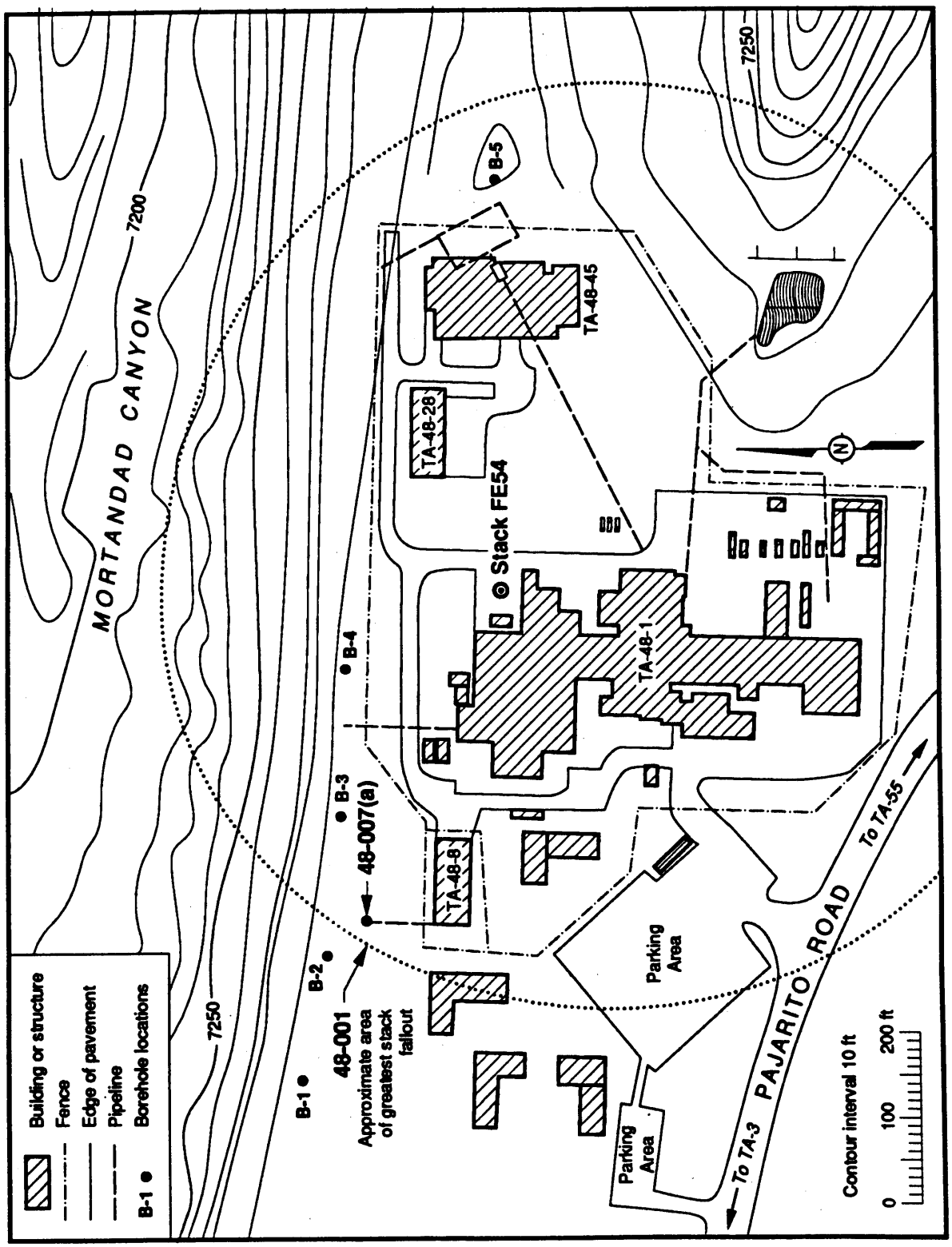


Figure 35. Schematic sample location map for SWMU Aggregate K (SWMU 48-001).

TABLE 7-14

TOTAL DISCHARGE OF AIRBORNE RADIOACTIVITY AT TA-48 FOR 1967 THROUGH 1970

Source of Pollutant	Pollutant	1967 (Ci)	1968 (Ci)	1969 (Ci)	1970 (Ci)
Stacks	^{235}U	1.7×10^{-4}	1.3×10^{-4}	6.5×10^{-4}	2.4×10^{-5}
Stacks[a]	FP[b]	1.7×10^{-2}	1.29×10^{-2}	3.9×10^{-3}	1.4×10^{-3}
Stacks[c]	^{239}Pu	1.10×10^{-4}	1.46×10^{-4}	1.26×10^{-4}	3.1×10^{-5}
FE-45, 46[d]	^{239}Pu	—	—	—	2.6×10^{-5}
FE-45, 46[d]	FP[b]	—	—	—	1.6×10^{-3}
FE-51[d]	^{239}Pu	—	—	—	7.2×10^{-9}
FE-51[d]	FP[b]	—	—	—	6.9×10^{-8}

Source: Voelz (1971, 04-0194).
[a]Total discharge from stacks 1, 2, and 3.
[b]Fission products.
[c]Total discharge from stack 2.
[d]New operations in 1970.

TABLE 7-15

AIR EMISSIONS OF RADIONUCLIDES AT TA-48 FOR 1971

Source of Pollutant (Stacks)	Pollutant	Concentration in Air (μCi/ml)	Total Quantity Released During Reporting Period (μCi)
FE-11, 12, 13	^{235}U	8.2×10^{-14}	6
FE-11, 12, 13	FP[a]	2.7×10^{-13}	219
FE-15, 16	^{239}Pu	1.6×10^{-4}	11
FE-15, 16	FP[a]	6.0×10^{-13}	509
FE-37, 38, 29, 40	^{235}U	4.9×10^{-15}	0.4
FE-37, 38, 39, 40	FP[a]	4.1×10^{-14}	4
FE-45	^{239}Pu	1.0×10^{-14}	8
FE-45	FP[a]	1.7×10^{-12}	1,018
FE-51	^{239}Pu	2.6×10^{-15}	0.1
FE-51	FP[a]	2.4×10^{-14}	1

Source: LASL (1972, 04-0146).
[a]Fission products.

sance survey at the site of a proposed building, the Weapons Isotope Separator Facility (Fresquez 1991, 04-0079). Surface samples were defined as samples taken between 0 and 4.8 ft in depth, and subsurface samples were defined as samples collected from greater than 4.8 ft in depth (Fresquez 1991, 04-0078). The samples were taken in the vicinity of SWMUs Nos. 48-001, 48-005, and 48-007(e) (Figure 7-35). Levels of gross-alpha, and -gamma activity were at background for all samples collected. No PCBs or SVOCs were detected in any of the samples. All samples revealed concentrations of TCLP metals (Ag, As, Ba, Cd, Cr, Hg, Pb, and Se) to be less than EPA guideline levels. Trace amounts of three VOCs (p-Cymene, cumene, and Freon) were detected at <52 ppb. EPA action- level concentrations are not listed for these VOCs (Fresquez 1991, 04-0079).

7.15.1 Sampling Plan Rationale and Objectives

The basic objective of the surface and subsurface characterization for this SWMU is to determine if contaminants are present, and if found, initiate investigations as to whether or not the contaminants have migrated. The characterization process will generate the following sampling objectives:

- Collecting geologic data (e.g., attitude and frequency of linear features such as fractures, attitude of tuff units, textures of volcanic rocks) to support transport model calculations.
- Classifying contaminant pathways on the surface and subsurface.
- Detecting and classifying contaminants.
- Originating investigations to determine if lateral and vertical migration of contaminants has occurred.

The conceptual model for SWMU No. 48-001 is thought to involve a three-stage process:

1) Airborne material expelled from the exhaust systems is deposited (settled) onto the soils. The mechanisms governing the deposition of contaminants are wind direction, stack height and velocity, and particle size.

2) Contaminants deposited on soils are washed into Mortandad Canyon. The mechanisms governing sediment transport are run-off and particle size. Run-off is controlled by the amount of precipitation, the grade of the surface , and the rate of infiltration.

3) Contaminants deposited on soils are transported by water and infiltrate into the soil horizon (unsaturated zone) as colloids. The depth of migration of colloidal particles is controlled by flux and sorption.

In the preliminary SAP development of Aggregate K, the AIRDOS-EPA model was used to predict the location of contaminant particle deposition. Emissions of ^{90}Sr, ^{144}Ce, ^{137}Cs, ^{241}Am, ^{239}Pu, and ^{238}Pu were modeled (Figures 7-36 and 7-37).

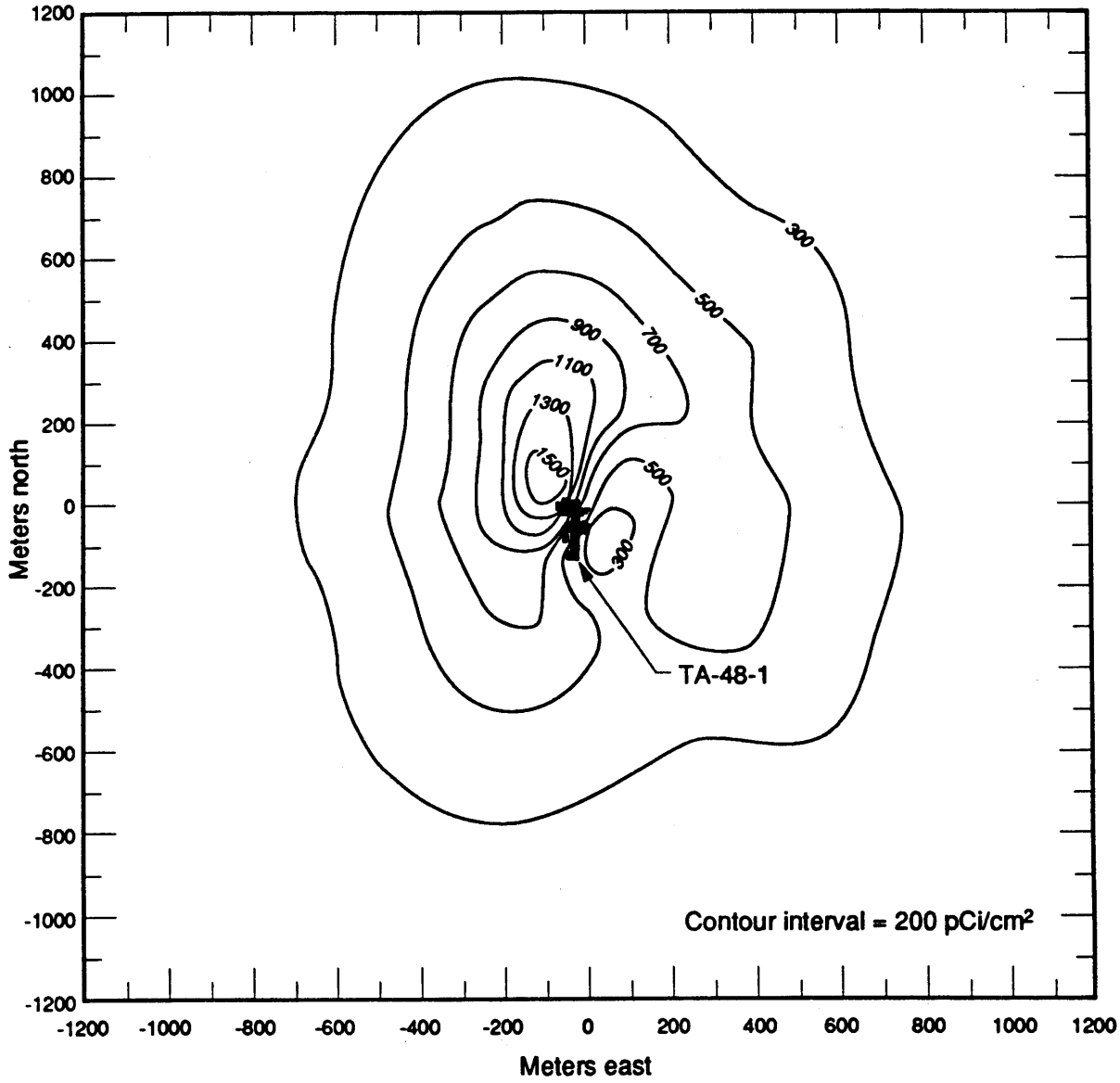


Figure 7-36. Isopleth map showing the distribution of Cs-137 at SWMU 48-001, TA-48 stack FE54.

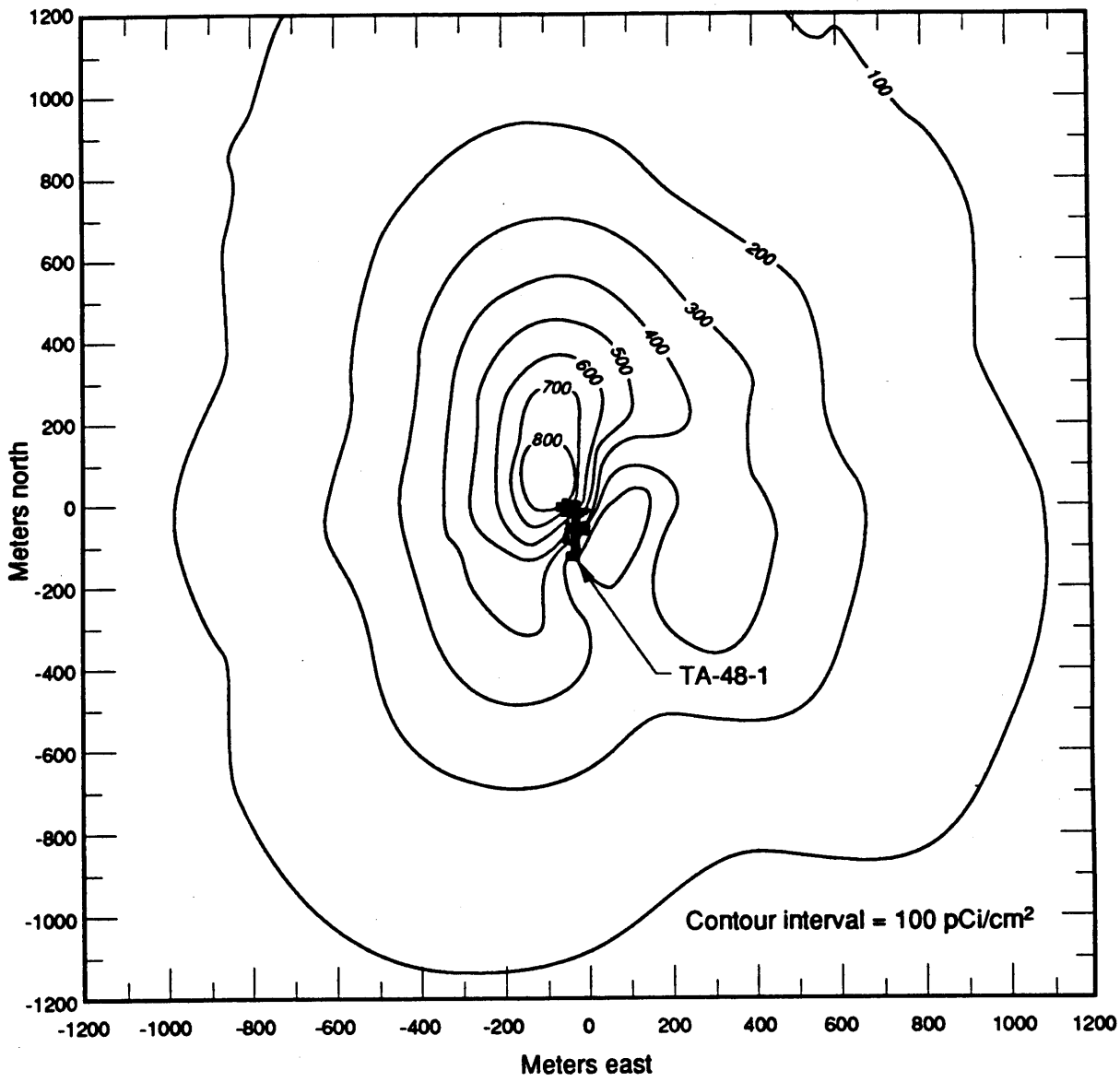


Figure 7-37. Isopleth map showing the distribution of Sr-90 at SWMU 48-001, TA-48 stack FE54.

Other contaminants are not presented because AIRDOS predicted the deposition pattern to be similar for all contaminants modeled. Further discussion of AIRDOS modeling results is located in Section 7.2.

A decision logic diagram for Phase I field investigation activities to be conducted at SWMU Aggregate is presented in Figure 7-38 and discussed in the following text.

7.15.2 Phase I Field Investigation Activities

The sampling plan is designed to locate potential contaminants at their most likely source. The field activities will include the engineering survey and environmental survey discussed in Section 7.4, and surface/subsurface sampling (Figure 7-35).

During the environmental survey, observations will be made to note any drainage gullies to the canyons; if any exist, they will be mapped as potential transport pathways for sediment. Observations will also be made on the canyon edges to identify fracture patterns in the tuff underlying the soils; if any prevailing fracture geometry is observed, these will be mapped.

Four locations will be sampled in the area in which the AIRDOS model predicted higher concentrations of radionuclides, and one location in which the model predicted low concentrations (Figure 7-37). This will help to confirm modeling results (validate the model).

The sampling objective is to sample within the higher concentration isopleths as predicted by AIRDOS. Figure 7-35 shows the approximate sampling locations. Samples will be taken by hand auger; however, the surface sample may be taken with a Teflon or stainless-steel scoop. Logs describing soil horizon changes will be prepared. Three samples will be taken at each location on the surface, top 1 ft, and subsurface. Subsurface sampling will continue as deep as the hand auger allows. Soils are expected to have a depth of 2 to 3 ft. The samples will be surveyed (scanned) on site for radiation, vertical samples will be taken until radiation is not detected or is at background levels. Soil samples with detectable levels of organic vapors, screened using a PID or organic vapor analyzer (OVA), will be analyzed for VOCs .

7.15.3 Sample Screening and Analysis

Each sample will be screened with a scintillation detector for contact radiation. All sample packages will be screened for the surface level of contamination and contact radiation.

Archival information provides little information on the identity of site contaminants, therefore, the first 50 % of all surface locations will be analyzed for the full radiological and metal analytical suite (Table 7-16).

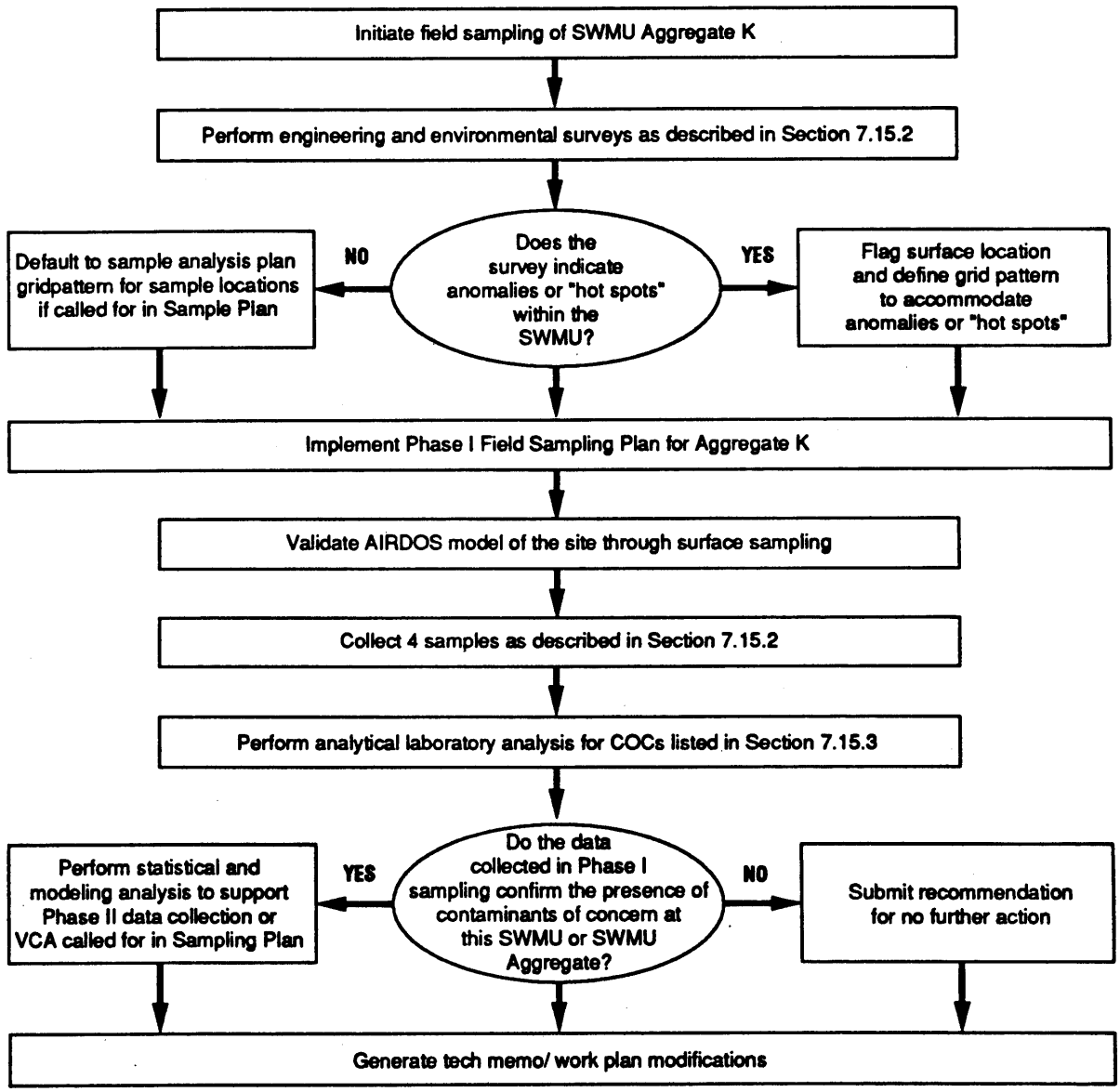


Figure 7-38. Decision logic for the sampling and analysis of SWMU Aggregate K.

TABLE 7-16

PHASE I SAMPLING SUMMARY FOR OU 1129 SWMU AGGREGATE K
(SWMU No. 48-001)

SWMU	LOCATION	DEPTH	TYPE OF ANALYSIS REQUIRED[1] A	B	C	D	E	F	G	H	I
48-001	B-1	0-1 ft	X	X	X	X	X	X			
		1-2 ft	X	X	X	X	X	X			
		2-3 ft	X	X	X	X	X	X			
	B-2	0-1 ft	X	X	X	X	X	X			
		1-2 ft	X	X	X	X	X	X			
		2-3 ft	X	X	X	X	X	X			
	B-3	0-1 ft	X	X	X	X	X	X			
		1-2 ft	X	X	X	X	X	X			
		2-3 ft	X	X	X	X	X	X			
	B-4	0-1 ft	X	X	X	X	X	X			
		1-2 ft	X	X	X	X	X	X			
		2-3 ft	X	X	X	X	X	X			
	B-5	0-1 ft	X	X	X	X	X	X			
		1-2 ft	X	X	X	X	X	X			
		2-3 ft	X	X	X	X	X	X			
		Rinsate Blanks	1	1	1	1	1	1			
		Bottle Blanks	1	1	1	1	1	1			
		Trip Blanks	0	0	0	0	1	0			
		Duplicates	1	1	1	1	1	1			
		TOTALS	18	18	18	18	19	18			

[1] A = gross α, β, γ
B = γ spectrometry
C = α spectroscopy
D = metals by ICPES
E = VOCs
F = SVOCs
G = PCBs
H = ^3H in soil
I = miscellaneous analytes

7.16 SWMU Aggregate L, Phase I

SWMU Nos. 48-002(a and b) include a former container storage area and are Phase I characterization areas according to the process outlined in Chapter 5.0. Both of these SWMUs are listed in the HSWA Module VIII (EPA 1990, 0306) (Table 1-1). SWMU Nos. 48-002 (a and b) are located on TA-48, north of Pajarito Road, on Mesita del Buey (the southern finger of South Mesa) between Mortandad Canyon on the north and Two Mile Canyon on the south (Figure 7-39). The open circles in Figure 7-39 show the location of SWMU Nos. 48-002(a and b).

The storage area (SWMU No. 48-002) was located on the south end of building TA-48-1, the Radiochemistry Laboratory (Figure 7-39). SWMU No. 48-002(a) was a storage area outside of the building. SWMU No. 48-002(b) was a container storage area located at one of the loading dock areas.

An initial field observation report (Perkins 1986, 04-0169) mentioned the presence of about 200 rusty flasks in decayed and broken wooden-frame holders at SWMU No. 48-002(a). A follow-up memorandum (Garvey 1986, 04-0087) confirmed the presence of these flasks. Each flask was estimated to hold about 2 quarts of high-purity mercury, which was thought to have been recycled at TA-50-1 by a triple distillation process to remove radionuclides. The flasks were estimated to have been there for several years starting between 1976 to 1981 and ending approximately 1989, when the mercury was eventually removed (LANL 1990, 0145). The available documentation contains no indication of any spills or leaks associated with this storage area; however, because the documentation is sparse and unclear, this SWMU was not included on the NFA list. As no reported spills or leaks associated with the mercury storage area exist, the area might not have been contaminated with mercury; regardless, sampling will be conducted as described in this SAP.

SWMU No. 48-002 (b) was a container area located at one of the loading dock areas on the south side of building TA-48-1. The 1986 Comprehensive Environmental Response Program (CEARP) field survey noted the presence of labeled and unlabeled drums at the site, and evidence of spills and leaks (Perkins 1986, 04-0169). A November 1988 field survey noted spills at this area, which were apparently from leaky drums. The 1988 Laboratory subcontractor environmental audit noted only one long, unlabeled cylinder (LANL 1990, 0145). All materials were removed from this area before July 1991, and the site is no longer used for storage.

In January 1991, five surface and five subsurface soil samples were collected from the site of a proposed parking lot immediately east of the security fence on the east side of TA-48 (Fresquez 1990, 04-0073; Fresquez 1991, 04-0077). The proposed parking lot area was suspected of being contaminated by run-off from the container storage areas on the south of the building. Gross-beta and -gamma activity in all surface and subsurface samples were at background levels. However, gross-alpha activity ranged from background to 45 pCi/g for surface soil samples and from background to 65 pCi/g for subsurface samples. Alpha activity was below the DOE guideline value of 75 pCi/g for subsurface samples, but surface soil samples from the western and northwestern half of the proposed parking area exceeded the DOE guideline of 25 pCi/g for surface alpha activity (Fresquez 1991, 04-0077). No VOCs were detected in any of the samples, and most samples did not contain detectable levels of SVOCs. Di-n-butyl-phthalate (an SVOC plasticizer) was detected in two samples at 1 ppm (below the EPA action level). The only PCBs detected, mixed arochlors at <0.61 ppm, were also below EPA action levels.

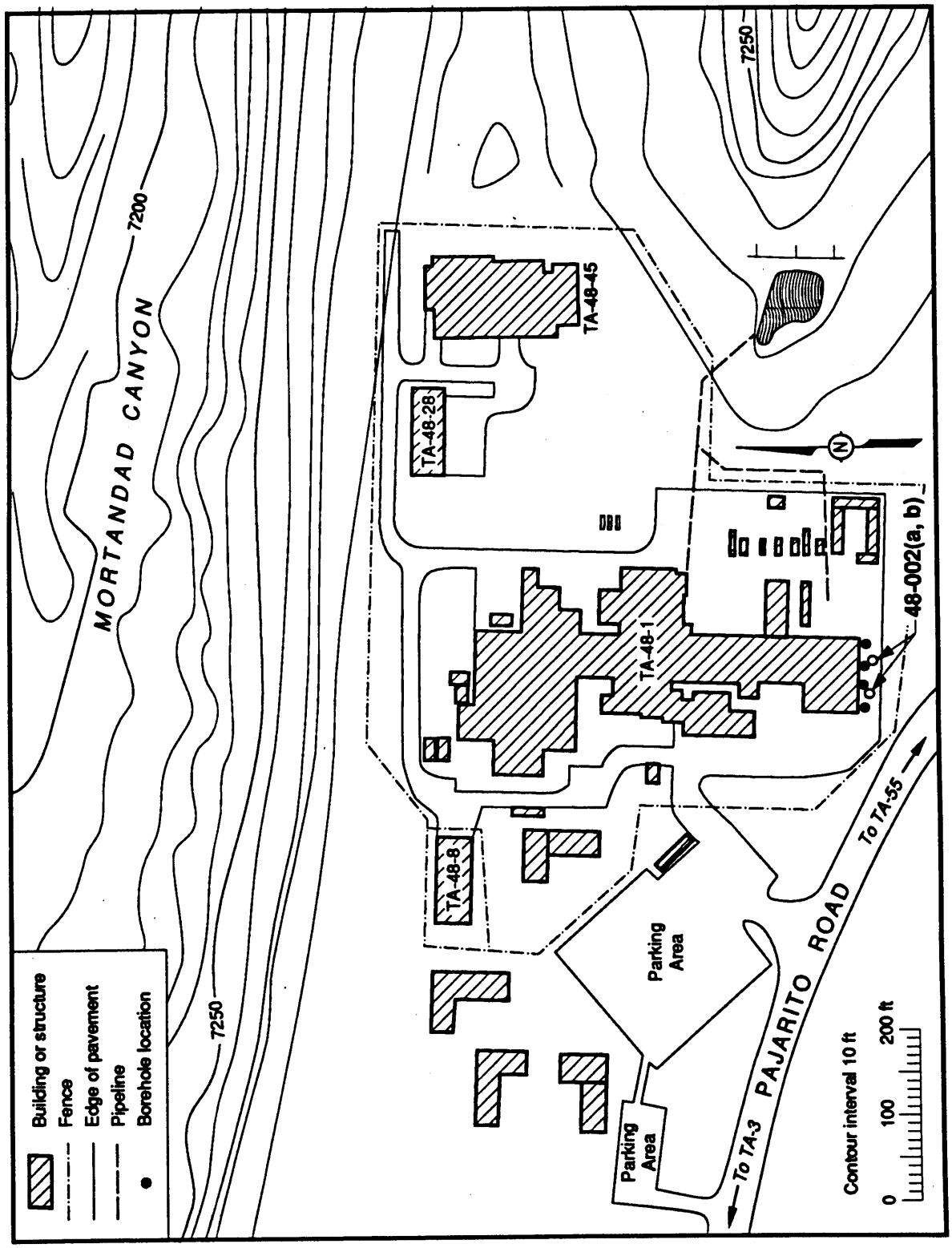


Figure 7-39. Schematic sample location map for SWMU Aggregate L [SWMUs 48-002 (a, b)].

7.16.1 Sampling Plan Rationale and Objectives

The objective of the surface and subsurface characterization for this SWMU is to determine the presence of contaminants, and if found, initiate investigations to determine whether the contaminants have migrated. The characterization process will meet the following sampling objectives:

- Collecting geologic data (see Section 7.11) to support transport model calculations.
- Classifying contaminant pathways on the surface and subsurface.
- Detecting and classifying contaminants.
- Originating investigations to determine if lateral and vertical migration of contaminants has occurred.

The conceptual model for SWMU No. 48-002 takes into account two means of contaminant occurrence and transport:

1) Mercury or other stored contaminants may have been spilled in the storage area, and/or storage tanks on paved surfaces may have leaked. The contaminants may have been transported from the paved surfaces to exposed soils by surface run-off.

2) Contaminants deposited on soils may have been transported by water and infiltrated into the soil horizon (unsaturated zone) as colloids.

A decision Logic Diagram for Phase I field investigation activities to be conducted at SWMU Aggregate L is presented in Figure 7-40 and is discussed in the following text.

7.16.2 Phase I Field Investigation Activities

The sampling plan is designed to locate potential contaminants. The field activities for this aggregate include the engineering and environmental surveys discussed in Section 7.4, and surface sampling (Figure 7-39). During the engineering and environmental surveys, any stained areas will be identified.

Four locations will be sampled in the storage area or in areas in which staining is detected. Figure 7-39 shows the approximate sampling locations.

Soils are expected to have a depth of 2 to 3 ft. At each sampling location, samples will be collected at the surface, in the 1-ft. interval beneath the surface, and in the interval between 1 and 3 ft. below the surface. Surface samples will be taken with a Teflon or stainless-steel scoop. Subsurface samples will be taken using a hand auger. Observations pertaining to soil horizon changes will be recorded. The samples will be surveyed (scanned) on site for radiation and for organic vapors using a PID or OVA.

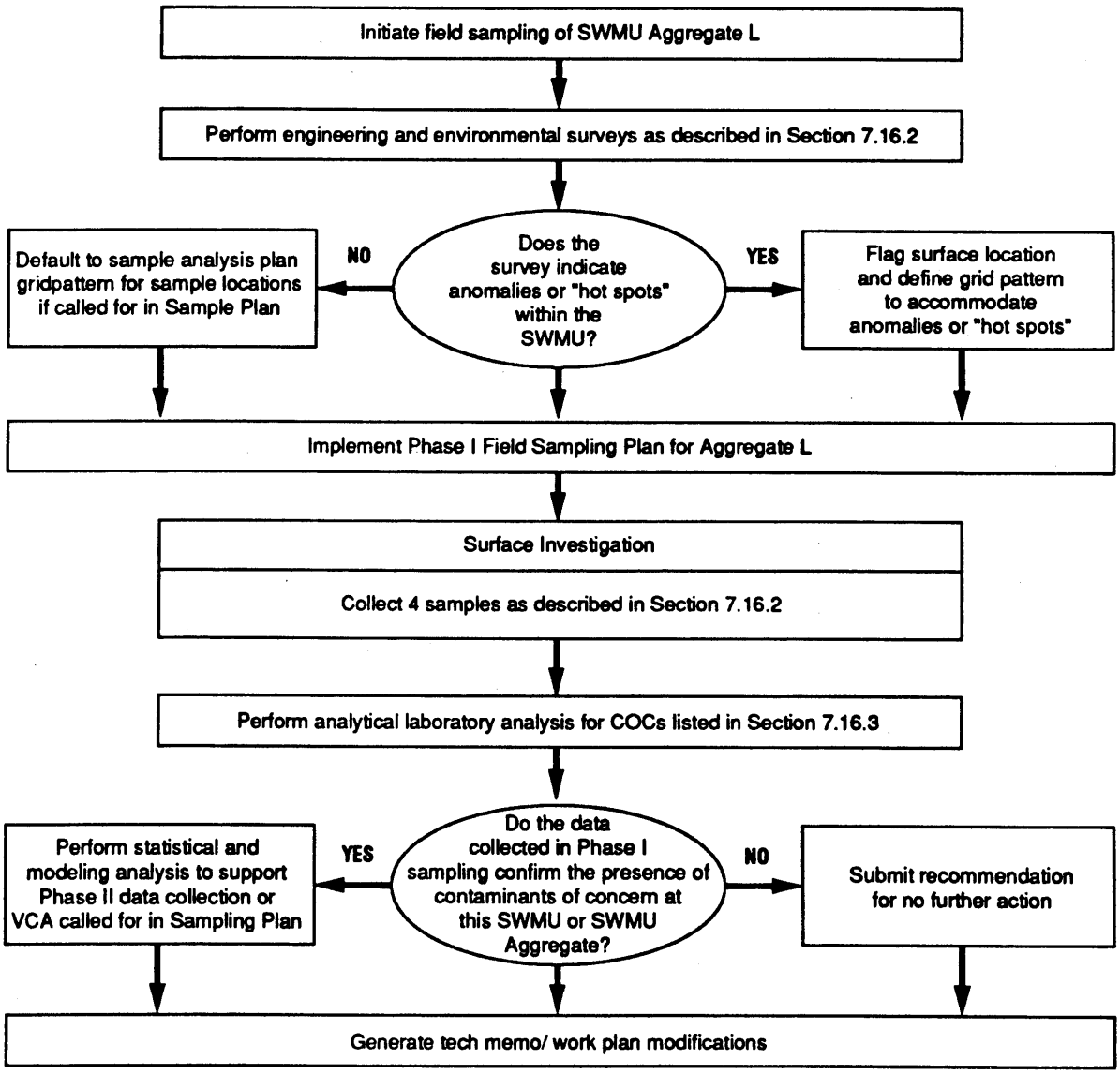


Figure 7-40. Decision logic for the sampling and analysis of SWMU Aggregate L.

7.16.3 Sample Screening and Analysis

Each sample will be screened with a scintillation detector for contact radiation. All sample packages will be screened for surface contamination and contact radiation. If positive radiological results are obtained from field screening, the samples will be analyzed in the laboratory for gross-alpha, -beta, -gamma; gamma spectrometry; and alpha spectroscopy. Samples with detectable levels of organics indicated by the PID or OVA will be analyzed for VOCs and SVOCs. Samples that can be identified as possible container leaks or spills will be analyzed for metals, and samples collected from the mercury storage area will be analyzed for mercury. Table 7-17 summarizes sampling requirements for SWMU Aggregate L.

TABLE 7-17

PHASE I SAMPLING SUMMARY FOR OU 1129 SWMU AGGREGATE L
(SWMU Nos. 48-002 [a and b])

SWMU	LOCATION	DEPTH	TYPE OF ANALYSIS REQUIRED[1] A	B	C	D	E	F	G	H	I*
42-002 (a and b)	B-1	SURFACE	X	X	X	X	X	X			X
		0-1 ft	X	X	X	X	X	X			X
		1-3 ft	X	X	X	X	X	X			X
	B-2	SURFACE	X	X	X	X	X	X			X
		0-1 ft	X	X	X	X	X	X			X
		1-3 ft	X	X	X	X	X	X			X
	B-3	SURFACE	X	X	X	X	X	X			X
		0-1 ft	X	X	X	X	X	X			X
		1-3 ft	X	X	X	X	X	X			X
	B-4	SURFACE	X	X	X	X	X	X			X
		0-1 ft	X	X	X	X	X	X			X
		1-3 ft	X	X	X	X	X	X			X
*Mercury	15 samples	Rinsate Blanks	1	1	1	1	1	1			1
		Bottle Blanks	1	1	1	1	1	1			1
		Trip Blanks	0	0	0	0	1	0			0
		Duplicates	1	1	1	1	1	1			1
		TOTALS	15	15	15	15	16	15			15

[1] A = gross α, β, γ B = γ spectrometry C = α spectroscopy
E = VOCs D = metals by ICPES F = SVOCs
G = PCBs H = ^3H in soil I = miscellaneous analytes

7.17 SWMU Aggregate M, Phase I

SWMU Aggregate M contains SWMU No. 48-003, an inactive septic system located north of Pajarito Road. SWMU No. 48-003 is listed in the HSWA Module VIII (EPA 1990, 0306)(Table 1-1). SWMU No. 48-003 was formerly SWMU No. 48-003 (a and b) in the HSWA Module. The SWMU contains two components, a leach field and outfall. Figure 7-41 depicts the location of SWMU No. 48-003. A detailed description of the location, site activities, and history of SWMU No. 48-003 within OU 1129 is found in Section 3.5 of this Work Plan.

7.17.1 Sampling Plan Rationale and Objectives

The objective of this Phase I sampling plan is to determine the presence or absence of surface and subsurface contamination at the locations of the SWMU. This sampling plan uses a judgmental sampling approach to investigate the septic tank, filter bed, and outfall that compose SWMU No. 48-003. If contamination is confirmed to be present after the Phase I investigation, a Phase II investigation will be conducted to determine the nature and extent of contamination at the site. Sampling activities are biased toward areas in which residual contamination is most likely to be present on the basis of the following conceptual model for a release at this site:

- The waste stream is not defined because archival information indicates that along with sanitary waste, an unknown variety and amount of other wastes were deposited into the septic system.
- Any remaining contaminant plumes may have moved vertically along fracture planes that are in contact with the leach fields and outfalls because of the transport mechanism provided by liquids associated with the waste stream.

The surface investigations at Aggregate M are designed primarily to answer the following questions:

1) Does surface and subsurface contamination currently exist in Aggregate M?
2) Are there any near-surface artifacts remaining that represent potential contaminant release points?
3) What is the potential for surface and subsurface migration of contaminants?
4) What are the current waste stream constituents?

If contamination is confirmed to be present after the Phase I investigation, a Phase II investigation will be conducted to determine the nature and extent of contamination at the site.

Archival information indicates that the contaminants that may be present at SWMU No. 48-003 may include organics, inorganics, and radionuclides (see Section 3.5).

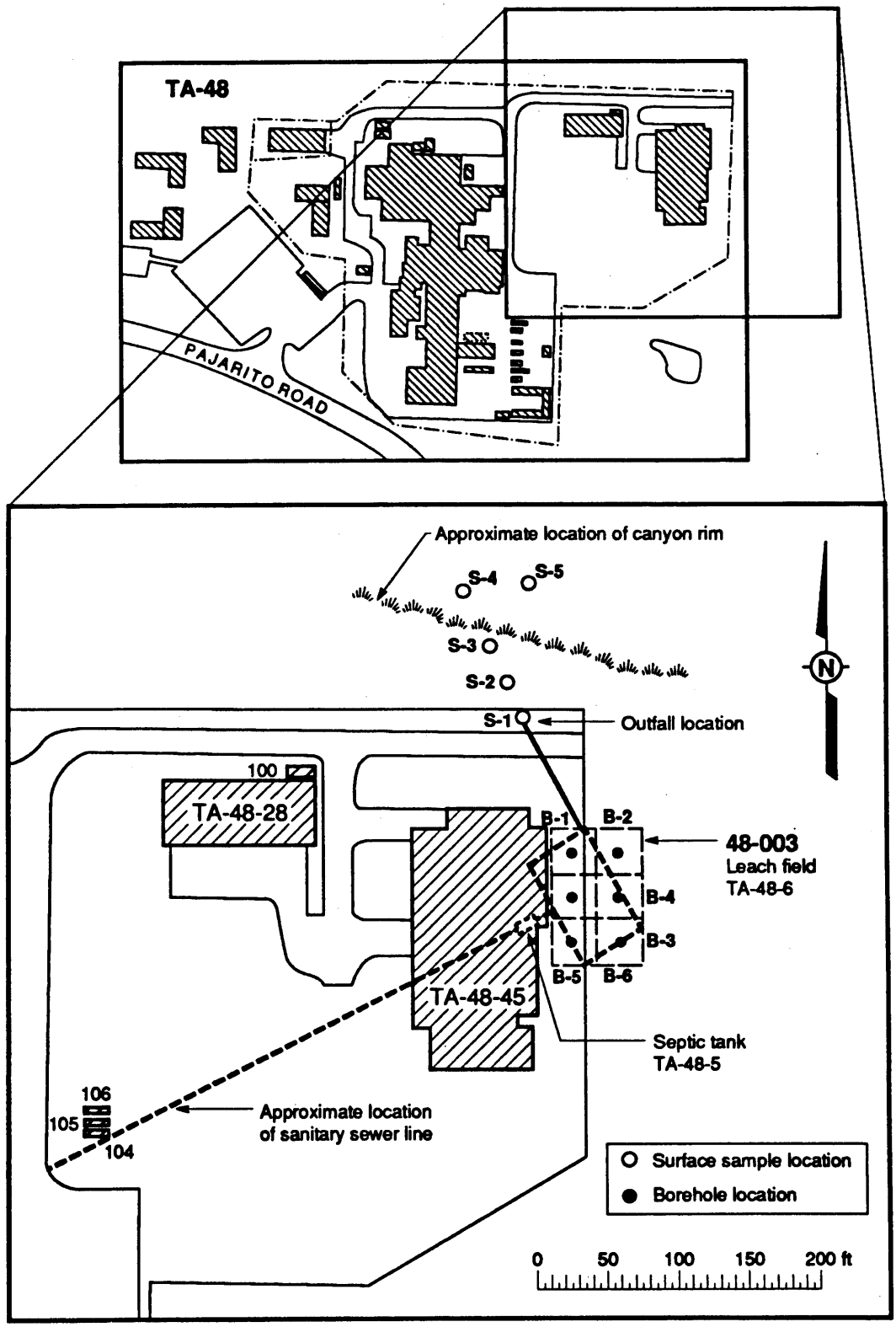


Figure 7-41. Schematic sample location map for SWMU Aggregate M.

The septic system at SWMU No. 48-003 primarily received sanitary waste; however, an unknown amount of hazardous chemicals and radionuclides was suspected to have been discharged to the tank. The septic tank and filter bed were removed during a 1986 D&D effort. The former site of the septic tank and a corner of the former filter bed are currently located beneath building TA-48-45 (Figure 7-41). The majority of the leach field area lies outside the building. Investigation of the leach field outside the building is considered to be indicative of potential contaminants located beneath the building. The soil beneath building TA-48-45 will not be investigated. Therefore, the Phase I investigation will be limited to the former filter bed outside the east perimeter of the building and the outfall discharge area located to the north.

A decision logic diagram for Phase I field investigation activities to be conducted at SWMU Aggregate M is presented in Figure 7-42 and discussed in the following text.

The technical approach for the Phase I assessment of SWMU No. 48-003 will consist of four tasks. These tasks include the engineering survey and environmental surveys discussed in Section 7.4, subsurface sampling of the leach field area, and surface sampling of the outfall area (Figure 7-41).

During the land engineering survey, the former filter bed area and outfall will be located, and a 60-ft-wide by 90-ft-long area encompassing the entire filter bed will be located and staked into grid with blocks 30 ft by 30 ft (Figure 7-41). The radiation survey will be conducted along the lines of the grid to identify potential radiological anomalies. Stationary radiological counts for a duration of one minute will be collected in the center of each grid block using a FIDLER and the area will be surveyed for the presence of VOCs using an OVA.

7.17.2 Phase I Field Investigation Activities

SWMU No. 48-003, Filter Bed - Subsurface Investigation

The septic tank and associated filter bed were decontaminated and decommissioned in 1986. According to engineering drawings, the former filter bed was a surface feature measuring 40 ft 7 in. wide by 81 ft 2 in. long. A 60-ft by 90-ft grid will be established during the engineering survey to cover the area of the leach field. During a 1988 site reconnaissance, gamma activity was measured at 14 mR/hr approximately 3 ft from the surface near the site of the former filter bed. These survey results suggest that D&D may not have been adequate and that remnant radioactive contamination may be present.

First, six soil boring locations will be selected at anomalous areas identified within the grid during the environmental survey. If no anomalies are present, soil boring locations will be selected at random within each of the six grid blocks. One borehole will be drilled within the six (30-ft by 30-ft) grid blocks to identify potential contamination at the leach field.

Once the area is surveyed and anomalies are identified, six soil borings will be installed to depth of 15 ft using a decontaminated continuous 5-ft core barrel. As the 5-ft sections of core are retrieved from the borehole using a wireline, the soil and/or rock will be screened with a scintillation detector and PID. Screening measurements will be recorded on the field log. Soil will be sampled from intervals with the greatest above-background contamination. If no above-background contamination is de-

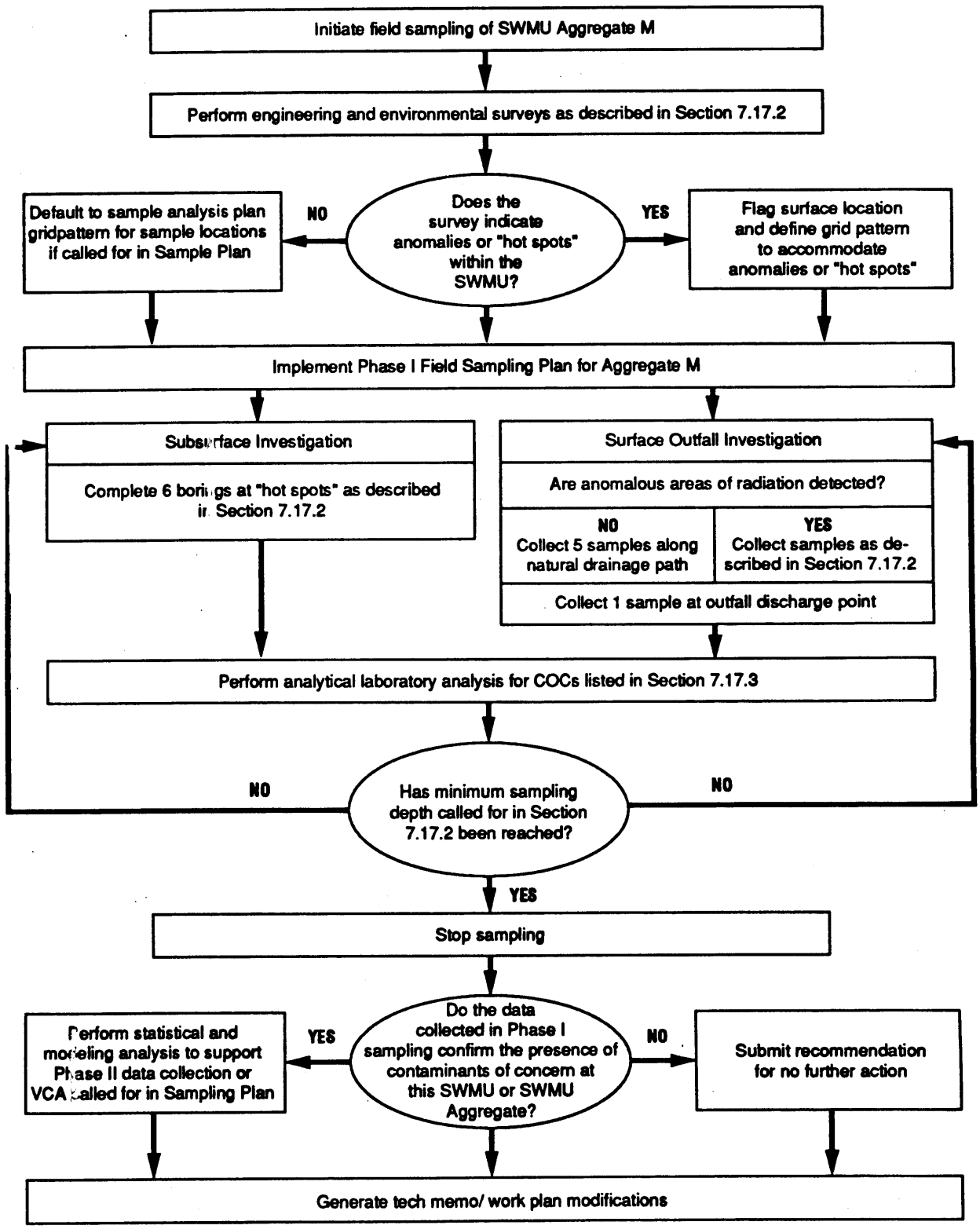


Figure 7-42. Decision logic for the sampling and analysis of SWMU Aggregate M.

tected, the upper 0 to 5 ft of the first core interval and the midpoint of the bottom two core intervals (5 to 10 ft and 10 to 15 ft) will be sampled. Soil samples will be collected with a stainless-steel trowel. The purpose of the soil borings is to provide a contamination profile, if present, and to help gain geographic control as to the exact location of the former filter bed. The surface core samples will be used to determine the effectiveness of the 1986 D&D and to ascertain residual contamination.

The borings will be drilled and sampled at 5-ft intervals, or 2 intervals below which above-background measurements are no longer detected. If no contamination is present, drilling will stop. Appendix B contains the procedures for decontaminating sampling and drilling equipment, and for collecting soil and rock samples with a split-barrel core.

Collected samples will be screened for radioactivity and submitted to the laboratory for analysis. The total number of matrix samples for the Phase I investigation at the filter bed area is 18 per method. Samples will be analyzed for Level III gross-alpha, -beta, -gamma; gamma spectrometry; alpha spectroscopy; VOCs; SVOCs; and metals (Table 7-18).

TABLE 7-18

PHASE I SAMPLING SUMMARY FOR OU 1129 SWMU AGGREGATE M
(SWMU No. 48-003)

SWMU	LOCATION	DEPTH	TYPE OF ANALYSIS REQUIRED[1] A	B	C	D	E	F	G	H	I
48-003	B-1	0-5 ft	X	X	X	X	X	X			
		5-10 ft	X	X	X	X	X	X			
		10-15 ft	X	X	X	X	X	X			
	B-2	0-5 ft	X	X	X	X	X	X			
		5-10 ft	X	X	X	X	X	X			
		10-15 ft	X	X	X	X	X	X			
	B-3	0-5 ft	X	X	X	X	X	X			
		5-10 ft	X	X	X	X	X	X			
		10-15 ft	X	X	X	X	X	X			
	B-4	0-5 ft	X	X	X	X	X	X			
		5-10 ft	X	X	X	X	X	X			
		10-15 ft	X	X	X	X	X	X			
	B-5	0-5 ft	X	X	X	X	X	X			
		5-10 ft	X	X	X	X	X	X			
		10-15 ft	X	X	X	X	X	X			
	B-6	0-5 ft	X	X	X	X	X	X			
		5-10 ft	X	X	X	X	X	X			
		10-15 ft	X	X	X	X	X	X			
	S-1		X	X	X	X		X			
	S-2		X	X	X	X		X			
	S-3		X	X	X	X		X			
	S-4		X	X	X	X		X			
	S-5		X	X	X	X		X			
		Rinsate Blanks	2	2	2	2	1	2			
		Bottle Blanks	2	2	2	2	1	2			
		Trip Blanks	0	0	0	0	1	0			
		Duplicates	2	2	2	2	1	2			
		TOTALS	29	29	29	29	22	29			

[1] A = gross α, β, γ
E = VOCs
G = PCBs

B = γ spectrometry
D = metals by ICPES
H = ^{3}H in soil

C = α spectroscopy
F = SVOCs
I = miscellaneous analytes

SWMU No. 48-003, Outfall - Surface and Subsurface Investigations

Samples will be collected from the outfall area in which potential contamination would most likely concentrate. The former outfall, also designated as SWMU No. 48-003, received effluent from the septic tank and filter bed. Little is known about potential contaminants that may have discharged through the outfall; however, the septic system is suspected to have received hazardous chemicals and radionuclides.

The outfall discharged to a natural bare rock drainage area on the north-facing slope of Mortandad Canyon. Contamination is expected to be minimal in this area because the majority of the effluent volume probably flowed down the slope into the canyon. The objective of the outfall area sampling will be to determine the presence of potential contaminants along the trace of the outfall to the toe of the slope.

First, the outfall area will be screened with a scintillation detector to identify anomalous areas of above-background radiation. If anomalous areas are detected, five surface samples locations will be selected. If anomalous areas are not identified, five samples will be selected along the path of the natural drainage channel in which remnant contamination is the most likely to accumulate.

One surface soil or rock core sample will be collected from the outfall discharge point. Two surface soil or rock core samples will be collected from the drainage channel, and two samples will be collected at the toe of the slope (Figure 7-41). This area is being sampled because it is assumed to most likely have residual contamination. Samples will either be collected with a stainless-steel trowel for soil, or with a hammer and chisel for rock chips.

The total number of matrix samples for the Phase I investigation at the outfall area is five per method. Samples will be analyzed for Level III gross-alpha, -beta, -gamma; gamma spectrometry; alpha spectroscopy; metals; and SVOCs (Table 7-18). If contamination is detected, additional investigation will be necessary.

7.17.3 Sample Screening and Analysis

Each sample collected will be screened with scintillation detector for contact radiation. All sample packages must be screened for surface contamination and contact radiation. Subsection 2.1 of Appendix B contains a discussion of field screening procedures. All samples will be analyzed for Level III gross-alpha, -beta, -gamma; gamma spectrometry; alpha spectrometry; SVOCs; and metals listed in Table V.8 of the ER Program Generic QAPjP. The soil boring samples collected from the leach field will also be analyzed for Level III VOCs. Table 7-18 outlines the total number of matrix and QA/QC samples required for this field investigation, the corresponding analyses, and sample requirements.

7.18 SWMU Aggregate N, Phase I

SWMU Aggregate N contains SWMU No. 48-005, including abandoned radioactive waste lines 34, 36, and 38 located north of Pajarito Road. SWMU No. 48-005 was listed in the HSWA Module VIII (EPA 1990, 0306)(Table 1-1). Remaining portions of these lines, which are located within the TA-48 security fence, vary in length from 100 ft at line 34, 300 ft at Line 36, and 50 ft at line 38. Also associated with SWMU No. 48-005 is an outfall originating from line 37, which was completely removed in 1981. Figure 7-43 depicts the location of SWMU No. 48-005. A detailed description of the location, site activities, and history of SWMU No. 48-005 within OU 1129 is found in Section 3.5 of this Work Plan.

7.18.1 Sampling Plan Rationale and Objectives

The objective of this Phase I sampling plan is to determine the presence or absence of surface and subsurface contamination. This sampling plan uses a judgmental sampling approach to investigate the waste lines and outfall at SWMU No. 48-005. Sampling activities are biased toward areas at which residual contamination is most likely to be present on the basis of the following conceptual model for a release at this site:

- Any remaining COCs are thought to be localized in the proximity of the former line trenches.
- Previous D&D activity may not have cleaned the line traces to background.
- The waste stream is not defined; therefore, initial sample locations will conduct analysis for a wide range of potential COCs. Results from these initial samples will then be utilized to structure the Phase II sampling analyte suite.

The surface investigation at Aggregate N is designed primarily to answer the following questions:

1) Does surface and subsurface contamination currently exist in Aggregate N?
2) Are there any near-surface artifacts remaining that represent potential contaminant release points?
3) What is the potential for surface and subsurface migration of contaminants?
4) What are the current waste stream constituents?

Archival information indicates that the industrial waste lines, SWMU No. 48-005, were used to transport liquid wastes containing radionuclides and chemicals from TA-48 to a chemical waste treatment plant at TA-45 (Chapter 3.0). The remaining line segments located inside the security fence were not removed "due to the location of the pipes and low levels of contamination" (Elder et al. 1986, 0456). Therefore, the

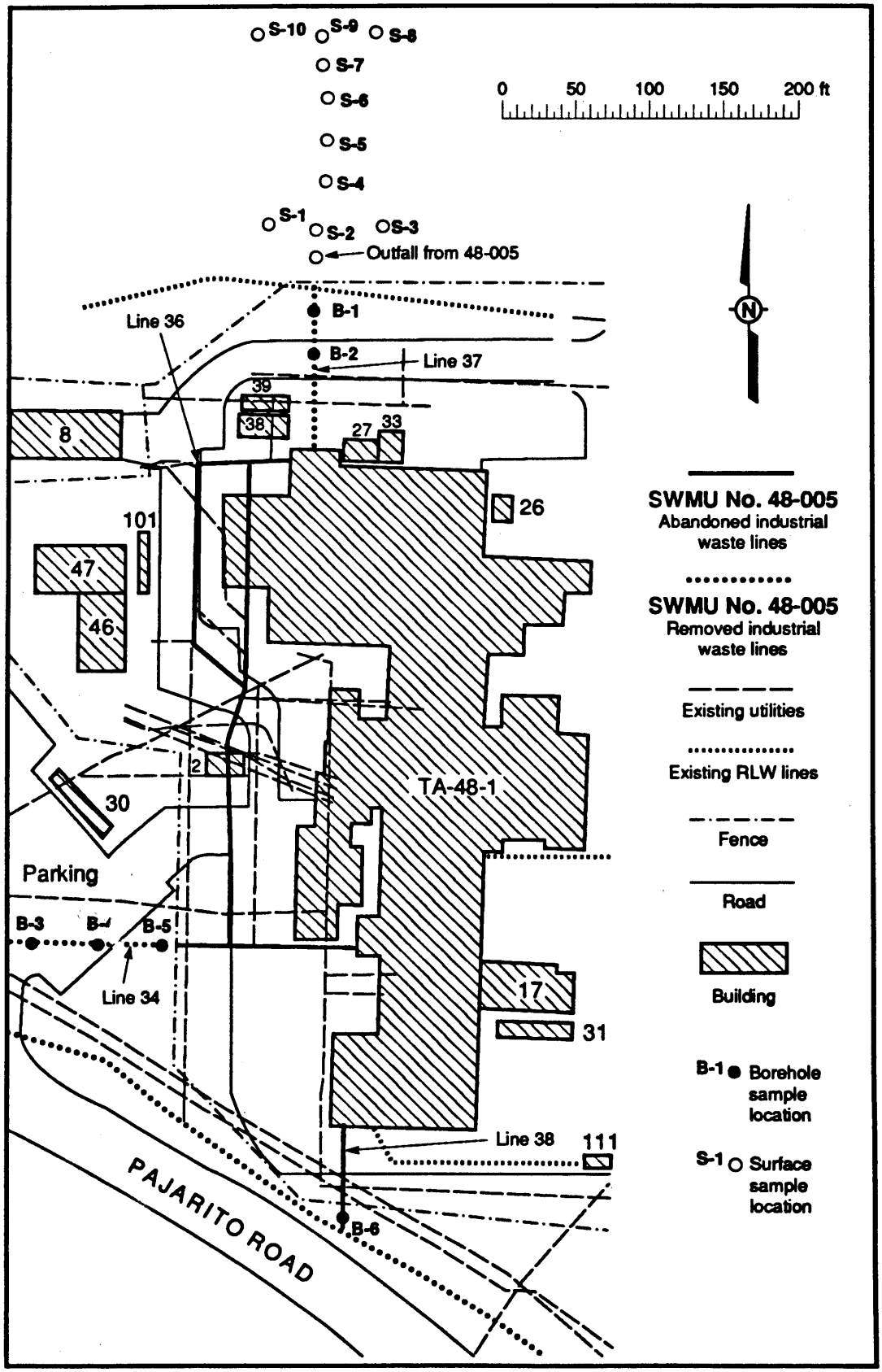


Figure 7-43. Schematic sample location map for SWMU Aggregate N.

Phase I investigation will be limited to sampling the area around the former waste lines outside the security fence, former waste lines at the west and south perimeter of building TA-48-1, former waste lines to the north of building TA-48-1 within the security fence, and the outfall discharge area. If contamination is detected above background during Phase I, Phase II will investigate the remaining sections of lines 34, 36, and 38 located within the security fence at TA-48. The following is a list of items that will be considerations during the Phase II investigation:

- The security fence is an "institutional control," which prohibits public site access;
- The industrial waste lines are situated under a guard station, roads and sidewalks, and various utilities (Cox 1985, 04-0053);
- Sampling in and around the west side of TA-48 is hazardous to personnel health and safety because of the numerous types and varieties of utilities above and around the abandoned waste lines;
- The geographic control on the utilities may be insufficient to adequately protect personnel from hazards such as electrocution, and natural gas explosion (Figure 7-43); and
- Waste line sections inside the security fence at TA-48 were left in place because of the low levels of contamination associated with them.

Characterization of the former waste lines will provide the information necessary to evaluate remedial alternatives for the lines remaining within the security fence. Because of the number of utilities above the remaining waste line sections, D&D of the waste lines will be delayed, if necessary, until (or if) building TA-48-1 is decontaminated and decommissioned.

A decision logic diagram for Phase I field investigation activities to be conducted at SWMU Aggregate N is presented in Figure 7-44 and discussed in the following text.

7.18.2 Phase I Field Investigation Activities

The technical approach for the Phase I assessment of SWMU No. 48-005 will consist of four tasks. These tasks include the engineering survey and environmental surveys described in Section 7.4; test pitting and subsurface sampling of the abandoned industrial waste line areas; and surface sampling of the outfall area (Figure 7-43).

During the engineering survey the former industrial waste lines and the outfall, the locations of former industrial waste lines 34 and 37, and the ending point of remaining line 38 will be identified and marked with stakes (Figure 7-43). Test pits along the trace of lines 34 and 37, and a point at the end of line 38 will also be located and staked. The radiation survey will be conducted along the trace of these industrial waste lines to identify potential radiological anomalies at the site. Stationary radiological counts for a duration of one minute will be collected at random points along the trace of these waste lines using a FIDLER.

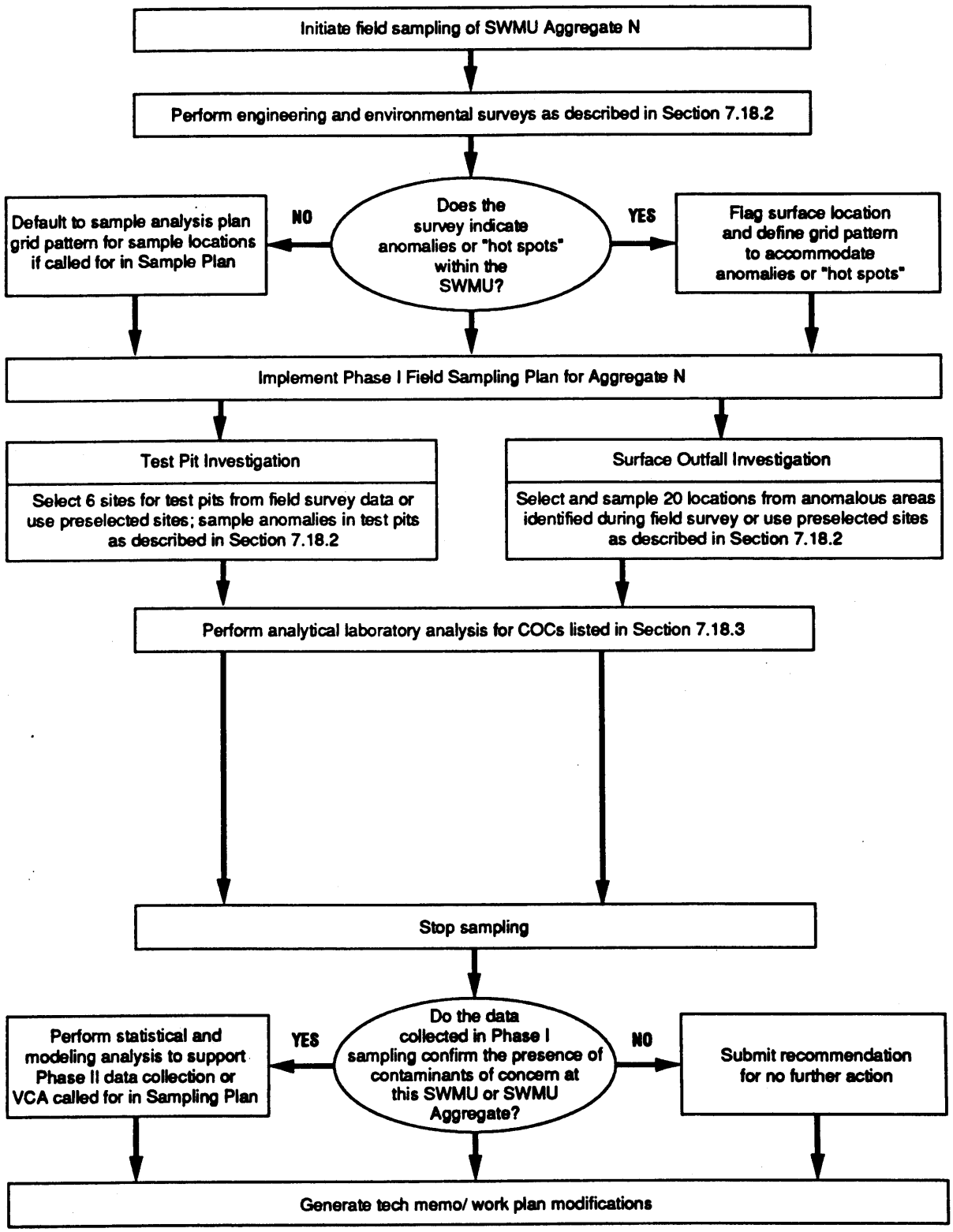


Figure 7-44. Decision logic for the sampling and analysis of SWMU Aggregate N.

SWMU No. 48-005, Waste Lines Subsurface Investigation

Portions of lines 34 and 38 located outside the security fence and all of line 37 located inside the security fence of TA-48 were decontaminated and decommissioned for radioactivity in 1981 and 1984 . The industrial waste lines were located at depths ranging from 7 to 11 ft. Contamination at this SWMU is expected to consist of low-level radioactivity and hazardous chemicals.

Once the area is surveyed and anomalies are identified, six test pits will be excavated normal to the trace of the industrial waste lines. First, three test pits will be located along the western end of former line 34, two test pits will be located along the northern end of former line 37, and one test pit will be located at the southern end of former line 38. The test pits will either be located at anomalous areas identified during the field surveys, or at the previously selected points shown in Figure 7-43. The purpose of the test pits is to determine the effectiveness of the 1981 and 1984 D&D activities, and to ascertain the presence or absence of residual contamination. The test pits will be excavated to the approximate depth of the former waste line (between 7 and 11 ft) or to a maximum depth of 12 ft with a decontaminated back hoe. Soil from the excavated test pits will be screened with a scintillation detector and an OVA. One soil sample will be collected from each test pit at anomalous areas identified during the radiation and surveys. If no anomalies are identified during the field surveys, samples will be collected from the approximate depth of the former waste line (i.e., the fill/natural soil contact).

Soil will be placed in the appropriate sample containers using a stainless-steel trowel. Collected samples will be screened for radioactivity and submitted to the laboratory for analysis. Samples will be analyzed for Level III VOCs; SVOCs; gross-alpha, -beta, -gamma; gamma spectrometry; alpha spectroscopy; and metals (Table 7-19). The total number of subsurface soil samples for the Phase I investigation is six per method.

SWMU No. 48-005, Outfall - Surface Investigation

The outfall originated at line 37 and ran from the north end of TA-48-1 northward to the canyon. The nature of the outfall effluent is unknown; however, radioactivity and hazardous chemicals are suspected to have been discharged. The discharge channel from this outfall was not investigated during the 1981 and 1984 D&D activities conducted at TA-48. Therefore, the area in proximity to the outfall as identified during the engineering survey will be sampled (Figure 7-43).

First, the area north of TA-48-1 in the vicinity of former line 37 will be screened with a scintillation detector to locate the outfall. The soil and rock in this area will be investigated for evidence of drainage channeling. Ten surface soil/rock samples will be collected at radiological anomalies identified during the field survey. If no anomalies are identified, channels will be sampled along the trace of the outfall to the toe of the slope as shown in Figure 7-43. Sample locations will be selected on the basis of potential for accumulation of residual contamination. The objective of the Phase I outfall sampling is to identify the former SWMU location and to ascertain the presence of residual contamination along the trace of the outfalls from the mesa top to the toe of the slope (Figure 7-43).

Three surface soil/rock samples will be collected from the immediate outfall discharge area, five samples will be collected from the channel, and two samples will be collected at the toe of the slope (Figure 7-43). Surface sample locations will be selected in the field on the basis of above-background measurements obtained during the radiation survey. If no anomalies are found, sample locations will be

located at natural features at which residual contamination would likely accumulate. Samples will either be collected with a stainless-steel trowel for soil or by collecting rock chip samples with a hammer and chisel (see Appendix B for sampling procedures).

The total number of matrix samples for the Phase I investigation is 16 per method. Samples will be analyzed for Level III gross-alpha, -beta, -gamma; gamma spectrometry; alpha spectrometry; metals; and SVOCs (Table 7-19). VOCs will not be analyzed because of volatilization that occurs at the rock surface. If monitoring instruments detect contamination, additional investigation will be necessary.

7.18.3 Sample Screening and Analysis

Each sample collected will be screened with a scintillation detector for contact radiation. All sample packages must be screened for surface contamination and contact radiation. Subsection 2.1 of Appendix B contains a discussion of field screening. All samples will be analyzed for Level III SVOCs; metals; gross -alpha, -beta, -gamma; gamma spectrometry; and alpha spectroscopy. Only the test pit samples at the former waste lines will be analyzed for VOCs.

Table 7-19 outlines the total number of matrix and QA/QC samples required for this field investigation, the corresponding analyses, and sample requirements.

TABLE 7-19

PHASE I SAMPLING SUMMARY FOR OU 1129 SWMU AGGREGATE N
(SWMU No. 48-005)

SWMU	LOCATION	DEPTH	TYPE OF ANALYSIS REQUIRED[1] A	B	C	D	E	F	G	H	I
48-005	P-1	12 ft.	X	X	X	X	X	X			
	P-2	12 ft.	X	X	X	X	X	X			
	P-3	12 ft.	X	X	X	X	X	X			
	P-4	12 ft.	X	X	X	X	X	X			
	P-5	12 ft.	X	X	X	X	X	X			
	P-6	12 ft.	X	X	X	X	X	X			
	S-1		X	X	X	X		X			
	S-2		X	X	X	X		X			
	S-3		X	X	X	X		X			
	S-4		X	X	X	X		X			
	S-5		X	X	X	X		X			
	S-6		X	X	X	X		X			
	S-7		X	X	X	X		X			
	S-8		X	X	X	X		X			
	S-9		X	X	X	X		X			
	S-10		X	X	X	X		X			
		Rinsate Blanks	1	1	1	1	1	1			
		Bottle Blanks	1	1	1	1	1	1			
		Trip Blanks	0	0	0	0	1	0			
		Duplicates	1	1	1	1	1	1			
		TOTALS	19	19	19	19	10	19			

[1] A = gross α, β, γ B = γ spectrometry C = α spectroscopy
E = VOCs D = metals by ICPES F = SVOCs
G = PCBs H = ^3H in soil I = miscellaneous analytes

7.19 SWMU Aggregate O, Phase I

SWMU Aggregate O consists of SWMU Nos. 52-002(a) and 52-003(a), located on the north side of Puye Road. SWMU No. 52-002(a) and SWMU No. 52-003(a) are listed in the HSWA Module VIII (EPA 1990, 0306)(Table 1-1). The original SWMU numbers were 52-002(b, c, e, f, g, h, i, and j); these have been recommended for NFA in Chapter 6. SWMU No. 52-002(a) is an active septic system that has served the Ultra-High-Temperature Reactor Experiment (UHTREX) Building, TA-52-1, since 1965. The septic system is composed of septic tank TA-52-3, distribution box TA-52-4, and a tile drain field trench leach system. SWMU No. 52-003(a) is the former location of TA-52-2, the waste treatment facility in which liquid acid waste from the UHTREX reactor facility were neutralized before being piped to TA-50. The waste treatment facility was removed in 1989 during the UHTREX D&D project. Figure 7-45 depicts the location of the SWMUs. A detailed description of the location, site activities, and history of these SWMUs within OU 1129 is found in Section 3.6 of this Work Plan.

7.19.1 Sampling Plan Rationale and Objectives

The objective of the Phase I sampling of these SWMUs is to determine if subsurface soil contamination at the septic system (SWMU No. 52-002[a]) and the former waste treatment facility (SWMU No. 52-003[a]) is present. This sampling plan uses a judgmental sampling approach to investigate the SWMUs in Aggregate O. Sampling activities are biased toward areas in which residual contamination is likely to be present on the basis of the following conceptual model for a release at this site:

- Previous environmental surveys have shown no radioactivity above background. No other environmental surveys have been conducted for other COCs.
- The content of the waste stream at these sites is not defined. Therefore, samples will be analyzed for a wide range of potential COCs, and the results of that analysis will be used to structure the analytical suite for Phase II.
- If present, contaminant plumes may have moved vertically (along fracture planes that are in contact with the leach fields and outfalls) along the path the waste stream.

The surface investigation at Aggregate O is designed primarily to answer the following questions:

1) Does surface and subsurface contamination currently exist in Aggregate O?
2) What is the potential for surface and subsurface migration of contaminants?
3) What are the waste stream constituents?

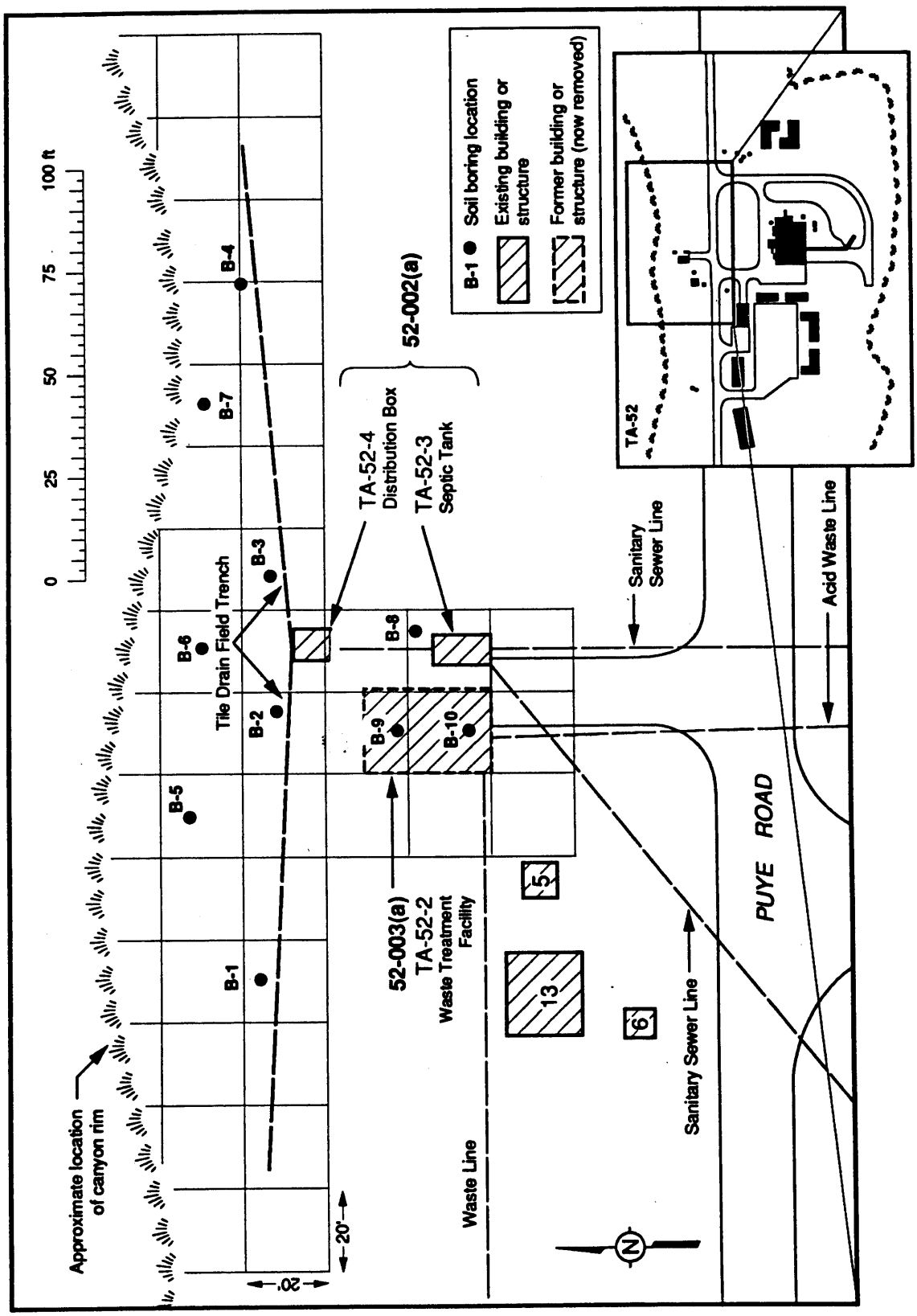


Figure 7-45. Schematic sample location map for SWMU Aggregate O.

Archival information indicates that the former waste treatment facility received liquid radioactive wastes from the UHTREX facility. This waste stream may have contained various solvents and inorganic wastes. The active septic system receives primarily sanitary wastes from UHTREX, but solvents, chemicals, and radionuclides may have been introduced to the system in the past. In this investigation, sampling of subsurface soils and/or tuff beneath the septic tank, the former tile drain field trench, and the former waste treatment facility location will be conducted.

Decision logic for Phase I field investigations activities to be conducted at SWMU Aggregate O is presented in Figure 7-46 and discussed in the following text.

7.19.2 Phase I Field Investigation Activities

The Phase I investigation of Aggregate O will consist of three tasks. These tasks include the engineering survey and environmental surveys discussed in Section 7.4, and subsurface sampling of the active septic system and former waste treatment facility (Figure 7-45).

The engineering survey will locate the former waste treatment facility and the tile drain field trench and will verify the locations of the septic tank and distribution box. A sampling grid will be surveyed to encompass a T-shaped area consisting of two adjacent rectangular areas; one with dimensions 60 ft by 60 ft and the other with dimensions 300 ft by approximately 60 ft. The sampling grid, which extends to the canyon edge, is designed to evaluate the areas potentially affected by SWMU Nos. 52-002(a) and 52-003(a) (Figure 7-45). Individual grid blocks will be 20 ft by 20 ft. The radiation survey will be conducted over the grid area. The grid will also be used to survey for the presence of VOCs using a PID. In addition, stationary radiological counts for a duration of one minute will be collected in the center of each grid block using a FIDLER.

SWMU No. 52-002(a), Active Septic System - Subsurface Investigation

SWMU No. 52-002(a) consists of a septic tank TA-52-3, a distribution box TA-52-4, and a tile drain field trench. The system was installed in 1965 and is currently active. According to engineering drawings, overflow from the 2,580-gal. septic tank is diverted to a 300-ft-long tile drain trench with a 4-in.-diameter pipe. Radiation screening conducted in 1988 at SWMU No. 52-002(a) did not exceed background levels. On the basis of these results and because all structures associated with SWMU No. 52-002(a) are located in the subsurface, surface samples will not be collected as part of this plan unless anomalously high radiation or VOC readings are detected during the environmental surveys.

Eight soil boring locations will be selected as shown in Figure 7-45. The purpose of soil borings B-1 through B-4 is to assess potential subsurface contamination in the tile drain field trench area. Borings B-5 through B-7 are placed near the canyon edge down the slope from the drain field to assess potential migration of contaminants from the drain field. Soil boring B-8 is located 5 ft north of the septic tank to assess potential leakage from the tank. B-8 will only be drilled if COCs are discovered in the leach field. Additional boreholes may be installed at anomalous areas identified within the grid during the environmental surveys.

All eight soil borings will be installed to a minimum depth of 20 ft using a decontaminated continuous 5-ft core barrel. As the 5-ft sections of core are retrieved from the

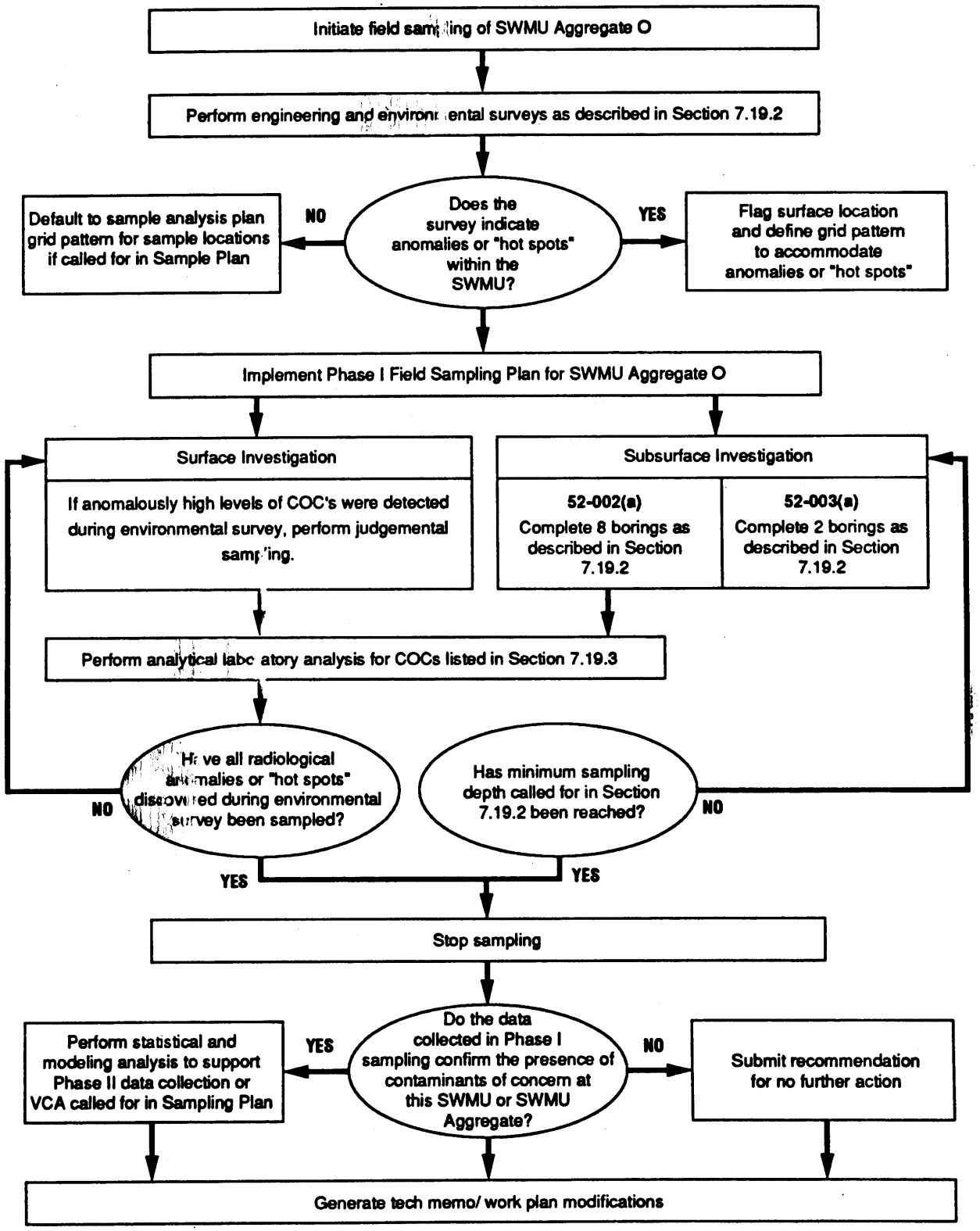


Figure 7-46. Decision logic for the sampling and analysis of SWMU Aggregate O.

borehole using a wireline, the solid and/or rock will be screened for radioactivity with a scintillation detector, and for VOCs with a PID. Screening measurements will be recorded on the field log. If preliminary surveys indicate the presence of VOCs above detection limits or above-background radioactivity, samples will be collected from points with the highest screening readings. If no above-background contamination is detected, the midpoint of each core interval will be sampled. Assuming a total depth of 20 ft, soil borings B-1 through B-7 will be sampled at 4 intervals (i.e., 0 to 5 ft, 5 to 10 ft, 10 to 15 ft, and 15 to 20 ft). Assuming a total depth of 20 ft, boring B-8 will be sampled at 3 intervals (5 to 10 ft, 10 to 15 ft, and 15 to 20 ft). If contamination is found in the last core interval, the borings will continue until 2 intervals indicate no above-background measurements. Appendix B contains the procedures for decontaminating sampling and drilling equipment, and for collecting soil and rock samples with a split-barrel core.

Collected samples will be screened for radioactivity and submitted to the laboratory for analysis. The minimum number of matrix samples of the Phase I investigation at the active septic system (based on a minimum drilling depth of 20 ft) is 32 per method. Samples will be analyzed for Level III VOCs; SVOCs; metals; gross-alpha, -beta, -gamma; gamma spectrometry; and alpha spectroscopy.

SWMU No. 52-003(a), Waste Treatment Facility - Subsurface Investigation

SWMU No. 52-003, the waste treatment facility was decontaminated and decommissioned in 1989. According to a Laboratory report on the decommissioning of the UHTREX Reactor Facility, surface soils near the former waste treatment facility were excavated below the foundation to solid tuff, the area was then backfilled, graded, and revegetated (Salazar and Elder 1991, 04-0268). Based on this information, this plan will not address surface sampling.

Two soil boring locations, B-9 and B-10, will be selected as shown in Figure 7-45. The purpose of soil borings B-9 and B-10 is to assess potential subsurface contamination beneath the former waste treatment facility site. A primary concern is the potential leakage of liquid waste from two concrete waste holding tanks that were installed into the ground on the north side of the facility. Additional boreholes may be installed at anomalous areas identified during the environmental surveys. Soil borings will be installed to minimum depth of 20 ft using a decontaminated continuous 5-ft core barrel. As the 5-ft sections of core are retrieved from the borehole using a wireline, the soil and/or rock will be screened with a scintillation detector and a PID. Screening measurements will be recorded on the field log. Soil will be sampled from intervals with the greatest above-background contamination. If no above-background contamination is detected, the midpoint of each core interval will be sampled. Because soil in the area was previously excavated to tuff and backfilled, sample collection will begin at the soil/tuff interface and will continue for two core intervals.

If contamination is found in the last core interval, the borings will be drilled to a total depth of 40 ft, sampling at 5-ft intervals, or until 2 intervals below which above-background measurements are no longer detected. Appendix B contains the procedures for decontaminating sampling and drilling equipment, and for collecting soil and rock samples with a split-barrel core.

Collected samples will be screened for radioactivity and submitted to the laboratory for analysis. The minimum number of matrix samples for the Phase I investigation at the former waste treatment facility (based on a minimum drilling depth of 20 ft) is 8 per method. Samples will be analyzed for Level III VOCs; SVOCs; gross-alpha, -beta, -gamma; gamma spectrometry; alpha spectroscopy, and metals (Table 7-20).

TABLE 7-20

PHASE I SAMPLING SUMMARY FOR OU 1129 SWMU AGGREGATE O
(SWMU Nos. 52-002[a] and 52-003[a])

SWMU	LOCATION	DEPTH	TYPE OF ANALYSIS REQUIRED[1] A	B	C	D	E	F	G	H	I
52-002 (a)	B-1	0-5 ft	X	X	X	X	X	X			
		5-10 ft	X	X	X	X	X	X			
		10-15 ft	X	X	X	X	X	X			
		15-20 ft	X	X	X	X	X	X			
	B-2	0-5 ft	X	X	X	X	X	X			
		5-10 ft	X	X	X	X	X	X			
		10-15 ft	X	X	X	X	X	X			
		15-20 ft	X	X	X	X	X	X			
	B-3	0-5 ft	X	X	X	X	X	X			
		5-10 ft	X	X	X	X	X	X			
		10-15 ft	X	X	X	X	X	X			
		15-20 ft	X	X	X	X	X	X			
	B-4	0-5 ft	X	X	X	X	X	X			
		5-10 ft	X	X	X	X	X	X			
		10-15 ft	X	X	X	X	X	X			
		15-20 ft	X	X	X	X	X	X			
	B-5	0-5 ft	X	X	X	X	X	X			
		5-10 ft	X	X	X	X	X	X			
		10-15 ft	X	X	X	X	X	X			
		15-20 ft	X	X	X	X	X	X			
	B-6	0-5 ft	X	X	X	X	X	X			
		5-10 ft	X	X	X	X	X	X			
		10-15 ft	X	X	X	X	X	X			
		15-20 ft	X	X	X	X	X	X			
	B-7	0-5 ft	X	X	X	X	X	X			
		5-10 ft	X	X	X	X	X	X			
		10-15 ft	X	X	X	X	X	X			
		15-20 ft	X	X	X	X	X	X			
	B-8	5-10 ft	X	X	X	X	X	X			
		10-15 ft	X	X	X	X	X	X			
		15-20 ft	X	X	X	X	X	X			

TABLE 7-20. (concluded)

SWMU	LOCATION	DEPTH	TYPE OF ANALYSIS REQUIRED[1] A	B	C	D	E	F	G	H	I
52-003 (a)	B-9	0-5 ft	X	X	X	X	X	X			
		5-10 ft	X	X	X	X	X	X			
		10-15 ft	X	X	X	X	X	X			
		15-20 ft	X	X	X	X	X	X			
	B-10	0-5 ft	X	X	X	X	X	X			
		5-10 ft	X	X	X	X	X	X			
		10-15 ft	X	X	X	X	X	X			
		15-20 ft	X	X	X	X	X	X			
		Rinsate Blanks	2	2	2	2	2	2			
		Bottle Blanks	2	2	2	2	2	2			
		Trip Blanks	0	0	0	0	1	0			
		Duplicates	2	2	2	2	2	2			
		TOTALS	45	45	45	45	46	45			

[1] A = gross α, β, γ
E = VOCs
G = PCBs
B = γ spectrometry
D = metals by ICPES
H = ^{3}H in soil
C = α spectroscopy
F = SVOCs
I = miscellaneous analytes

7.19.3 Sample Screening and Analysis

Each sample collected will be screened with a Geiger-Mueller Meter and scintillation detector for contact radiation. All sample packages must be screened for surface contamination and contact radiation. All samples will be analyzed for Level III SVOCs; metals; gross-alpha, -beta, -gamma; gamma spectrometry; and alpha spectroscopy.

Table 7-20 outlines the total number of matrix and QA/QC samples required for this field investigation, the corresponding analyses, and sample requirements.

17.20 SWMU Aggregate P, Phase I

SWMU Aggregate P contains SWMU Nos. 63-001(a) and 63-001(b), two active septic systems. Both SWMUs are currently located within the boundaries of TA-63. Before the establishment of TA-63 in 1989, both of these SWMUs were within the boundaries of TA-52. SWMU No. 63-001(a) was formerly numbered SWMU No. 52-002(f and g) and was listed on the HSWA Module VIII (LANL 1990, 0306) under that number (Table 1-1). SWMU No. 63-001(b) was formerly numbered SWMU No. 52-002(k) and was listed on the HSWA Module VIII under that designation. Figure 7-47 presents the locations of SWMU Nos. 63-001(a) and 63-001(b). A detailed description of the site activities and history of SWMU Nos. 63-001(a) and 63-001(b) within OU 1129 is found in Section 3.8 of this Work Plan.

7.20.1 Sampling Plan Rationale and Objectives

The objective of this Phase I sampling plan is to determine the presence or absence of subsurface contamination in the vicinity of the SWMUs in Aggregate P. The sampling plan uses a judgmental sampling approach to investigate SWMU No. 63-001(a), a 1,000-gal. septic tank with associated drain line and seepage pit, and SWMU No. 63-001(b), a 950-gal. septic tank with associated drain line and seepage pit. Sampling activities are biased toward areas in which residual contamination is most likely to be present on the basis of the following conceptual model for a release at this site:

- Previous environmental surveys have shown no radioactive anomalies. No other environmental surveys have been conducted for other COCs.
- The content of the waste stream is not defined. Therefore, initial sample locations will be analyzed for a wide range of potential COCs. If positive results are obtained from these initial analyses, that information will be used to structure the sample analyte suite for Phase II.
- Contaminant plumes may have moved vertically along fractures that intersect leach fields and outfalls in liquids associated with the waste stream.

The surface investigation at Aggregate P is designed primarily to answer the following questions:

1) Does surface and subsurface contamination currently exist in Aggregate P?
2) What is the potential for surface and subsurface migration of contaminants?
3) What are the waste stream constituents?

Archival information indicates that the contaminants suspected at SWMU Nos. 63-001(a) and 63-001(b) include organic solvents and hazardous chemicals. Radionuclides are not expected at this site, but analysis will be conducted to determine if

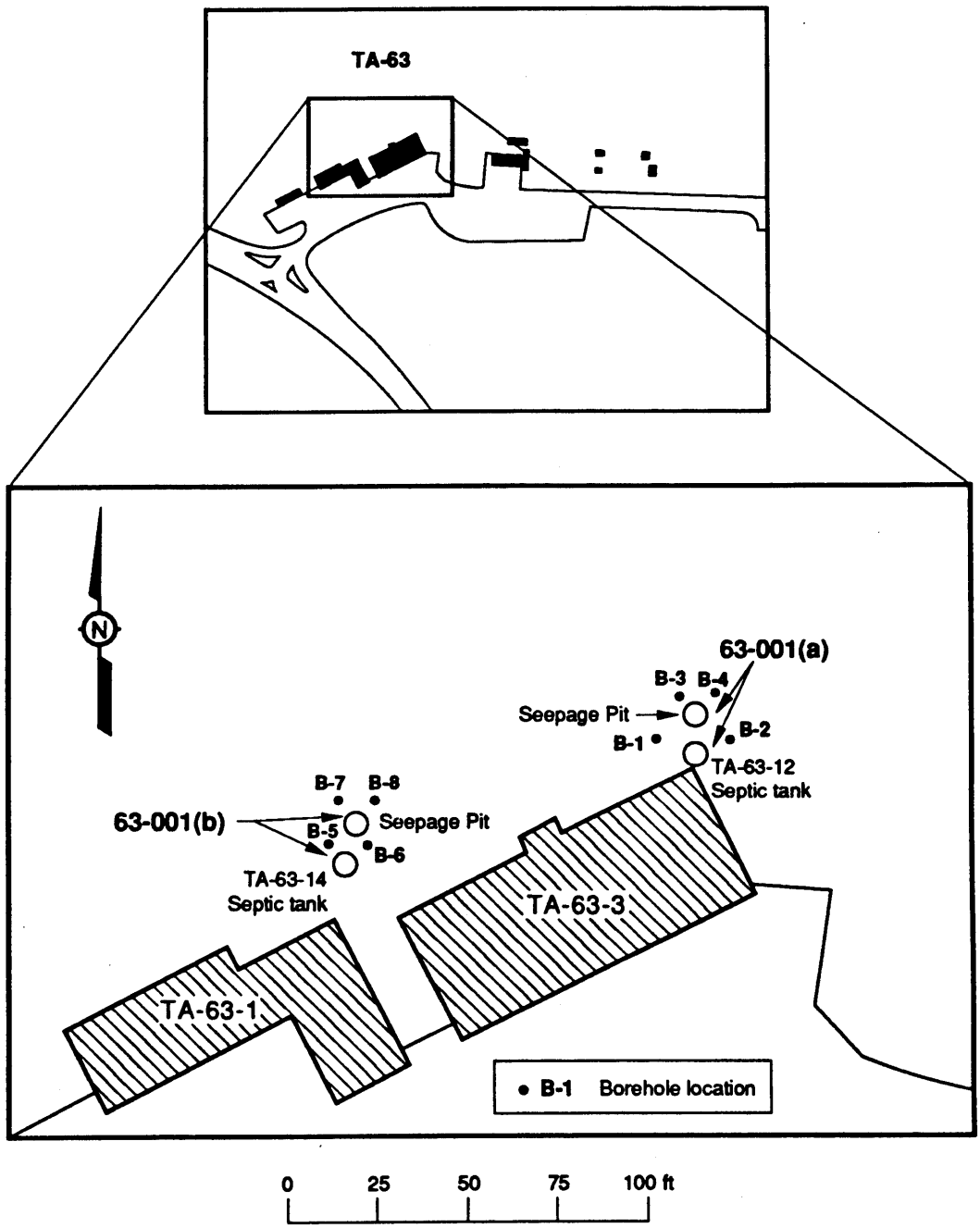


Figure 7-47. Schematic sample location map for SWMU Aggregate P.

radionuclides are present. Both systems receive only sanitary waste; however, solvents and other chemicals may have been discharged into the systems in previous years.

In this investigation, subsurface sampling will be conducted in the immediate vicinity of the septic tanks and seepage pits. Decision logic for the Phase I field investigation activities to be performed at SWMU Aggregate P is presented in Figure 7-48 and discussed in the following text.

7.20.2 Phase I Field Investigation Activities

The technical approach for the Phase I investigation at SWMU Nos. 63-001(a) and 63-001(b) will consist of three tasks. These include the engineering and environmental surveys discussed in Section 7.4, and subsurface sampling in the vicinity of the septic tanks and seepage pits (Figure 7-47).

The engineering survey will locate the septic tanks and seepage pits and the perimeters of the septic tanks and seepage pits will be marked with stakes. A rectangular grid approximately 20 ft by 35 ft enclosing each system will be located for the radiation survey. Stationary radiological counts for a duration of one minute will be collected at the center of each septic tank and drain pit using a FIDLER. The grid will also be used to locate a survey for the presence of VOCs using a PID.

Each septic system in SWMU Nos. 63-001(a and b) consists of an active septic tank, associated drains, and a seepage pit. Both seepage pits are constructed to a depth of 50 ft and are 4 ft in diameter. The Phase I investigation will perform subsurface sampling to determine if hazardous constituents have been released from the septic systems. Surface contamination is not expected because all portions of the systems are subsurface, which the environmental survey will, in part, confirm.

The subsurface investigation of SWMU Nos. 63-001(a and b) will consist of eight soil borings. These borings will be made using a decontaminated, continuous, 5-ft core barrel (Figure 7-47). One soil boring will be placed approximately 5 ft west and another 5 ft east of each septic tank for a total of four borings. These boreholes (B-1, B-2, B-5, and B-6) are indicated in Figure 7-47. The purpose of these boreholes is to determine if hazardous constituents may have leaked from the septic tanks. These 4 borings will be drilled to a minimum depth of 20 ft. Coring will begin at the ground surface and continue through the entire depth of the boring. As the 5-ft sections of core are retrieved from the borehole using a wireline, they will be screened for radionuclides using a scintillation detector and for VOCs using a PID. Sample screening will begin with the second 5-ft interval retrieved because contamination is not expected above the base of each tank. Samples will be collected from the 5-ft core interval in which the highest radiation reading and highest VOC reading are found. If the screening for radionuclides is negative or below background, samples will not be submitted for radionuclide analyses. If the screening for VOCs is negative then the sample will be collected from the midpoint of the 5-ft continuous-core interval.

To investigate the potential release of contaminants from the seepage pits, one soil boring will be placed approximately 5 ft west and 5 ft east of each seepage pit for a total of four borings. Because the pits are 50 ft deep, the borings will be drilled to a depth of 60 ft. Coring will begin at the ground surface and continue to a depth of 60 ft. For each 5-ft interval of core, radiation and VOC screening will be implemented using the methods discussed previously. Along each 5-ft core interval between the

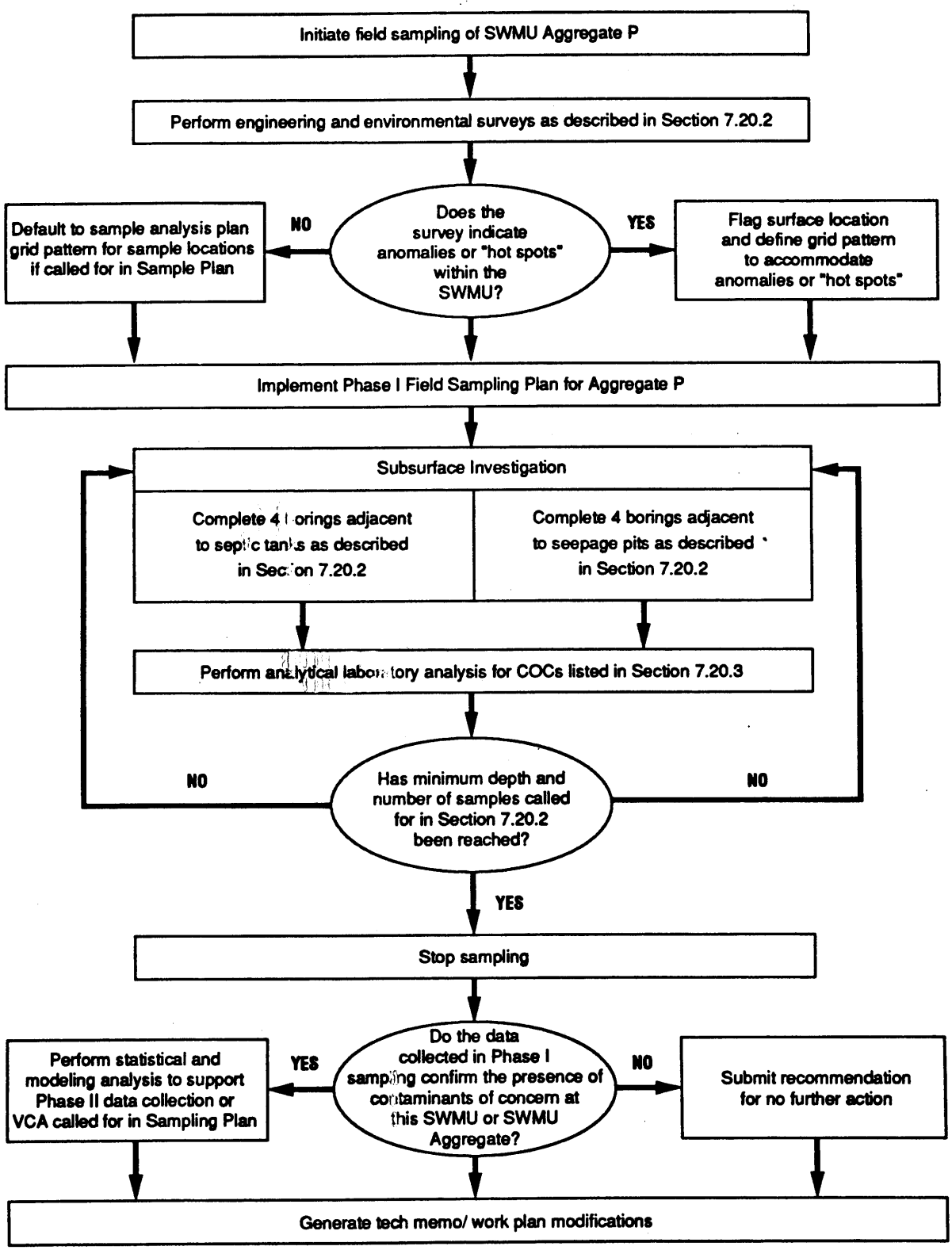


Figure 7-48. Decision logic for the sampling and analysis of SWMU Aggregate P.

surface and 60 ft, in which radionuclide or VOC readings are found to be above background, samples will be collected. When above background radioactivity is found in the interval, a sample will be collected along the 5-ft interval where the radionuclide reading is the greatest. A sample will be collected along the 5-ft interval where the VOC readings are highest. For intervals between 45- and 60- ft samples will be taken from the midpoint of the core interval.

The minimum drill hole depth is 60 ft. If radiation and VOC readings have not exceeded background levels for two consecutive 5-ft intervals at that depth, then drilling will cease. If above-background readings are detected at the 60-ft depth, then drilling will continue until radiological and VOC measurements are below background for two consecutive intervals, or until the drilling rig is not capable of going deeper.

The total number of matrix samples for the Phase I subsurface investigation is 64, assuming the minimum borehole depths of 20 ft for septic tanks and 60 ft for seepage pits are adequate. Samples will be analyzed for Level III metals, VOCs, SVOCs, and the miscellaneous analytes nitrate, nitrite, and total organic carbon (TOC) (Table 7-21).

7.20.3 Sample Screening and Analysis

Each sample will be screened with a scintillation detector for radiation. All sample packages must be screened for surface contamination and contact radiation. Samples will be analyzed for Level III gross-alpha,-beta, and -gamma; gamma spectrometry; alpha spectroscopy; VOCs; SVOCs; metals; nitrate; nitrite; and TOC.

Table 7-21 outlines the total number of matrix and QA/QC sample required for this field investigation, the corresponding analyses, and sample requirements. Appendix B should be consulted for procedure regarding the use of specified field sampling equipment; sample handling, packaging and shipping; equipment decontamination; and Level I and Level II field instruments.

TABLE 7-21

PHASE I SAMPLING SUMMARY FOR OU 1129 SWMU AGGREGATE P
(SWMU No. 63-0015[a])

SWMU	LOCATION	DEPTH	TYPE OF ANALYSIS REQUIRED[1] A	B	C	D	E	F	G	H	I
63-001 (a)	B-1	5-10 ft	X	X	X	X	X	X			X
		10-15 ft	X	X	X	X	X	X			X
		15-20 ft	X	X	X	X	X	X			X
	B-2	5-10 ft	X	X	X	X	X	X			X
		10-15 ft	X	X	X	X	X	X			X
		15-20 ft	X	X	X	X	X	X			X
	B-3	0-5 ft	X	X	X	X	X	X			X
		5-10 ft	X	X	X	X	X	X			X
		10-15 ft	X	X	X	X	X	X			X
		15-20 ft	X	X	X	X	X	X			X
		20-25 ft	X	X	X	X	X	X			X
		25-30 ft	X	X	X	X	X	X			X
		30-35 ft	X	X	X	X	X	X			X
		35-40 ft	X	X	X	X	X	X			X
		40-45 ft	X	X	X	X	X	X			X
		45-50 ft	X	X	X	X	X	X			X
	B-4	0-5 ft	X	X	X	X	X	X			X
		5-10 ft	X	X	X	X	X	X			X
		10-15 ft	X	X	X	X	X	X			X
		15-20 ft	X	X	X	X	X	X			X
		20-25 ft	X	X	X	X	X	X			X
		25-30 ft	X	X	X	X	X	X			X
		30-35 ft	X	X	X	X	X	X			X
		35-40 ft	X	X	X	X	X	X			X
		40-45 ft	X	X	X	X	X	X			X
		45-50 ft	X	X	X	X	X	X			X
		50-55 f	X	X	X	X	X	X			X
		55-60 ft	X	X	X	X	X	X			X

TABLE 7-21, (concluded)

SWMU	LOCATION	DEPTH	TYPE OF ANALYSIS REQUIRED[1] A	B	C	D	E	F	G	H	I
63-001 (a)	B-1	5-10 ft	X	X	X	X	X	X			X
		10-15 ft	X	X	X	X	X	X			X
		15-20 ft	X	X	X	X	X	X			X
	B-6	5-10 ft	X	X	X	X	X	X			X
		10-15 ft	X	X	X	X	X	X			X
		15-20 ft	X	X	X	X	X	X			X
	B-7	0-5 ft	X	X	X	X	X	X			X
		5-10 ft	X	X	X	X	X	X			X
		10-15 ft	X	X	X	X	X	X			X
		15-20 ft	X	X	X	X	X	X			X
		20-25 ft	X	X	X	X	X	X			X
		25-30 ft	X	X	X	X	X	X			X
		30-35 ft	X	X	X	X	X	X			X
		35-40 ft	X	X	X	X	X	X			X
		40-45 ft	X	X	X	X	X	X			X
		45-50 ft	X	X	X	X	X	X			X
		50-55 f	X	X	X	X	X	X			X
		55-60 ft	X	X	X	X	X	X			X
	B-8	0-5 ft	X	X	X	X	X	X			X
		5-10 ft	X	X	X	X	X	X			X
		10-15 ft	X	X	X	X	X	X			X
		15-20 ft	X	X	X	X	X	X			X
		20-25 ft	X	X	X	X	X	X			X
		25-30 ft	X	X	X	X	X	X			X
		30-35 ft	X	X	X	X	X	X			X
		35-40 ft	X	X	X	X	X	X			X
		40-45 ft	X	X	X	X	X	X			X
		45-50 ft	X	X	X	X	X	X			X
		50-55 f	X	X	X	X	X	X			X
		55-60 ft	X	X	X	X	X	X			X
		Rinsate blanks	3	3	3	3	3	3			
		Bottle blanks	3	3	3	3	3	3			3
		Trip blanks	3	3	3	3	3	3			3
		Duplicates	3	3	3	3	3	3			3
		TOTALS	84	84	84	84	84	84			84

[1] A = gross α, β, γ
B = γ spectrometry
C = α spectroscopy
D = metals by ICP/ES
E = VOCs
F = SVOCs
G = PCBs
H = ^{3}H in soil
I = miscellaneous analytes

REFERENCES

Becker, N. M., W. D. Purtymun, and M. Maes, 1985. "Environmental Surveillance at Los Alamos During 1984," Los Alamos National Laboratory Report LA-10421-ENV, Los Alamos, New Mexico. (Becker et al. 1985, 0029)

Environmental Protection Group, December 1990. "Environmental Surveillance at Los Alamos During 1989," Los Alamos National Laboratory Report LA-12000-ENV, Los Alamos, New Mexico. (Environmental Protection Group 1990, 0497)

EPA (US Environmental Protection Agency), November 1986. "Test Methods for Evaluating Solid Wastes; Physical/Chemical Methods," SW-846, Revision 0, Washington, DC. (EPA 1986, 0291)

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)

Fresquez, P., October 31, 1990. "An Environmental Restoration Interim Action (ERIA) Reconnaissance Survey of a Proposed Parking Lot Just East of TA-48-1", Los Alamos National Laboratory Memorandum to John Krueger (HSE-13) from Phil Fresquez (HSE-8), Los Alamos, New Mexico. (Fresquez 1990, 04-0073)

Fresquez, P., March 12, 1991. "Results of an Environmental Restoration Interim Action (ERIA) Reconnaissance Survey of a Proposed Parking Lot East of TA-48", Los Alamos National Laboratory Memorandum to Henry Nunes (HSE-13) from Phil Fresquez (HSE-8), Los Alamos, New Mexico.(Fresquez 1991, 04-0077)

Fresquez, P., April 1, 1991. "An Environmental Restoration Interim Action (ERIA) Reconnaissance Survey at the Site of the Weapons Isotope Separator Facility at TA-48", Los Alamos National Laboratory Memorandum to Henry Nunes (HSE-13) from Phil Fresquez (HSE-8), Los Alamos, New Mexico. (Fresquez 1991, 04-0078)

Fresquez, P., April 11, 1991. "Results of an Environmental Restoration Interim Action (ERIA) Reconnaissance Survey Over Areas Where Wastewater Collection Lines are Planned to be Installed en Route to the New Sanitary Wastewater Systems Consolidation (SWSC) Treatment Plan at TA-46," Los Alamos National Laboratory Memorandum HSE-8:91-597 to Henry Nunes (HSE-13) from Phil Fresquez (HSE-8), Los Alamos, New Mexico. (Fresquez 1991, 04-0232)

Fresquez, P., May 31, 1991. "Results of an Environmental Restoration Interim Action (ERIA) Reconnaissance Survey at the Site of the Weapons Isotope Separator Facility at TA-48", Los Alamos National Laboratory Memorandum to Robert Gonzales (HSE-13) from Phil Fresquez (HSE-8), Los Alamos, New Mexico. (Fresquez 1991, 04-0079)

Garvey, D. B., August 29, 1986. Los Alamos National Laboratory Memorandum to Distribution from Doris B. Garvey, Los Alamos, New Mexico. (Garvey 1986, 04-0087)

General Sciences Corporation, June 1990. "PCGEMS User's Guide, Release 1.0," draft, US Environmental Protection Agency, Office of Pesticides and Toxic Substances, Exposure Evaluation Division, Washington, DC," prepared by General

Sciences Corporation, Contract No. C3024281, Laurel, Maryland. (General Sciences Corporation 1990, 04-0264)

Gonzales, R., April 25, 1991. "Lab Job No. 10724-35, D&D of Separator Pit," Los Alamos National Laboratory Memorandum to Distribution from Robert Gonzales, Los Alamos, New Mexico. (Gonzales 1991, 04-0088)

International Technology Corporation, December 1988. "Solid Waste Management Units Report," Los Alamos National Laboratory, Los Alamos, New Mexico," Volumes I-IV prepared by International Technology Corporation, Project No. 301215.02.01, Los Alamos, New Mexico. (International Technology Corporation 1988, 0329)

LANL (Los Alamos National Laboratory), April 25, 1988. Beta-Gamma Measurements, Los Alamos, New Mexico. (LANL 1988, 04-0126)

LANL (Los Alamos National Laboratory), April 25, 1988. Gamma Ray Count Rate Data, Los Alamos, New Mexico. (LANL 1988, 04-0127)

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 International Technology 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)

LASL (Los Alamos ScientificLaboratory), circa 1969. "Gaseous Waste Management," Los Alamos Scientific Laboratory, Los Alamos, New Mexico. (LASL, circa 1969, 0702)

McInroy, D., April 1, 1992. Meeting between K. Roberson (International Technology [IT] Corporation) and D. McInroy (EM-8) on IT Corporation Meeting Log, Los Alamos, New Mexico. (McInroy 1992, 04-0255)

Montoya, G. M., 1985. "Site Characterization & Enhancement Program August 1985," Los Alamos National Laboratory Lab Book, Los Alamos, New Mexico. (Montoya 1985, 04-0158)

Nyhan, J. W., L. W. Hacker, T. E. Calhoun, and D. L. Young, June 1978. "Soil Survey of Los Alamos County, New Mexico," Los Alamos Scientific Laboratory Report LA-6779-MS, Los Alamos, New Mexico. (Nyhan et al. 1978, 0161)

Perkins, B., March 2, 1986. "Environmental Surveillance HSE-8 Initial Field Observation Report," Los Alamos, New Mexico. (Perkins 1986, 04-0169)

Scholl, J. L., April 1989. "Los Alamos Site Characterization Program Special Projects Report," (draft), prepared for Los Alamos National Laboratory by NUS Corporation, Los Alamos, New Mexico. (Scholl 1989, 0485)

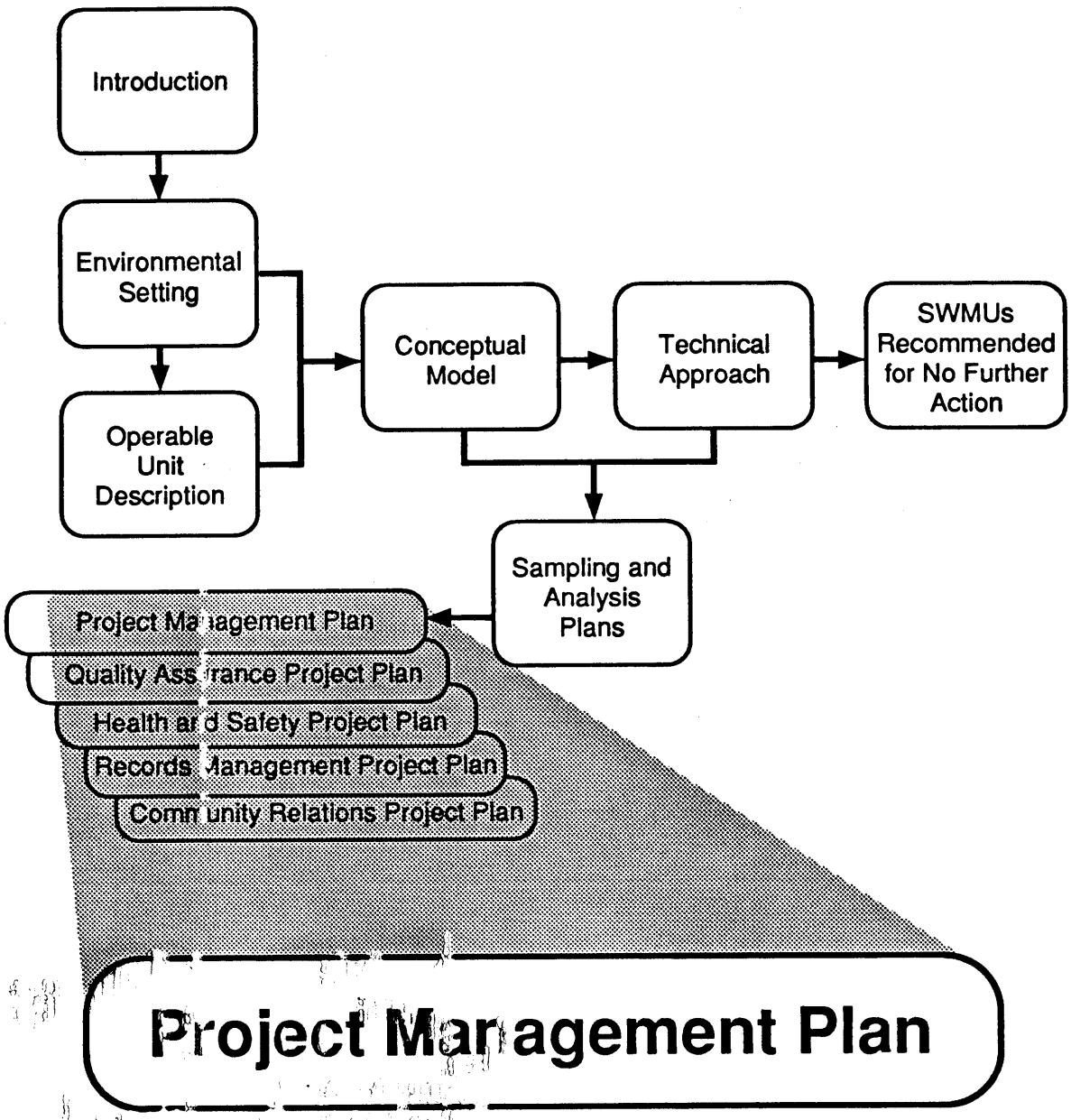
Scholl Fritz, L., October 25, 1985. "TA-35 Oil Spill/PCB Soil Sampling Survey and Results," Los Alamos National Laboratory Memorandum to File from Lynn Scholl Fritz (HSE-8), Los Alamos, New Mexico. (Scholl Fritz 1985, 04-0083)

Shafer, S. B., circa 1989. ER Program Site Visits, Roy F. Weston, Inc. Field Notebook, Control #52, Los Alamos, New Mexico. (Shafer circa 1989, 04-0187)

Travis, B., and H. Nuttall, 1985. "A Transport Code for Radiocolloid Migration: With an Assessment of an Actual Low-Level Waste Site," *Materials Research Symposium Proceedings*, Vol. 44, Materials Research Society. (Travis and Nuttall 1985, 04-0266)

Travis, B., and B. Trent, September 11, 1991. "Three Dimensional Computer Simulations of Bioremediation and Vapor Extraction," Los Alamos National Laboratory Report LA-UR-91-2875, Los Alamos, New Mexico. (Travis and Trent 1991, 04-0265)

ANNEX I


Introduction
Environmental Setting
Operable Unit Description
Conceptual Model
Technical Approach
SWMUs Recommended for No Further Action
Sampling and Analysis Plans
Project Management Plan
Quality Assurance Project Plan
Health and Safety Project Plan
Records Management Project Plan
Community Relations Project Plan
Project Management Plan

1.0 PROJECT MANAGEMENT PLAN

This annex presents the technical approach, organizational structure, schedule, budget, and reporting milestones for implementing the Operable Unit (OU) 1129 Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) as set forth in this Work Plan. The Project Management Plan (PMP) for the OU 1129 RFI concurs with and is an extension of the Environmental Restoration (ER) Program Management Plan found in Annex I of the Installation Work Plan (IWP) (LANL 1991, 0553). This annex addresses the PMP requirements of the Hazardous and Solid Waste Amendments (HSWA) Module (Task II, E, p. 39) of Los Alamos National Laboratory's (the Laboratory's) RCRA Part B Permit (NMEID 1989, 0595).

1.1 Schedule

The start date for the OU 1129 RFI/corrective measures study (CMS) process was set in the IWP Program Management Plan (Annex I, Table I-3) and the schedule for the entire process was detailed in Appendix S of the IWP LANL (1991, 0553). The projected schedule for the corrective action process for OU 1129 is provided in Figure I-1. Implementation of this schedule is dependent on regulatory review and approval of the OU 1129 Work Plan. Any delays in Environmental Protection Agency (EPA) approval will require adjustments to Figure I-1 accordingly.

Implementation of OU 1129 RFI activities is also contingent upon available funding. The RFI schedule was generated on the basis of the following assumptions:

- Regulatory agencies review and approve the OU 1129 RFI Work Plan and supporting project plans as shown in Figure I-1.
- The Laboratory may initiate certain tasks (e.g., interim corrective measures or voluntary corrective actions) before the regulatory agencies grant final approval of the Work Plan.
- An adequate number of support personnel (e.g., emergency management technicians, trained drilling contractors, etc.) are available for conducting necessary tasks.
- Solid waste management units (SWMUs) expected to require Phase II investigations will be scheduled earlier in the Phase I RFI to allow time for data assessment and subsequent investigations.
- Department of Energy (DOE) budget cuts for OU 1129 for fiscal years 1992 and 1993 currently constrain work planned for the first two investigation years.
- Field work, when possible, is not scheduled each year between November 15 and March 15 because of inclement weather.

Figure I-1. OU 1129 RFI Schedule.

1.2 Cost Estimation

The schedule presented in Figure I-1 is based on fixed budgets for the first two years (i.e., 1992 and 1993) of the RFI. The fixed budgets in fiscal years (FYs) 1992 and 1993 are based on expected DOE-funding levels. DOE-funding requests are set two years in advance; thus current budget constraints are assumed not to affect OU 1129 RFI funding in FY 94. Funding requests for FY 94 and beyond will presumably reflect the cost and schedule that most efficiently complete the RFI efforts. Table I-1 is a project costing of the major OU 1129 RFI activities through the CMS and is reflected in the summary of the estimated budget (Table ES-2) in the Executive Summary of this Work Plan. Table I-2 presents a summary cost estimate for each SWMU aggregate-specific-Phase I sampling plan (Chapter 7.0). The cost estimates reflect DOE guidance regarding appropriate contingency assumptions.

1.3 Reporting

The Laboratory will present the results of RFI field work in three principal documents: quarterly phase reports, technical memoranda/work plan modifications, and the RFI report. The purpose of each of these reports is detailed in the following sections.

1.3.1 Quarterly Phase Reports

As the OU 1129 RFI is implemented, the Laboratory will summarize technical progress in quarterly phase reports, as required by the HSWA Module of the Laboratory's RCRA Part B operating permit (Task V, C, page 46). The Laboratory will provide detailed technical assessments in technical memoranda/work plan modifications. The proposed submittal schedule for the quarterly phase reports for OU 1129 can be found in Table ES-I in the Executive Summary at the front of this Work Plan.

1.3.2 Technical Memoranda/Work Plan Modifications

The Laboratory will submit technical memoranda/work plan modifications for work conducted on aggregates of SWMUs or on individual SWMUs. These documents will function as interim reports on completed portions of the RFI. They will serve as partial RFI Phase I reports summarizing the results of initial site characterization activities and as partial RFI Phase II work plans describing the follow-up activities being planned (including any modifications to field sampling plans suggested by initial findings).

1.3.3 RFI Report

The RFI report will summarize all field work conducted during its five-year duration. As required by the HSWA Module of the Laboratory's RCRA Part B operating permit (Task V, D, page 46), the Laboratory will submit an RFI report within 60 days of completion of the RFI. As stated in Section 3.5.3 of the IWP (LANL 1991, 0553), the RFI report will describe the procedures, methods, and results of field investigations and will include information on type and extent of contamination, sources and migration pathways, and actual and potential receptors. The report will also contain

TABLE I-1

Projected Budget for OU 1129 Corrective Action Process

ACTIVITY ID	DURATION WORK DAYS	ACTIVITY DESCRIPTION	ACTIVITY BUDGET COST
1100001	2000	ADS MANAGEMENT	1,305,146
		BEGIN RFI FIELD PHASES COSTING	123.5
1310010	160	DETERMINE ACCESS & COORDINATE NEEDS	37,120
1310011	332	ARRANGE SITE ACCESS	38,512
1320019	150	DETERMINE CONTRACTING NEEDS	43200
1320020	10	DEVELOPMENT OF SUBCONTRACTOR SOW	11,520
1320025	22	IDENTIFICATION OF SUBCONTRACTOR	6,336
1320030	22	SUBCONTRACTOR SELECTION AND AWARD	12,672
1330095	118	DETERMINE DATA MGT & QA TASK NEEDS	78,588
1330100	64	DEVELOP INTERNAL RECORDS MANAGEMENT PROCEDURE	60,928
1330105	53	ESTABLISH RPF INTERFACE	12,614
1330110	64	DEVELOP FIELD DATA MANAGEMENT SYSTEMS	37,632
1330115	30	TEST FIELD DATA MANAGEMENT SYSTEM	34,620
1330120	48	DEVELOP OU DATA MANAGEMENT SOP FOR RFI	5,856
1330125	19	PLAN DATA MANAGEMENT TEST	8,018
1330135	23	CONDUCT PRE-RFI DATA MANAGEMENT TEST	7,659
1330140	22	RESOLVE TEST ISSUES	6,600
1330145	88	DEVELOP/TEST DATA VALIDATION PROCEDURES FOR RFI	21,472
1330150	64	DEVELOP DATA MANAGEMENT QA PLAN FOR RFI	3,904
1330155	132	COORDINATE AND TEST ANALYTICAL SERVICES DATA MGT	16,104
1330200	121	DEVELOP/COORDINATE COST/SCHEDULE METHODS	62,194
1331001	225	IDENTIFY FIELD PLANNING REQUIREMENTS	33,750
1331008	66	IDENTIFY FIELD ANALYSIS & TECHNIQUES	13,926
1331009	60	FIELD IMPLEMENTATION SOP	12,660
1331010	135	LOGISTICS AND PLANNING FOR PHASE I	49,410
1331030	105	DRILLING PLANS REVISE AND CHECK	15,750
1331195	118	DETERMINE DATA ANALYSIS NEEDS	41,583.2
1331200	124	CHOOSE/INSTALL/VALIDATE SOFTWARE	39,184
1331210	58	INCORPORATE RISK ASSESSMENT METHODS FROM 92 IWP	16,170.4
1332100	44	REVISE H&S PLAN	28,776
1332105	38	TRAIN TO H&S PLAN	35,796
1336001	486	RFI FIELD MOBILIZATION	145,800
1340005	22	DEVELOP DATA MANAGEMENT QA PROCEDURE	4,642
1340010	113	FIELD SURVEY	295,834
1340049	66	RPF INTERFACE	23,364
1340050	90	A-DEVELOP QUARTERLY PHASE REPORT	42,768
1340054	90	B-DEVELOP QUARTERLY PHASE REPORT	42,768
1340055	223	PHASE I REMOTE SENSING & ENGINEERING SURVEY	747,050
1340058	90	C-DEVELOP QUARTERLY PHASE REPORT	42,768
1340062	90	D-DEVELOP QUARTERLY PHASE REPORT	42,768
1340066	90	E-DEVELOP QUARTERLY PHASE REPORT	42,768
1340100	258	IMPLEMENT PHASE I FIELD SAMPLING PLAN	2,824,584
1340105	400	IMPLEMENT PHASE II FIELD SAMPLING PLAN	3,030,400
1341099	118	DETERMINE SURVEY AND MAPPING NEEDS	17,700

TABLE I-1 (concluded)

Projected Budget for OU 1129 Corrective Action Process

ACTIVITY ID	DURATION WORK DAYS	ACTIVITY DESCRIPTION	ACTIVITY BUDGET COST
1341110	63	COORDINATE FIMAD RDBMS INTERFACE	48,346.2
1341120	42	PRODUCE VIDEOS RECORD OF SWMUs	46,452
1341130	22	COORDINATE NEW FIMAD MAP PRODUCTS	4,642
1341135	20	OVERLAY MODELING ON NEW MAPS	11,300
1341140	58	DEVELOP REMOTE SENSING PLAN ON NEW MAPS	51,074.8
1341145	39	DEVELOP NEW SAP MAPS	62,376.6
1341150	100	FIELD CHECK NEW FIMAD MAPS	323,600
1399001	594	SUBCONTRACTOR RFI FIELD LABOR	4,114,101
1399003		RFI PHASE I SAMPLING COST	1,100,000
1399005		RFI PHASE II SAMPLING COST	3,000,000
1399007		PHASE I ANALYTICAL COSTS	2,200,000
1399009		PHASE II ANALYTICAL COSTS	6,600,000
1399011		RFI FIELD PHASE COMPUTER HARDWARE/SOFTWARE COSTS	300,000
1399013		RFI SAMPLING EQUIPMENT COSTS	100,000
1399015		RFI FIELD INSTRUMENTATION	500,000
			=========
		SUBTOTAL FOR RFI FIELD PHASES	26,566,477
		BEGIN CMS PLAN TASKS	
1500100	66	INTERNAL DRAFT OF CMS WORK PLAN	127,116
1500110	25	LANL CMS WORK PLAN COMMENT RESOLUTION	29,350
1500120	20	DOE REVIEW OF DRAFT CMS WORK PLAN	
1500130	10	PUBLISH DRAFT CMS WORK PLAN	9,360
1500145	30	EPA/LANL CMS WORK PLAN NEGOTIATION	14,328
1500150	35	EPA COMMENT RESOLUTION DEV FINAL CMS WORK PLAN	50,246
1500155	0	EPA APPROVED CMS WORKPLAN (MILESTONE 14JUL97)	
			========
1500999		SUBTOTAL FOR CMS PLAN	239,217
		BEGIN RFI REPORT COSTING	
1400300	538	PREPARE INTERNAL LANL DRAFT OF RFI REPORT	4,378,244
1400310	35	COMMENT RESOLUTION OF LANL INTRNL DRAFT RFI RPT	243,460
1400325	28	COMMENT RESOLUTION OF DOE EXTERNAL REVIEW	165,200
1400330	20	PUBLISH DRAFT RFI REPORT	146,080
1400345	19	EPA/LANL RFI REPORT NEGOTIATION	56,350.2
1400350	20	EPA COMMENT RESOLUTION DEV FINAL RFI REPORT	160,320
			========
		SUBTOTAL FOR RFI REPORT	5,150,779
		RFI WORK PLAN	868,762
		VOLUNTARY CORRECTIVE ACTIONS	692,970
1500210	290	CONDUCT CMS	3,776,241
1500300	120	INTERNAL DRAFT OF CMS REPORT	932,308
			========
		ESTIMATED TOTALS FOR ACTIVITIES SHOWN	39,531,900

TABLE I-2

COST ESTIMATE FOR OU 1129 PHASE I SAMPLING EFFORT
NUMBER OF ANALYSES AND COST BY AGGREGATE

ACTIVITY	COST	"A" and "B"	"C"	Cost	"D"	Cost	"E"	Cost	"F"	Cost	"G"	Cost	"H"	Cost
Borehole sampling/hole	3700		8	29600	27	99900	2	7400	24	88800	1	3700	11	40700
Surface sampling/site	1200	NOTE:	10	12000					6	7200	6	7200		
		Sample collection and												
ANALYSIS		*analysis for these*												
H-3, soil	181	*aggregates will be based*											35	6335
Gross alpha,beta,gamma	166	*on results of remote*	32	5312	134	22244	10	1660	109	18094	36	5976	35	5810
Gamma spectrometry	166	*sensing surveys. See the*	32	5312	134	22244	10	1660	109	18094	36	5976	35	5810
Alpha spectroscopy	632	*text discussion for details.*	32	20224	134	84688	10	6320	109	68888	36	22752	35	22120
Metals by ICPES, all 25	555		32	17760	142	78810	11	6105	109	60495	37	20535		
Volatiles	331				147	48657	12	3972	104	34424	38	12578		
Semivolatiles	444		32	14208	140	62160	11	4884	109	48396	37	16428		
PCBs	218				140	30520	11	2398			37	8066	7	1526
Miscellaneous Analytes*	500		10	5000							37	18500		
TOTALS			188	109416	998	449223	77	34399	679	344391	301	121711	158	82301

TABLE I-2

(Table Continues)

COST ESTIMATE FOR OU 1129 PHASE I SAMPLING EFFORT

NUMBER OF ANALYSES AND COST BY AGGREGATE

ACTIVITY	"I"	Cost	"J"	Cost	"K"	Cost	"L"	Cost	"M"	Cost	"N"	Cost	"O"	Cost	"P"	Cost
Borehole sampling/hole	2	7400	36	133200	5	18500	4	14800	6	22200	5	18500	10	37000	8	29600
Surface sampling/site	8	9600	27	32400					5	6000	10	12000				
ANALYSIS																
H-3, soil																
Gross alpha,beta,gamma	22	3652	169	28054	18	2988	15	2490	29	4814	19	3154	45	7470	66	10956
Gamma spectrometry	22	3652	169	28054	18	2988	15	2490	29	4814	19	3154	45	7470	66	10956
Alpha spectroscopy	22	13904	169	106808	18	11376	15	9480	29	18328	19	12008	45	28440	66	41712
Metals by ICPES, all 25		0	154	85470	18	9990	15	8325	29	16095	19	10545	45	24975	66	36630
Volatiles	24	7944	152	50312	19	6289	16	5296	22	7282	10	3310	46	15226	67	22177
Semivolatiles	15	6660	154	68376	18	7992	15	6660	29	12876	19	8436	45	19980	66	29304
PCBs	23	5014														
Miscellaneous Analytes*							15	7500							66	33000
TOTALS	138	57826	1030	532674	114	60123	110	57041	178	92409	120	71107	281	140561	471	214335

Total Sampling Effort
$2,499,228

* MISC. ANALYTES INCLUDE:

Cl, SO4 by IC	PO4, color	NH3 as N by FIA	Boron
Nitrate by FIA	Fl, ISE	Cyanide, color	Unlisted
Nitrite by FIA	SiO2, color		

adequate information to support delisting of sites that require no further action and corrective action decisions.

1.4 Organization

The organizational structure for the ER Program is presented in Figure II-1 in Section 2.0 of the Laboratory ER Program Quality Program Plan (Annex II of the IWP, [LANL 1991, 0553]). Section 2.0 of the QPP identifies line authority and personnel responsibilities for each position identified in the figure.

Figure I-2 is an organizational chart showing responsibilities for implementation of the OU 1129 RFI field investigation. The following is a discussion of the responsibilities associated with the positions identified in Figure I-2, which are not identified and described in the IWP.

Basic Organization for OU 1129 RFI Operations

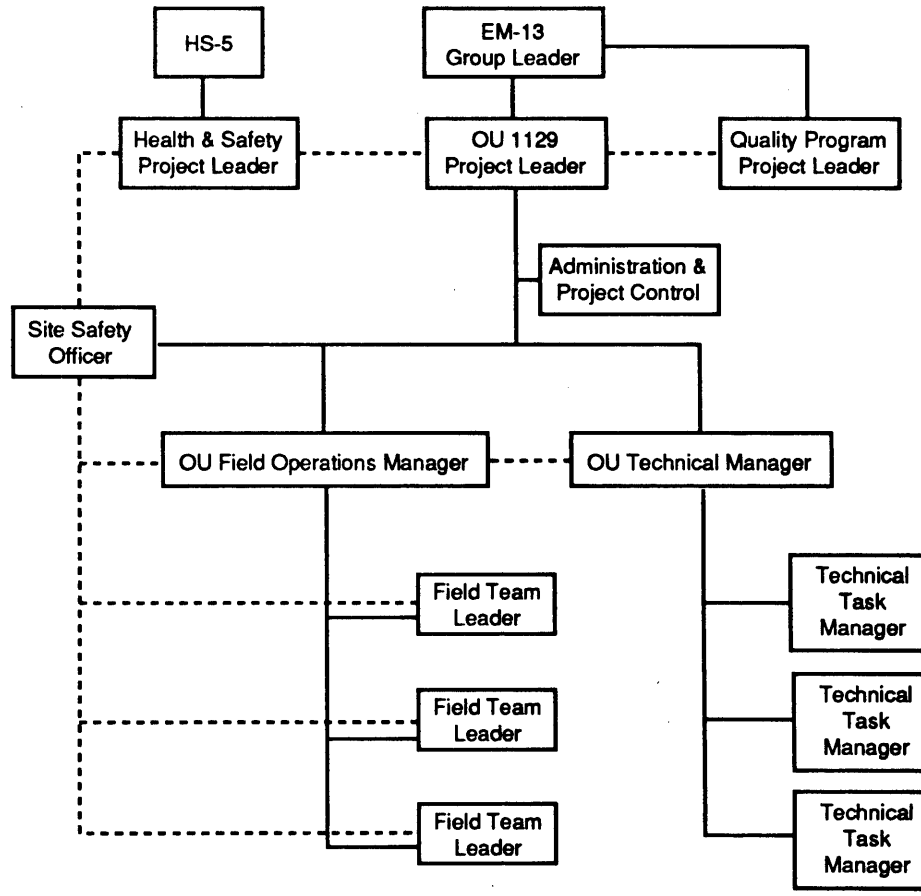


Figure I-2. Basic Organization for OU 1129 RFI Operations.

1.4.1 Field Operations Manager

The Field Operations Manager reports to the Operable Unit Project Leader (OUPL). The Field Operations Manager may be a contractor. The Field Operations Manager will

- oversee day-to-day field operations of all field teams;
- ensure the health and safety of all field team members;
- conduct planning and scheduling for implementation of the RFI field activities for all field teams; and
- manage and assign work to field team leaders.

1.4.2 Technical Manager

The OU Technical Manager reports to the OUPL and is responsible for managing all the individual technical task managers and for coordinating all technical issues affecting the RFI process. The Technical Manager may be a contractor. The Technical Manager will

- advise the OUPL on technical matters
- ensure that all quality assurance (QA), data management, data analysis, and modeling tasks are effectively implemented, and
- coordinate with the Field Operations Manager to resolve any data collection and management conflicts.

1.4.3 Field Team Leader

The Field Team Leader will report to the Field Operations Manager and is is responsible for directing the execution of field sampling activities using crews of field team members appropriate for the activity. The Field Team Leader is responsible for implementing the sampling and analysis plans (SAPs), the Health and Safety (H&S) Project Plan, and the project-specific Quality Assurance Project Plan (QAPjP). Field Team Leaders may be contractors. The Field Team Leader will

- oversee daily field operations for the Field Team including planning, scheduling, and implementing RFI field activities for the OU 1129 Work Plan;
- assign a Site Safety Officer (SSO) to ensure compliance with the H&S Project Plan;
- be familiar with emergency response procedures and notification requirements and their implementation;

- coordinate with field and technical team members, who may include sampling personnel, an SSO, Laboratory personnel, contractors, and staff members with technical knowledge of geology, hydrology, statistics, and other applicable disciplines.

1.4.4 Technical Task Managers

The Technical Task Manager reports to the OU Technical Manager and is responsible for the technical support tasks associated with the RFI process. These tasks include data management, QA, data analysis and validation, modeling, and surveying. The task manager may supervise additional technical support. They may be contractors.

1.4.5 Site Safety Officer

The SSO reports to the OUPL for administrative control and to HS-5, the Industrial Hygiene Group, for operational control and acts as a liaison to the Field Operations Manager and the Field Team Leader on health and safety issues. The SSO will have the authority and responsibility to halt any field operation because of health or safety concerns. Each SSO will assist the Field Team Leader in executing site safety procedures. An SSO may be a contractor.

The SSO will be trained in first aid procedures and in cardiopulmonary resuscitation (CPR) and will ensure that first aid supplies are available at the site. The SSO will know the location of facilities for emergency medical care, including those for injuries that might involve contamination by radioactive materials or hazardous chemicals. Specific duties of the SSO will appear in the final Health and Safety Project Plan as adopted by the Loboratory's ER Program (see Annex III in this Work Plan).

1.4.6 Field Team Members

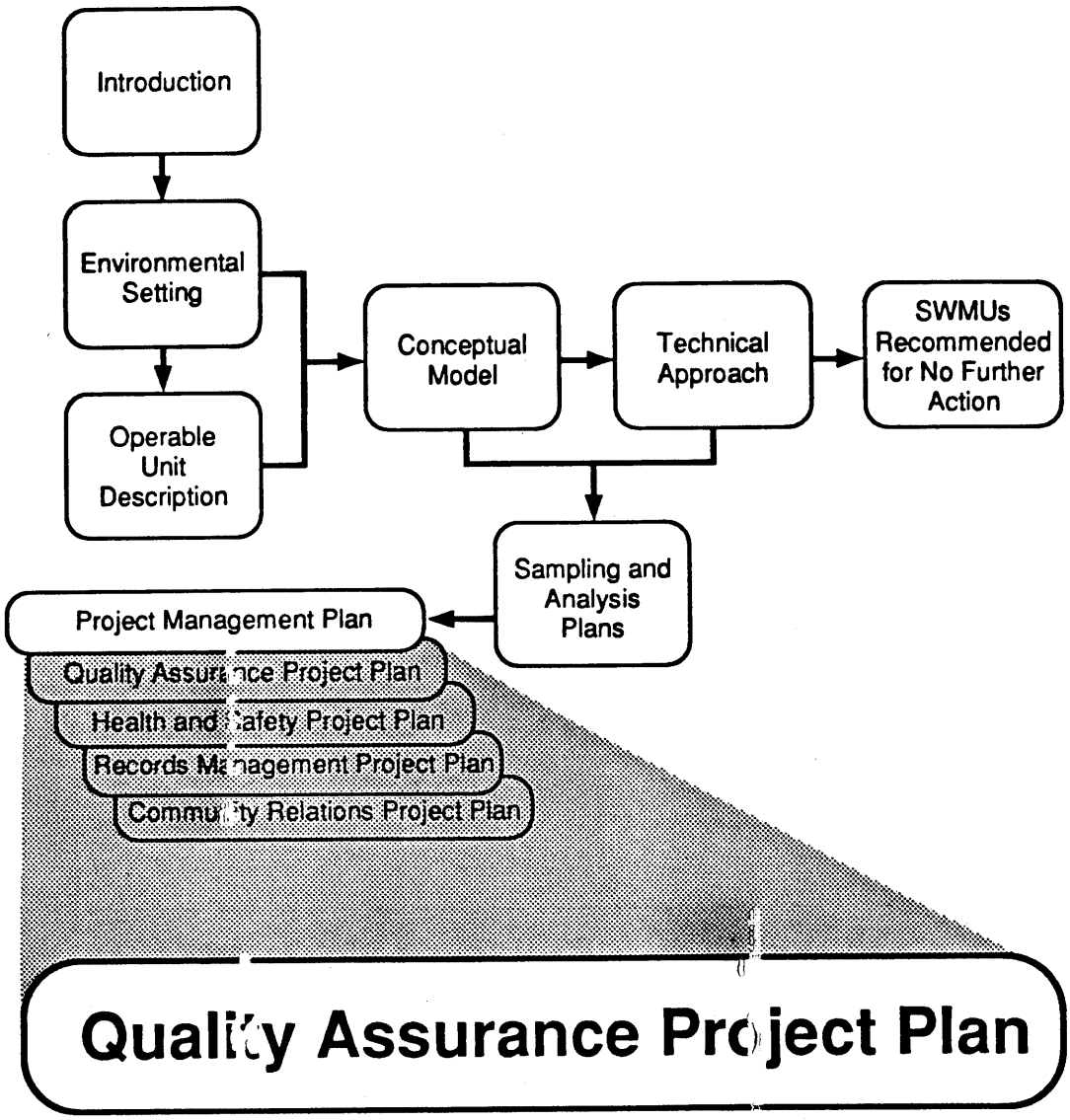
Field team members report to the field team leaders. Field team members are responsible for conducting the assigned field work in a manner that ensures that the data collected is technically valid and legally defensible. Teams are responsible for conducting the work detailed in the SAPs and are under the direction of the Field Team Leader(s). Field team members may be contractors.

REFERENCES

NMEID (New Mexico Environmental Improvement Division), November 8, 1989. "Hazardous Waste Facility Permit," Permit No. NM0890010515-1 issued to Los Alamos National Laboratory, Los Alamos, New Mexico, effective February 19, 1990, Santa Fe, New Mexico. (NMED 1989, 0595)

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)

ANNEX II


Introduction
Environmental Setting
Operable Unit Description
Conceptual Model
Technical Approach
SWMUs Recommended for No Further Action
Sampling and Analysis Plans
Project Management Plan
Quality Assurance Project Plan
Health and Safety Project Plan
Records Management Project Plan
Community Relations Project Plan
Quality Assurance Project Plan

SIGNATURE PAGE

Approval for Implementation

1. NAME: Robert Vocke
   TITLE: ER Program Manager, Los Alamos National Laboratory

   SIGNATURE: _____ DATE: _____

2. NAME: Karen Foster
   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: Rich Mayer
   TITLE: Environmental Engineer, Region VI, Environmental Protection Agency

   SIGNATURE: _____ DATE: _____

6. NAME: Charles Ritchey
   TITLE: Acting Chief of Office of Quality Assurance, Region VI Environmental Protection Agency

   SIGNATURE: _____ DATE: _____

7. NAME: Allyn Pratt
   TITLE: Project Leader, Environmental Restoration Group (EM-13), Los Alamos National Laboratory

   SIGNATURE: _____ DATE:

INTRODUCTION

This Quality Assurance Project Plan (QAPjP) for the Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) Work Plan for Operable Unit (OU) 1129 was written as a matrix report (Table II-1) that is based on the Los Alamos National Laboratory (the Laboratory) Environmental Restoration (ER) Program Generic QAPjP (Appendix T of the Installation Work Plan [IWP] [LANL 1991, 0553]).

The Laboratory ER Program Generic QAPjP describes the format for the individual OU QAPjPs. In the Generic QAPjP, Section 1.0 is the Signature Page, which is included in the front of this annex. Section 2.0 of the Generic QAPjP is a Table of Contents, which was omitted from this annex because the OU 1129 QAPjP is presented as a matrix. Section 3.0 of the Generic QAPjP is the Project Description, and Subsection 3.1 is the Introduction. This introduction will serve as the equivalent of Subsection 3.1 and the matrix (Table II-1) will begin with Subsection 3.2, Facility Description.

The OU 1129 QAPjP matrix (Table II-1) appears as a table in which the Generic QAPjP criteria are listed in the first column; these criteria correspond to the sections of the Generic QAPjP. The second column lists the specific requirements of the Generic QAPjP that the OU 1129 QAPjP must meet; the subsection titles and numbers in the second column correspond directly with those contained in Generic QAPjP. Sections of the Generic QAPjP that do not contain specific requirements are not included in the matrix, e.g., 3.4. The third column lists the location of information in the IWP and/or the OU 1129 Work Plan that fulfills the requirements in the Generic QAPjP. If OU 1129 will be following the requirements in the Generic QAPjP and no further information is necessary, the column contains the phrase "Generic QAPjP accepted." In some cases, a standard operating procedure (SOP) and/or a clarification note is included.

TABLE II-1

OU 1129 QAPjP MATRIX

Generic QAPjP Criteria	Generic QAPjP Requirements by Subsection	OU 1129 Incorporation of Generic QAPjP Requirements
Project Description	3.2 Facility Description	Los Alamos National Laboratory (LANL) ER Program IWP, Section 3.0, and OU 1129 Work Plan, Chapter 3.0.
	3.3 ER Program	LANL ER Program IWP, Section 2.0.
	3.4.1 Project Objectives	OU 1129 Work Plan, Chapters 1.0 and 5.0.
	3.4.2 Project Schedule	OU 1129 Work Plan, Annex I.
	3.4.3 Project Scope	OU 1129 Work Plan, Chapters 1.0 and 5.0.
	3.4.4 Background Information	OU 1129 Work Plan, Chapters 1.0, 2.0, and 3.0.
	3.4.5 Data Management	OU 1129 Work Plan, Annex IV, and LANL ER Program IWP, Annex IV.
Project Organization	4.1 Line Authority	OU 1129 Work Plan, Annex I.
	4.2 Personnel Qualifications, Training, Resumes	Maintained as Records within OU 1129 record system.
	4.3 Organizational Structure	LANL-ER-QPP, Section 2.0, and OU 1129 Work Plan, Annex I. See also ***Note 1.***
Quality Assurance Objectives for Measurement Data in Terms of Precision, Accuracy, Representativeness, Completeness, and Comparability	5.1 Level of Quality Control	Generic QAPjP accepted.
	5.2 Precision, Accuracy, and Sensitivity of Analyses	Generic QAPjP accepted.
	5.3 QA Objectives for Precision	Generic QAPjP accepted.
	5.4 QA Objectives for Accuracy	Generic QAPjP accepted.
	5.5 Representativeness, Completeness, and Comparability	Generic QAPjP accepted.
	5.6 Field Measurements	Generic QAPjP accepted.
	5.7 Data Quality Objectives	OU 1129 Work Plan, Chapter 5.0.

TABLE II-1 (continued)

OU 1129 QAPjP MATRIX

Generic QAPjP Criteria	Generic QAPjP Requirements by Subsection	OU 1129 Incorporation of Generic QAPjP Requirements
Sampling Procedures	6.0 Sampling Procedures	OU 1129 Work Plan, Appendix B.
	6.1 Quality Control Samples	Generic QAPjP accepted. Including ER Program SOP-01.05. See also ***Note 2***
	6.2 Sample Preservation During Shipment	Generic QAPjP accepted. Including ER Program SOP-01.02.
	6.3 Equipment Decontamination	Generic QAPjP accepted. Including ER Program SOP-01.06.
	6.4 Sample Designation	Generic QAPjP accepted. Including ER Program SOP-01.04.
Sample Custody	7.1 Overview	Generic QAPjP accepted. Including ER Program SOP-01.04.
	7.2 Field Documentation	Generic QAPjP accepted. Including ER Program SOP-01.04.
	7.3 Sample Management Facility	Generic QAPjP accepted.
	7.4 Laboratory Documentation	Generic QAPjP accepted.
	7.5 Sample Handling, Packaging, and Shipping	Generic QAPjP accepted. Including ER Program SOP-01.03.
	7.6 Final Evidence File Documentation	Generic QAPjP accepted.
Calibrations Procedures and Frequency	8.1 Overview	Generic QAPjP accepted.
	8.2 Field Equipment	Generic QAPjP accepted.
	8.3 Laboratory Equipment	Generic QAPjP accepted.
Analytical Procedures	9.1 Overview	Generic QAPjP accepted.
	9.2 Field Testing and Screening	Generic QAPjP accepted. Including ER Program SOP-06.02.
	9.3 Laboratory Methods	Generic QAPjP accepted. Sampling plans are described in OU 1129 Work Plan, Chapter 7.0.
Data Reduction, Validation, and Reporting	10.1 Data Reduction	Generic QAPjP accepted.
	10.2 Data Validation	Generic QAPjP accepted.
	10.3 Data Reporting	Generic QAPjP accepted.

TABLE II-1 (concluded)

OU 1129 QAPjP MATRIX

Generic QAPjP Criteria	Generic QAPjP Requirements by Subsection	OU 1129 Incorporation of Generic QAPjP Requirements
Internal Quality-Controlled Checks	11.1 Field Sampling Quality Control Checks	Generic QAPjP accepted.
	11.2 Laboratory Analytical Activities	Generic QAPjP accepted.
Performance and System Audits	12.0 Performance and System Audits	Generic QAPjP accepted.
Preventive Maintenance	13.1 Field Equipment	Generic QAPjP accepted.
	13.2 Laboratory Equipment	Generic QAPjP accepted.
Specific Routine Procedures Used to Assess Data Precision, Accuracy, Representativeness, and Completeness	14.1 Precision	Generic QAPjP accepted.
	14.2 Accuracy	Generic QAPjP accepted.
	14.3 Sample Representativeness	Generic QAPjP accepted. See also *Note 3*
	14.4 Completeness	Generic QAPjP accepted
Corrective Action	15.1 Overview	Generic QAPjP accepted. Including LANL-ER-QP-01.3Q.
	15.2 Field Correction Action	Generic QAPjP accepted.
	15.3 Laboratory Corrective Action	Generic QAPjP accepted.
Quality Assurance Reports to Management	16.1 Field Quality Assurance Reports to Management	Generic QAPjP accepted. See also *Note 4*
	16.2 Laboratory Quality Assurance Reports to Management	Generic QAPjP accepted.
	16.3 Internal Management Quality Assurance Reports	Generic QAPjP accepted.

Note 1: Section 4.0 Project Organization and Responsibility

The organizational structure of the ER Program is presented in Section 2.0 of the LANL ER Quality Program Plan (QPP) to the Project Leader (PL) level, including quality assurance functions. The OU 1129 Work Plan, Annex I, describes the organizational structure from the PL-level down and presents an organizational chart to demonstrate line authority.

Note 2: Section 6.1 Quality Control Samples

Soil samples for geotechnical analyses will be collected during the OU 1129 RFI. In contrast to samples submitted for chemical analyses, field quality control samples are not routinely associated with geotechnical samples.

Quality control for geotechnical sample-analysis results is prescribed in the specific laboratory procedure. An additional measure of quality control for geotechnical samples is achieved by the collection and submittal to the laboratory of a larger-than-sufficient volume of sample. A large sample volume may provide for reanalysis of an individual sample in the event that results from the initial aliquot did not meet specific method requirements.

Note 3: Section 14.3 Sample Representativeness

The field sampling plans presented in the OU 1129 Work Plan, Chapter 7.0, were developed to meet the sample representativeness criteria described in Subsection 14.3 of the Laboratory ER Program Generic QAPjP (Appendix T of the IWP [LANL 1991, 0553]).

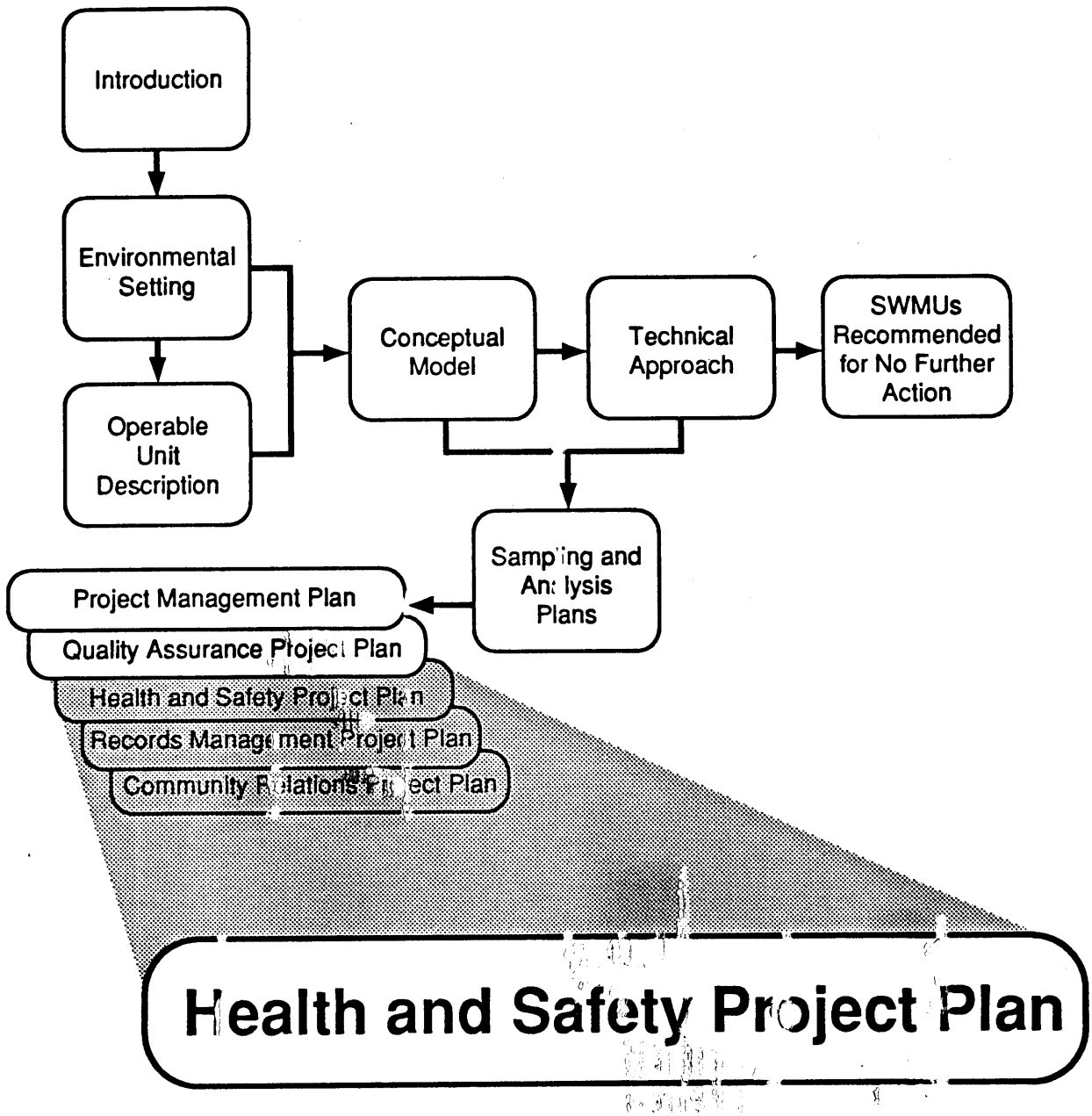
Note 4: Section 16.1 Field Quality Assurance Reports to Management

The OU 1129 Field Teams Leader, or a designee, will provide a monthly field progress report to the Laboratory ER PL. This report will consist of the information identified in Subsection 16.1 of the ER Program Generic QAPjP (Appendix T of the IWP [LANL 1991, 0553]).

REFERENCES

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.

ANNEX III


Introduction
Environmental Setting
Operable Unit Description
Conceptual Model
Technical Approach
SWMUs Recommended for No Further Action
Sampling and Analysis Plans
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 provides the framework within which personnel protection will be provided during the implementation of the Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) at Operable Unit (OU) 1129. Task specific H&S project plans will be prepared before initiating any field task. These plans will spell out the specific measure to be taken for personnel protection during implementation of the task. They will also define individual responsibilities as described in the operable unit H&S Project Plan. Overall H&S policy for the program is provided in Annex III of the Environmental Restoration Installation Work Plan (IWP) (LANL 1991, 0553).

As field investigation progresses, more effective measures for personnel protection than presented here may be identified. Deviations from this H&S Project Plan will be documented in the task-specific plan along with the reasons for the deviation. As changes are required, this plan will be updated.

Implementation of this plan will provide a safe environment for workers because it establishes health and safety procedures and guidelines for activities specified under the sampling and analysis plans (SAPs) for OU 1129 presented in Chapter 7.0. This H&S Project Plan includes an assessment of hazards, provisions for personnel, protection requirements, and emergency response procedures.

This document is based on the H&S Plan in Annex III of the Installation Work Plan (IWP) (LANL 1991, 0553) and the standard operating procedures (SOPs) (LANL 1991, 0411) prepared for the Laboratory; therefore, those documents must accompany the field team during all operations of the sampling phase.

1.2 Organization of the Plan

This plan addresses all aspects of the sampling effort conducted for the RFI. General responsibilities as well as individual roles in the implementation of this H&S Project Plan are designated under the OU Field Work Organization in Section 2.0. The prerequisites for personnel involved in the OU investigation are outlined in Section 3.0. Brief descriptions of the scope of the OU 1129 RFI and the required sampling tasks are reviewed in Section 4.0. The assessment of hazards associated with the sampling tasks and the specific solid waste management units (SWMUs) are summarized in Section 5.0. To determine hazards requiring personnel protection, air monitoring will be performed during the sampling phase of the investigation, as prescribed in Section 6.0. 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 7.0. The delineation of work zones as well as provisions for site control are recommended in Section 8.0. Decontamination procedures for both personnel and equipment are presented in Section 9.0. The emergency response plan and requirements for notification and documentation are included in Section 10.0.

1.3 Basis for the Plan

In addition to the general guidance within the IWP and the SOPs, this plan is based on Laboratory policies, the Laboratory H&S Manual, US Department of Energy (DOE) orders, Occupational Safety and Health Administration (OSHA) regulations, National Institute for Occupational Safety and Health (NIOSH) recommendations (NIOSH et. al. 1985, 0414), American Conference of Governmental Industrial Hygienists (ACGIH) recommendations, US Nuclear Regulatory Commission (NRC) regulations, and U.S. Environmental Protection Agency (EPA) guidance. These regulations and guidelines have been established for the protection of workers on hazardous waste and radiation sites and therefore apply to personnel engaged in the investigation of OU 1129. A listing of requirements governing this H&S Plan is presented in Section 2.0 of the IWP Annex III, H&S Plan.

2.0 OPERABLE UNIT FIELD WORK ORGANIZATION

This section describes general responsibilities for health and safety according to the University of California (UC) Environmental Restoration (ER) Program and the specific responsibilities of individuals implementing this H&S Plan for the OU 1129 investigation. Included in this section is a listing of the roles within the field work organization, an organizational chart, provisions for health and safety audits, and a mechanism for requesting variances from the H&S Plan.

2.1 General Responsibilities

The Laboratory Manual, Chapter 1, Environment, Safety, and Health (ES&H) (LANL 1990, 0335) provides policy for management and employee safety responsibilities and for the safety of contract personnel and visitors. The general safety responsibilities are summarized in Section 5.0 of the IWP, Annex II, H&S Plan. Specific safety responsibilities for personnel involved in this OU investigation are listed in this section.

2.2 Individual Responsibilities

Certain employees and contractors have specific health and safety responsibilities within the line management of the ER Program activities.

2.2.1 Environmental Management and Health and Safety Division Leaders

The Environmental Management (EM) Division Leader is responsible for directing the organization units conducting the ER Program, and the Health and Safety (H&S) Division Leader is responsible for directing the health and safety units under his authority. Both the EM and H&S Division Leaders are responsible for addressing programmatic health and safety concerns. They are also responsible for promoting a comprehensive health and safety program that will include special areas such as radiation protection, occupational medicine, industrial safety, industrial hygiene, criticality safety, waste management, and environmental protection and preservation.

2.2.2 Environmental Restoration Program Group Program Manager

The Environmental Restoration (ER) Program Group (EM-13) Program Manager reports to the EM Division Leader. The ER Program Group Program Manager will:

- ensure that the Laboratory's ER activities are consistent with the goals and objectives of the EM Division Leader, DOE, EPA, NMED, and others, as appropriate;
- ensure compliance with change control procedures;
- evaluate costs, schedules, and performance;
- submit monthly and quarterly reports to DOE, EPA, and NMED;
- track deliverables and milestones established by DOE, EPA, and NMED;
- ensure the establishment and implementation of the quality, health and safety, records management, and community relations programs; and
- ensure that policies, guidance, and relevant information are communicated to ER personnel by
  - periodically conducting meetings,
  - distributing essential guidance memoranda and letters, using a receipt acknowledgment system when necessary,
  - ensuring the preparation and controlled distribution of administrative procedures, and
  - establishing a standard routing system for routine guidance.

2.2.3 Operable Unit Project Leader

The Operable Unit Project Leader (OUPL) reports to the ER Program Group Program Manager. The OU project leader will:

- oversee day-to-day operations, including planning, scheduling, and reporting technical and related administrative activities;
- ensure preparation of planning documents and procedures for scientific investigations;
- prepare monthly and quarterly reports;

- oversee subcontractors, as necessary;
- coordinate with technical team leaders;
- conduct technical reviews of milestones and final reports;
- interface with the UC QPP Leader (QPPL) to resolve quality concerns and to coordinate audits;
- ensure compliance with the ER Program health and safety, community relations, and records management plans; and
- ensure compliance with the technical and QA requirements of the Laboratory's ER Program

2.2.4 Health and Safety/Health Physics Project Leaders

The Health and Safety/Health Physics Project Leaders report to the Health and Safety Division Leaders. The Health and Safety/Health Physics Project Leaders will:

- prepare the ER health and safety program and ensure its implementation;
- review OU-specific health and safety plans prepared by sub-contractor or UC personnel;
- coordinate with Laboratory personnel to use resources as appropriate for the ER health and safety program;
- ensure that the ER Program complies with applicable environmental regulations, DOE orders, Laboratory requirements, and applicable state regulations;
- oversee the maintenance of the health and safety data base for the ER Program in such areas as worker training and medical surveillance; and
- prepare monthly and quarterly reports.

2.2.5 Quality Program Project Leader

The Quality Program Project Leader (QPPL) is responsible for directing and managing the Laboratory's ER quality program. The QPPL operates independently of the cost and schedule of project management. The QPPL is not assigned duties that preclude full attention to QA responsibilities or that conflict with the reporting and resolution of QA issues. The QPPL reports to the ER Program Group Program Manager on day-to-day activities and to the EM deputy division leader when necessary to resolve QA issues. The QPPL will:

- ensure that the adequacy and effectiveness of the ER quality program are evaluated by independent organizations,

- nsure that UC and its subcontractors implement the ER uality program,
- esolve disputes regarding quality,
- ov rsee a QA staff,
- as ist project leaders in the development of QAPjPs,
- revi w and approv all ER QA program and project plans and imp lement procedures,
- ens re that QA aud its are conducted, and
- serve as liaison bet veen the Laboratory's ER QA program and EP A's regional QA office.

2.2.6 Field T am Manager

The Field Team Manager reports to the Operable Unit Project Leader. The Field Team Manger will:

- ove ee day-to-day field operations of all field teams;
- ensure the health and safety of all field team members;
- conduct planning and scheduling for implementation of the RFI field activities for all eld teams; and
- manage and assign work to Field Team Leaders.

2.2.7 Field Team Leader

The Field Team Leader will report to the Field Team Manager. The Field Team Leader is responsible for directing the execution of field sampling activities using crews of Field Team Members appropriate for the activity. The Field Team Leader is responsible for implementing the Sampling and Analysis Plans (SAPs), the Health and Safety Plan (H&S Plan), and the project-specific Quality Assurance Project Plan (QAPjP). Field Team Leaders may be contractors. The Field Team Leader will:

- oversee daily field operations for the Field Team including planning, scheduling, and implementing RFI field activities for the OU 1129 Work Plan;
- assign a Site Safety Officer (SSO) to ensure compliance with the H&S Plan;
- be familiar with emergency response procedures and notification requirements and their implementation;
- act as back-up to the SSO in an emergency; and

- coordinate with Field and Technical Team Members which may include sampling personnel, a Site Safety Officer (SSO), Laboratory personnel, contractors, and staff members with technical knowledge of geology, hydrology, statistics, and other applicable disciplines.

2.2.8 Site Safety Officer

The Site Safety Officer (SSO) reports to the Health and Safety/Health Physics Project Leaders, and acts as a liaison to the Field Team Manager and the Field Team Leader on health and safety issues. The SSO will ensure that the ER Program Work Plan is implemented during the field operations. Each SSO will direct a Field Team Leader in executing site safety procedures. SSOs may be contractors.

The SSO will be trained in first aid procedures and in cardiopulmonary resuscitation (CPR) and will ensure that first aid supplies are available at the site. The SSO will know the location of facilities for emergency medical care, including those for injuries that might involve contamination by radioactive materials or hazardous chemicals. The Site Safety Officer will:

- perform and document initial inspections for all on-site equipment;
- evaluate the potential hazards at a site;
- be informed about the results of sample analysis pertaining to health and safety as the ER site investigation and remediation work progresses;
- concur with the Field Team Leader(s) about the location of exclusion area boundaries;
- present safety briefing to workers;
- determine protective clothing requirements for workers;
- determine personal dosimetry requirements for workers;
- maintain a current list of telephone numbers for emergency situations;
- have an operating radio transmitter/receiver in case telephone service is not available;
- maintain an up-to-date copy of the H&S Plan for work at the site;
- maintain an up to-date copy of the emergency plan and procedures for the site;
- establish the safety requirements to be followed by visitors;
- provide visitors with a safety briefing;

- maintain a logbook of workers and visitors within the exclusion area at a site;
- determine whether workers can perform their job safely under prevailing weather conditions;
- take control of an emergency situation;
- ensure that all personnel have been trained in the appropriate safety procedures and have read and understood this OU H&S Plan, and that all requirements are followed during OU activities;
- conduct daily health and safety briefings for the Field Team Leader(s) and Field Team Members;
- conduct daily health and safety audits of the work activities; and
- have authority and require that field work be terminated if unsafe conditions develop or an imminent hazard is perceived.

2.2.9 Quality Program Liaison

The Quality Program Liaison reports to the Quality Program Project Leader on day-to-day activities. The Quality Program Liaison will ensure that the ER Quality Program, the Generic Quality Assurance Project Plan (QAPjP), and the OU-1129 QAPjP are followed during field operations. Each Quality Program Liaison will act as a liaison between the Field Team Leader and the Quality Program Project Leader when executing site quality procedures. Quality Program Liaisons may be contractors.

2.2.10 Field and Technical Team Members

Field and Technical Team Members report to the Field Team Leaders, Site Safety Officers, and Quality Program Liaisons, as applicable. Field Team Members are responsible for conducting the assigned work in a manner that ensures that the data collected is technically valid and legally defensible. All field teams will have, at a minimum, a Site Safety Officer (SSO) and a qualified field sampler. Teams are responsible for conducting the work detailed in the Sampling and Analysis Plans (SAPs) and are under the direction of the Field Team Leader(s). Field Team members may be contractors.

Technical Team Members are responsible for providing technical input for their discipline throughout the RFI/CMS process. During the OU 1129 RFI, they have participated in the development of the work plan and the sampling and analysis plans (SAPs) and will participate in field work, data analysis, report preparation, work plan modifications, and planning of subsequent investigations as necessary. The primary disciplines currently represented on the OU 1129 technical team are hydrogeology, statistics, geochemistry, and health physics. The composition of the technical team may change with time as the technical expertise needed to implement the OU 1129 RFI changes.

2.3 Health and Safety Audits

Health and safety audits will be performed during activities associated with this plan to ensure compliance with the SOP-02.05, Safety Meetings and Inspections. The frequency of these audits will vary with 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 form. The Site Safety Officer will coordinate with the Field Team Leader to correct any deficiencies. The completed audit form should be retained at the work site and be available for inspection by the Laboratory 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. These check lists are included in ER Program SOP-02.11, Training and Medical Surveillance.

The Laboratory EM and HS divisions may also conduct health and safety audits separately or concurrently with the internal ER audits to ensure compliance with the Laboratory ES&H Manual.

2.4 Variances from Health and Safety Requirements

Where special conditions exist, a written request for a variance from a specific health and safety requirement may be submitted by the Site Safety Officer to the Field Team Leader and the H&S PL. If the Field Team Leader and the H&S PL agree with the request, it will be reviewed by the OU PL or a designee. Higher levels of management may be consulted as appropriate. The H&S PL will evaluate the condition of the request and, if appropriate, grant in writing a variance specifying the conditions under which the requirements may be modified. The variance will become part of this H&S Plan. An example variance log is contained in LANL-ER-SOP-01.04, Sample Control and Field Documentation.

3.0 PERSONNEL PREREQUISITES

This section describes the prerequisites for all personnel involved in site work for OU 1129. Further guidance is provided in Sections 10.0, 11.0, 12.0, and 13.0 of the IWP, Annex III, H&S Plan, and in the ER Program SOP-02.11.

3.1 Training Requirements

The training requirements for ER Program workers at hazardous sites are established in Section 11.0 of the IWP, Annex III, H&S Plan, and in the ER Program SOP-02.11. The requirements include training in health and safety for hazardous waste sites, respiratory protection, radiation safety, and specialized areas such as CPR, first aid, and recognition of high explosive (HE) materials and ordnance.

All site workers must be trained according to Title 29 U.S. Code of Federal Regulations (CFR) Part 1910.120 before their initial assignment to any project. All site workers shall receive a minimum of 40 hours of training off-site and a minimum of 3 days of actual field experience directly managed by a trained, experienced supervisor. Subcontractor personnel must meet the aforementioned training re-

quirements. Field team members, including subcontractors, who are limited to nonhazardous activities must complete 24 hours of off-site training and 8 hours of on-site training.

The on-site Field Team Leader must receive a minimum of 8 hours of additional training on program supervision. Each site worker must receive 8 hours of refresher training annually. A copy of the certificate of training completion shall be maintained with 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 shall also be kept at the job site.

3.2 Employee Medical Surveillance Program

Field team members who are potentially exposed to hazardous materials during ER Program investigations shall participate in a medical surveillance program provided by the Laboratory in accordance with 29 CFR Part 1910.120 and DOE Order 5480.8 (DOE 1987, 0731). According to 29 CFR Part 1910.120, a medical examination is required for all employees who are exposed or potentially exposed to substances at or greater than the established permissible exposure limits (PELs) for more than 30 days per year, for all employees who wear a respirator for 30 days or more per year, and for members of hazardous materials teams. Such examinations must occur

- before initial assignment to establish base-line conditions;
- at least every 12 months;
- at termination of employment or reassignment to an area where the employee would not be covered by an examination within the last 6 months;
- upon notification that the employee has developed signs or symptoms of exposure; and
- upon the exposure of an unprotected employee and in cases where the physician recommends a specific schedule for examination (suitability of field team members for conducting field sampling activities, including respirator use, shall be evaluated and documented by a physician).

Further details of the medical surveillance program are provided in Section 12.0 of the IWP, Annex III, H&S Plan, and in ER Program SOP-02.11. In addition, the program must comply with Laboratory Administrative Requirement (AR) 2-1, Occupational Medicine Program; AR 3-6, Biological Monitoring for Radioactive Materials; 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 per the requirements in Section 13.1 of the IWP, Annex III, H&S Plan. Because of their confidential nature, the Laboratory's Occupational Medicine Group (HS-2) will

maintain medical records. The Laboratory Training Office (LTO) within the Human Resources Division (HRD) will maintain training records. In addition, DOE Order 5484.1, "Environmental Protection Safety and Health Protection Information Reporting Requirements" (DOE 1990, 0733) and DOE form F 5484.7, "Annual Summary Exposures Resulting in Internal Body Depositions of Radioactive Materials," will be submitted by March 31 for monitored employees. Preparation of these reports will be coordinated with the Laboratory HS-1, the Health Physics Operations Group. Reporting requirements for injuries, exposures, accidents, releases, and unplanned occurrences will be addressed in Section 10.0 of this H&S Plan.

4.0 SCOPE OF WORK

This section describes the SWMUs within OU 1129 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 within OU 1129. This determination includes the identification of source points and environmental receptors associated with each SWMU. The tasks and activities within the sampling phase are described in the SAPs, Chapter 7.0. The H&S Plan will establish procedures for performing activities in a safe manner.

4.2 OU Description

As described in Chapter 2.0, OU 1129 consists of Technical Areas (TAs) -4, -5, -35, -42, -48, -52, -55, -63, and -66. The SWMUs within OU 1129 are either located inside or outside of current or former TA boundaries. The SWMUs represent a wide range of locations and potential contaminants that must be considered in the H&S Plan. Property on which OU 1129 SWMUs are located is owned by DOE. Potential waste materials in these areas include radioactive materials, sanitary wastes, HE, building debris, municipal and laboratory wastes, waste oil and fuels, solvents, incinerator ash, asphalt-manufacturing products, acids, polychlorinated biphenyls (PCBs), and unknown wastes. Parts of this H&S Plan are generic to the ER Program, but guidance will be provided to address the hazards specific to the potential contaminants, localities, and tasks for OU 1129.

4.2.1 SWMU Sampling Locations

The sampling locations for the OU 1129 SWMUs are specified in the SAPs, Chapter 7.0.

4.2.2 Topographical Considerations

The environmental setting for OU 1129 is described in Chapter 2.0. Because some of the SWMUs are located near the edges of mesas, in canyons, or on canyon shelves, accessibility and logistics will be difficult. These activities will require special precautions as outlined in Chapter 7.0 of this H&S Plan.

4.2.3 Meteorological Considerations

The climatology of Los Alamos County is reviewed in Section 2.1.3 of Chapter 2. Because of the semiarid, mountain climate in Los Alamos, the field teams must prepare for a wide variety of weather conditions during sampling excursions. Field team members may experience heat stress, cold stress, and exposure to lightning and slippery surfaces. These hazards and the equipment necessary to minimize them are addressed in Section 7 of this H&S Plan.

4.3 Description of Tasks

Various tasks may be performed to characterize the nature and extent of contamination. These tasks can be separated into three categories:

- Field Surveys may include radiological and nonradiological surveys to perform preliminary site characterization, and geophysical surveys to assist in locating subsurface structures or features that may influence the interpretation of hazardous-waste site characterization.

- Surface Sampling may include collection of soil/rock and sediment samples to characterize on-site contamination. These samples will be collected from the first 12 in. of soil from locations within the SWMUs such as impoundments, outfall points, drainage areas, and sediment traps.

- Subsurface Sampling may consist of collecting soil and groundwater with the installation of soil borings and monitoring wells; sampling beneath drainlines, storm sewers, underground storage tanks (USTs), septic tanks, and sumps; and coring and trenching. Each task is analyzed for its specific hazards and associated protective measures in Sections 5.0, 6.0, and 7.0 of this H&S Plan.

5.0 HAZARD ASSESSMENT

This section presents potential hazards that may be encountered by site workers. The tasks and activities scheduled for OU 1129 will be analyzed with respect to these hazards.

5.1 Types of Hazards

The types of hazards that may be encountered during work in OU 1129 are discussed in the following paragraphs.

5.1.1 Oxygen Deficiency

The oxygen content of normal atmospheres is approximately 21 percent by volume. Oxygen-deficient atmospheres are defined in 29 CFR Part 1910.120 as atmo-

spheres in which the percentage of oxygen per volume is less than 19.5 percent. As the percentage of oxygen approaches a deficient level, workers exhibit symptoms of oxygen deprivation that include impairment of attention, coordination, and judgement as well as an increase in breathing and heart rate.

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 1129 will be conducted outdoors, oxygen-deficient atmospheres are not expected. However, the field team must 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/Flammability

The following potential sources of explosive or flammable hazards within OU 1129 are:

- disturbance of HE, ordnance, shock-sensitive, or friction-sensitive compounds;
- ignition of explosive or flammable chemicals;
- ignition of materials due to oxygen enrichment;
- sudden release of materials under pressure; and
- chemical reactivity that may result in explosions, fires, or heat.

These conditions may result in hazards of intense heat, open flame, smoke inhalation, flying debris, and the release of toxic chemicals. Field team members must be aware of materials specific to each SWMU that may contribute to the aforementioned conditions.

Each explosive or flammable gas or vapor has a range of concentrations at which it 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 members must be aware of any areas in which radiological hazards exist. The presence of radiological wastes has been documented or is suspected based on historical evidence from several SWMUs in OU 1129 (See Chapter 3).

The primary pathways by which field team members may be exposed to radiological hazards during sampling are the following:

- inhalation of contaminated particulates or 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.

5.1.4 Toxicological Hazards

Exposure to toxic chemicals can result in a wide range of adverse effects dependent upon 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 1129 indicates the presence of chemical wastes in several of the SWMUs. Types of potential toxicological wastes include radioactive waste, sanitary waste, municipal waste, laboratory waste, HE waste, building debris, waste oil and fuels, solvents, incinerator ash, asphalt, acids, PCBs, and unknown waste products. The primary pathways for chemical exposure include the following:

- inhalation of toxic gases, vapors, or contaminated particulates;
- inadvertent ingestion of contaminated materials;
- dermal absorption through contact with vapors, contaminated liquids, or contaminated particulates through wounds and broken skin; and
- injection of contaminated liquids or contaminated particulates through puncture wounds.

Information for known contaminants includes Published Exposure Limits (PELs) and symptoms of exposure. The published exposure limits consist of the PELs established by OSHA in 29 CFR Part 1910.120, Subpart Z (OSHA 1991, 0610); the Recommended Exposure Limits (RELs) set forth by NIOSH in NIOSH Recommendations for Occupational Health Standards (1986); and the Threshold Limit Values (TLVs) developed by the ACGIH in Threshold Limit Values and Biological Exposure Indices for 1990-91.

TLVs 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 upon the best available information from industrial experience and animal or 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. Policy has been to use these TLVs as base guidelines for good hygienic practices; however, whenever applicable, strict 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 (TWA) concentration for a normal 8-hr. workday and a 40-hr workweek. Several chemical substances have short-term exposure limits (STELs) 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 STEL is defined by ACGIH and OSHA as a 15-min. TWA exposure that should not be exceeded within a 2-hr. period during a workday, even if the 8-hr. TWA is within applicable limits. OSHA requires that the 15-min. ceiling concentration never be exceeded for a particular chemical constituent. This notation appears as 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 airborne or direct contact. Little quantitative data are available describing 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, toxicology 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, timely risk management decisions on the results of such information is often impossible. Two categories of carcinogens are designated on the basis of the most current literature and information. These include confirmed human carcinogens and suspected human carcinogens. These chemical categories are derived from either limited epidemiologic studies and clinical reports of single exposure, or through test methods in one or more animal species. The worker potentially exposed to a known human carcinogen 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 will depend upon the chemical and the conditions of exposure. Any adverse physiological reaction should be considered extremely serious and reported to the Field Team Leader 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 can range from skin or eye irritation to severe burns. Corrosives may 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/gas clouds, splashing of contaminated liquids, or contact with contaminated soils/sludges.

5.1.6 Biological Hazards

Field team members are likely to encounter biological hazards in some areas of OU 1129. Evidence indicates that sanitary waste was discharged through septic tanks and outfalls into OU 1129. Contact with reptiles, animals, and insects such as rattlesnakes, rodents, mosquitoes, ticks, spiders, and fleas may be hazardous. Infectious agents that can be transmitted as a result of abrasions or puncture wounds from objects such as broken glass, scrap metal, and other debris may also be hazardous. Field team members must also be aware of hazardous biological agents contracted through unhygienic practices such as failing to sanitize respirators, or drinking and eating on site.

5.1.7 Physical Hazards

OU 1129 sampling activities may present a number of potential physical hazards including the following:

- 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
- materials handling
- temperature extremes
- excavations
- underground hazards
- traffic
- compressed gases and systems
- breaking concrete
- topography
- lightning

5.1.7.1 General Physical Exposures

Field team members will handle a variety of chemicals/materials during the project. The primary physical exposures will be acids, caustics, and various effluent waste streams that may contain petroleum or solvent sludge. Field team members may be exposed to these materials through inhalation, skin absorption, and ingestion. Physical hazards also include personnel encounters with energized or 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 decibels (dB). 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 unfavorable natural ventilation. Sampling activities may require personnel 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 CPR must be administered.

The effects of electric shock on the human body are as follows:

- 1 milliampere—barely perceptible—no real danger
- 3 to 9 milliamperes—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 milliamperes—may cause involuntary muscular reactions, or possible respiratory paralysis
- 75 milliamperes to 4 amperes—possible fibrillation (ineffective, erratic pumping of the heart)

- 4 amperes or greater—can cause immediate cardiac arrest (heart stoppage)

Shock from high-voltage/current sources can also cause severe external and internal burns. A potential ignition source from sparking electrical contacts exists.

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, cutting, or puncturing. 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 present ignition and airborne contaminant sources. Cutting equipment and compressed-gas cylinders present potential physical, electrical, and flammable hazards such as welding flash and welding burns.

5.1.7.8 Materials Handling

Manual material handling 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, leading to punctures and cuts. Binding 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. Such conditions could potentially create heat or cold stress for personnel. The following are heat-related problems:

- HEAT RASH causes irritation and decreases a person's ability to tolerate heat. It is aggravated by chafing clothing.
- HEAT CRAMPS are caused by a chemical electrolyte imbalance brought on by profuse perspiration combined with inadequate water intake. This results in muscle spasm and pain in the extremities and abdomen.
- HEAT EXHAUSTION occurs when stress on various organs to meet increasing demands to cool the body results in shallow breathing, pale, cool, moist skin, profuse sweating, dizziness and lassitude.

- HEAT STROKE 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.

The following are cold-related problems:

- FROST BITE is characterized by pain, reddening of tissue, loss of dexterity, and tingling or lack of sensation in the affected extremities.

- HYPOTHERMIA 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

Excavation will take place at some of the SWMUs. These excavations will provide access to spaces for soil and water sampling. The hazards of these operations go beyond excavation to include the potential for direct or airborne contact with site contaminants.

Personnel may have to enter an excavation to adequately collect samples. Excavations pose a significant threat to employees if they are not carefully controlled. An improperly dug or 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 are encountered during drilling or excavation. These structures include gas utilities, power lines, product lines, concrete vaults, tanks, etc. Encountering these structures creates the potential for electrocution, explosion, spill/release, or other injuries to the crew.

5.1.7.12 Traffic

The possibility of vehicle-related injury or accident is inherent to all aspects of field work. Vehicle-related accidents may occur during travel to or from the site as well as during on-site activities. The latter will be a major factor given the fairly continuous Laboratory activities and the use of heavy equipment during several of the planned work tasks. Additionally, work may take place in or near areas where there is heavy vehicle traffic.

5.1.7.13 Compressed Gases and Systems

This section covers compressed-gas cylinders and systems such as compressors. The following hazards may be present:

- flying objects such as dust, dirt discharged from a cylinder-valve opening, or a whipping compressor hose;
- explosion/fire from a leaking system; or
- a damaged cylinder valve resulting in the cylinder becoming a missile.

5.1.7.14 Breaking Concrete

Accessing sampling areas will sometimes require breaking through a concrete pad. During this operation the following hazards may be present:

- possible increase in airborne concentration of site contaminants, particularly if the ground below is heavily saturated
- dust exposure from concrete saw use
- 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 slip, trip, and fall hazards in OU 1129 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 a flash are other examples. Field personnel hit by lightning will almost certainly be severely injured or killed. Lightning is a significant hazard at the Laboratory during the summer months.

5.2 Task-Specific Hazard Assessment

Three major sampling tasks will be conducted during this sampling effort. Under each of these tasks are various activities that will be performed depending on which SWMU is being investigated. The details for the tasks are described in the SAPs, Chapter 7. Potential hazards associated with the tasks are evaluated in the following text. Protective measures to be employed during the tasks are outlined in Section 7.0 of this H&S Plan.

5.2.1 Field Surveys

Field surveys are relatively low-risk activities. Oxygen-deficient and flammable hazards are not anticipated during these surveys, although field team members should be aware of the potential for such hazards in low-lying areas. It is possible that field team members may encounter radiation and chemical hazards through contact with contaminated surface soil/dust or inhalation of dust. Biological hazards may be encountered through poisonous or infectious agents and unhygienic practices. Physical hazards include the potential for slips, trips, and falls during surveying of uneven terrain or at the edges of a mesa. Field team members should be aware of the potential for heat and cold stress if they are working outdoors for a prolonged time. Survey personnel should also be cognizant of the possibility of lightning strikes.

Drilling through asphalt or concrete may be necessary at some sampling locations. Potentially contaminated soil will be disturbed and the likelihood of exposure to the soil through drilling is greater due to the generation of soil cuttings. Contact with soil dust and inhalation hazards for dust is possible. The potential for encountering UXO and ordnance exists with either technique. 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 pinch points.

5.2.2 Surface Sampling

The surface sampling program may consist of soil/rock or sediment sample collection from the first 12 in. of soil.

Surface sampling of soil/rock and sediment is typically a low-risk activity. Oxygen deficiency and explosive or flammable vapor/gas hazards will generally not be a problem unless the sampling point is in a low-lying area where gases or vapors can accumulate. Radiological and chemical contaminants may be present in the top 12 in. of soil or rock. Dermal contact with contaminated soil, sediment, and dust, and inhalation of dust are possible. Field team members will exercise caution toward 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

Subsurface sampling may consist of soil and groundwater sample collection from below the 12-in. level including the installation of soil borings and monitoring wells.

Subsurface sampling activities involving drain line and storm sewers, as well as USTs, septic tanks, and trenches may be associated with oxygen-deficient atmospheres. All of the operations may result in explosive/flammable conditions due to the potential for contamination by solvents, gasoline, and fuels. Drilling and excavation activities may enhance volatilization of these materials as well as contact with HE or ordnance. The potential for the accumulation of explosive/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 operation is the release of contents under pressure.

Because of the history of radionuclide and chemical disposal in the OU 1129 SWMUs, 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, sediment, and groundwater samples may contain high concentrations of contaminants. A related problem is the potential for corrosive hazards that may have resulted from disposal of acids in some of the SWMUs. The primary exposure pathways involve potential contact with contaminated soil, sediment, dust, or waste inhalation of contaminated dust and volatiles arising from disturbing the soil during drilling, backhoeing, and excavating and contact with contaminated groundwater through splashing or spraying.

Biological hazards also pose a potential hazard for all of the activities under this task. These include contact with animals or insects, infectious agents, and infectious waste.

The use of drill rigs and backhoes presents possible physical hazards because of the noise, pinch points, and failure of safety systems. Overhead/underground utilities must be located in advance of such operations. Other electrical hazards may involve short circuits within equipment or 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. In addition, excavated areas and trenches may collapse if they are not properly protected.

6.0 AIR-MONITORING PROGRAM

In accordance with 29 CFR Part 1910.120, an air-monitoring program will be implemented during the sampling activities under this Work Plan. The objectives of the air-monitoring program will be to identify and quantify airborne levels of hazardous substances 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 the 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 (i.e., monitoring volatile materials at a soil boring versus at a drum opening); and
- working with leaking drums, containers, or areas with obvious liquid contamination.

Instrument readings should be obtained at ground, waist, and head levels as a representation of ambient air. Applicable measurements will also be made in enclosed spaces and within boreholes, well heads, and drum openings.

This section provides a brief description of the monitoring equipment that may be used to detect various airborne hazards as well as the action level that will be observed during work in OU 1129. The subsections are listed in the order of the most immediate hazards. Additional guidance is available in Sections 8.0 and 9.0 of the IWP, Annex VI, H &S Plan. Operating procedures for the instruments are in the ER Program Section 10 SOPs for Combustible Gas Level, photoionization detectors (PIDs), flame ionization detectors (FIDs), radiation survey meters, and Draeger tubes.

6.1 Oxygen Deficiency

An oxygen indicator will be used to measure oxygen levels to detect oxygen-deficient conditions in confined spaces, low-lying areas, or in spaces that are not ventilated frequently. The action level for oxygen is 19.5 percent. At levels below 19.5 percent, the area must be evacuated and the area ventilated. In addition, oxygen-rich atmospheres create an increased potential for fires; therefore, the area will also be evacuated if levels exceed 25 percent. If evacuation is necessary, the area will be ventilated and the Site Safety Officer will continue monitoring the oxygen levels.

6.2 Explosivity/Flammability

A combustible gas indicator (CGI) will be used to monitor for explosive or flammable atmospheres. The presence of residual flammable/combustible liquids, such as gasoline or solvents, is possible at several SWMU's in OU 1129. The potential for explosion or fire occurs during drilling or trenching. Field team members should also be cautious in enclosed areas where flammable/combustible gases could collect. Because some SWMUs may contain unknown flammable constituents, combustible gas monitoring should be performed. The action level for explosive/flammable gases is 20 percent of the lower explosive limit (LEL). 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 removal of ignition sources and ventilation of the area) will be implemented. The Site Safety Officer will obtain continuous CGI readings. Because CGI instruments will not detect the presence of HE or ordnance, appropriately trained personnel will need to screen these hazards.

6.3 Radiological Hazards

A variety of radiation detectors and other equipment will be used to determine the extent of radiological hazards. These instruments are discussed in the SAP. 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 for the emissions. This monitoring program will comply with the requirements of DOE-AL Order 5480.1A, Chapter XI (DOE/AL 1982, 0792). 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 Standard Safety Operating Guides (EPA 1988). 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 (TLDs); radiation exposures will be as low as reasonably achievable (ALARA) according to 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. While some of these instruments can be calibrated to identify and quantify a particular substance, the field team will most likely encounter mixtures of substances within 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 or laboratory analysis can be employed for qualitative and quantitative purposes.

6.4.1 PID

A PID is a portable, nonspecific vapor/gas detector that uses a source of ultraviolet radiation to ionize chemical constituents. The PID is capable of detecting a variety of organic and inorganic chemicals dependent upon the chemical-specific ionization potential (IP) of each constituent.

For most SWMUs, the PID will be used as a survey tool to indicate total volatile organics/inorganics in air. The data will be used to indicate possible "hot spots" on the site, to monitor operations such as borehole drilling, 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 cited in Section 9.1 of the IWP, Annex III, H&S Plan.

In cases where a single constituent has been identified at a SWMU, the PID 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 response to the chemical of interest compared with the instrument 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 that particular chemical.

6.4.2 FID

An FID ionizes organic materials by means of a hydrogen flame. This instrument is capable of detecting a wide range of organic constituents, including methane. As in the case of the PID, the relative response factor for suspected contaminants is useful information to know. An FID can be used in both the survey or the quantitative mode.

6.4.3 Colorimetric Tubes

A colorimetric tube is a glass tube that is typically packed with reagent within which a chemical gas is impregnated. 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 such that the length of the stain corresponds to an approximate concentration. These tubes may be used in cases where a chemical has been suggested by the site history or identified by other means. Colorimetric tubes are especially useful for chemicals that are not easily detected by PID or FID, such as cyanides or carbon monoxide. One type of colorimetric tube is the Draeger tube, which is discussed in ER Program SOP-06.20, Draeger Tubes.

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 (MOS). This detector is typically used for inorganic gases that are toxic at relatively low concentrations and cannot be reliably detected by other means. Because of the historical evidence at some of the SWMUs, specific detectors will be used for hydrogen cyanide. Electrochemical gas monitors will be employed by the sampling crew during drilling and excavation activities. They are set to give an audible alarm at the PEL 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 mg/m^3. The measurements are useful if there are known concentrations of radionuclides, metals, PCBs, or 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 ambient air-monitoring results. Monitors will be provided to members whose job functions make them likely to receive the highest doses. TLDs 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 the course of the sampling efforts.

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 for site workers to be used during the OU 1129 investigation. These controls are categorized as engineering-control work practices and PPE.

OSHA regulations state that, wherever feasible, engineering controls and work practices shall be instituted to reduce employee exposure below the PEL and maintain it there. Engineering controls are mechanical means for reducing the hazards to workers; work practices are administrative controls for minimizing field team member exposure. If engineering controls and work practices are not successful in bringing exposure below permissible limits, PPE must be used. The OU 1129 investigation will employ a combination of these controls.

7.1 Engineering Controls/Work Practices

7.1.1 Oxygen Deficiency

Oxygen deficiency is defined as an atmosphere in which the percentage of oxygen by volume is less than 19.5 percent. Field team members will not be permitted to work in oxygen-deficient atmospheres. The most common means of restoring normal oxygen levels is ventilation. Ventilation can be achieved and maintained mechanically or naturally. Because of logistics in the field, mechanical devices may be difficult to use. Natural ventilation is effective but depends on current wind conditions.

7.1.2 Fire/Explosion Hazards

Explosive or flammable atmospheres are defined as atmospheres in which the concentration of combustible vapors is greater than 20 percent of the LEL. Site workers will not be permitted to work in any area where this condition exists. Ventilation can be used to reduce the concentrations of explosive/flammable gases and will be used at OU 1129 wherever possible.

An additional means of preventing explosion or fire is to ensure that no ignition sources are on 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 a drum opening, 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 the Laboratory AP G-5, Flammable and Combustible Liquids; and in TES 601, Flammable Liquids; 602, Flammable Gases; 603, Solvents; and 604, Epoxies. The ER program SOP-10.06, Health and Safety Monitoring of Combustible Gas Levels, will also be followed. Section 9.4 of the IWP, Annex III, H&S Plan, requires a fire and explosion prevention and control program at sites with flammable and reactive materials.

Air-monitoring equipment will not detect the presence of HE or ordnance. According to Section 9.4 of the IWP, Annex III, H&S Plan, all field activities in areas potentially contaminated with HE and/or ordnance will be reviewed by UC explosives safety personnel.

7.1.3 Radiation Hazards

In any ER Program work involving areas of known or potential radioactive contamination, the OU PL and the Site Safety Officer must prepare a work request specific to the site and submit it to HS-1, for review. The description of this work request appears in ER Program SOP-02.01, Personal Protective Equipment. If work is approved, HS-1 will issue a special work permit for radioactive work. The OU PL must obtain this permit before initiating work on 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. According to Section 8.0 of the IWP, Annex III, H&S 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 1 (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, C609). 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.

Methods for shielding field team members from radiation are not feasible for the OU 1129 investigations. The most effective means of protecting individuals from contamination are preventing contact with contaminated materials and controlling contaminated dust. Thorough monitoring and decontamination procedures are key components in reducing radiation hazards.

7.1.4 Chemical Hazards

Chemical hazards are to be monitored during the performance of duties in contaminated zones. If concentrations of toxic materials exceed the action limit (which is one-half the PEL or TLV), personnel shall be removed from the area until natural or mechanical ventilation reduces the levels to background values.
Airborne dust or particulates pose two problems: nuisance dust for which standards have been established at 10 mg/m^3, and the adsorption of hazardous substances on soil particles. During drilling or other activities that may generate dust, water can be sprayed in the area to suppress the dust. The effectiveness of dust control measures will depend on the size of the area to be sprayed and the rate of

evaporation of the water. Frequent applications may be required to achieve optimal results.

7.1.5 Corrosive Hazards

The most effective means of controlling exposure to corrosive hazards is to avoid contact with these materials. Although neutralization is an ideal remedy for reducing the hazard, the choice of a neutralizing agent will depend on the corrosive substances. Because corrosive materials in OU 1129 are likely to be unknown, engineering controls for corrosive materials are very limited.

7.1.6 Biological Hazards

7.1.6.1 Animals/Insects

Site workers may be exposed to a variety of snakes, insects, and rodents. For example, rattlesnakes may be encountered in some of the high grasses in areas near the mesas, outfalls, and sewage treatment plants. Site workers should avoid high grasses as much as possible. If field team members need access to these areas, workers will 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 grass 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, and both the victim and rodent 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 cleared in the appropriate fashion.

Poison Ivy (Toxicodendron radicans)

Poison ivy contains a toxic oil (urushic) that causes painful swelling and eruptions on the skin with external contact. Sensitivity varies between people. Cases of severe contact and 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 that have distinct, irregularly sized teeth along the margins. The leaf shape may resemble box elder, a common tree in the canyon near Los Alamos. The plant bares white or yellowish white berries.

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 mountainous areas, including the mountains of northern New Mexico, in pinon juniper woodlands or pine forests. It is a small plant, typically less than 2 ft in height, and resembles a wild onion in that the 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.

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 hemlocks are found in wet ground and along streams. They are tall plants (to 6 ft) with longitudinal ribs on the stem. The leaves are one- to three-times pinnately divided. The leaflets are coarsely toothed, with the lateral veins ending 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).

Poison Hemlock (Conium maculatum)

Poison hemlock is highly toxic when ingested. As with water hemlock, suspected poisoning should receive immediate medical attention. Ingestion of water hemlock or poison hemlock is often the result of misidentification with the many edible members of the same plant 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 appear somewhat similar to celery leaves. The small white flowers are arranged in umbels at the top of the plant and 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 and will determine the necessity for tetanus inoculation.

7.1.6.4 Hygienic Practices

Because the disposal of biological wastes in OU 1129 is suspected, contact with potentially contaminated materials will be avoided. Hygienic practices will be observed on site at all times. Eating, drinking, smoking, and chewing gum or tobacco will be prohibited on site. The hands and face must be washed upon leaving a contaminated area as well as before drinking, eating, or smoking. These practices are consistent with Section 9.4 of the IWP, Annex III, H&S 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 Plan.

7.1.7.1 General Physical Exposures

Failure of field project management staff and site workers to recognize, evaluate, and control site hazards can result in exposure to contaminants by means of skin contact or inhalation; burns; blow outs; slips, trips, and falls; and other hazards. A goal of zero on-site personnel exposures to physical hazards will be targeted.

Pinch points are associated with activities using equipment with 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 or entanglement is reduced by installing guards to shield moving parts. Field team members must ensure that the guards are in place before operation. If guards have been broken, worn, or removed, the tool or equipment should be tagged and remain out of service until the guard has been replaced. The Site Safety Officer will be responsible for maintaining a checklist for inspection purposes. OSHA requires most equipment to be inspected annually. This inspection is typically conducted by the manufacturer, representative, or dealer. Documentation of these inspections must accompany the equipment at all times.

Potential employee physical exposures shall be identified and evaluated for consistency with Laboratory and OSHA requirements. Physical exposures shall be reduced to an acceptable level through engineering and work-practice controls to the extent feasible. Additionally, personnel shall be properly protected in a manner consistent with Laboratory and OSHA requirements concerning PPE. PPE shall be provided to effectively eliminate the potential for skin contact and reduce potential inhalation to less than the PEL.

The minimum protection for any person who may come on the job site is as follows:

- 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 (i.e., residue), and cotton gloves when performing manual tasks such as loading/unloading supplies or handling/moving equipment and materials; and

- steel-toed safety shoes either of leather or a chemical-resistant material.

All field team members shall work together to establish and maintain site control. Field management should prohibit entry to the work area to personnel who lack the minimum acceptable training and medical and safety equipment as specified in the ER Program SOP-02.11.

Chemical and physical hazards associated with this project shall be eliminated as much as possible by engineering controls before work activities begin. These controls shall 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 shall 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. Where possible, all field team members shall recognize, evaluate, and control physical hazards.

7.1.7.2 Noise

Hearing protection shall be worn in areas where noise levels are suspected or shown to exceed 85 dBA. Field management will be responsible for identifying areas with high noise levels (continuous or intermittent) and on-site personnel shall wear hearing protection devices in these areas as required. Warning signs shall be posted.

7.1.7.3 Working in Confined Spaces

All systems to be entered shall be locked out/tagged out and electrically and/or mechanically de-energized, lines entering and leaving shall be broken/blanked off, and appropriate signs and personnel (safety watch) shall be posted before any entry is made.

All workers entering confined spaces shall have received training in confined space procedures before entry is made. The space shall be evaluated and cleared by a designated "qualified person." The "qualified person" shall have had training in confined space procedures, supervised field training in the evaluation of confined spaces, and experience in conducting confined space evaluations.

An initial hazard assessment shall be conducted that includes atmospheric testing for oxygen deficiency, flammable gas concentration, toxic contaminants, and physical hazards. No entry will be made unless the oxygen concentration is between 20 and 22 percent, the flammable gas concentration is less than 10 percent of the LEL, the toxic contaminants concentrations are less than half of the PEL, and physical hazards are controlled by engineering or administrative methods or by PP

Communication procedures shall be established and reviewed between persons entering the space and the outside standby crew member before entry. A tailgate safety meeting with all crew members shall 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 shall be Underwriters Laboratory (UL) approved for the potential hazards existing at the location the equipment is to be used. Electric tools and equipment shall be double insulated. All electrical connections shall be made through a ground fault circuit interrupter (GFCI). Fire extinguishers shall be kept in sufficient number and locations to allow on-site personnel to extinguish all fires.

Each electrical connection or electric wire shall 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 shall be protected from damage by routing them overhead and away from traffic areas. Electric tools and equipment shall 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 from overhead and underground utilities, use of portable equipment, and digging or hand auguring into underground utilities. Guidance for electrical shock hazards is available in ER Program SOP 04.01 Drilling Methods and Drill Site Management. In addition, the following practices will also decrease the potential for shock:

- only qualified and licensed personnel will be permitted to operate this 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 distance from overhead power lines; and 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 utilities manager before drilling activities begin;
- any cord with the grounding stem removed will be taken out of service and repaired or discarded; and
- GFCIs will be used on all portable electrical equipment.

7.1.7.5 Working around Heavy Equipment and Machinery

All heavy equipment shall have a functioning back-up alarm. This alarm 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 equipment in stationary operation should be barricaded at a distance from ground personnel sufficient to avoid swinging cabs, counter weights, and booms.

The number of passengers shall not exceed the number of functional seat belts available. Seat belts shall be used at all times. Personnel shall not ride on/in vehicles or equipment in a manner not designated for the conveyance of people. All equipment shall be used in the manner for which it was intended. Drivers shall operate the equipment in accordance with the manufacturer's instructions and in adherence to federal, state, and local regulations.

Weights for all items lifted shall be calculated before lifting. The boom angle, cable, and auxiliary lines will be determined to have a rated load margin of at least 20 percent greater than the weight of any lift. All rigging material used for a particular lift will represent a 50 percent margin of lift capability greater than the weight of the particular load.

Signaling the operator of a crane shall be accomplished by means of hand signals rather than radio. All heavy equipment shall 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 shall be kept sufficiently clean and orderly so that work activities can proceed in an efficient and safe manner that will produce and maintain safety and quality. They shall be adequately lighted, ventilated, protected, and accessible as appropriate for the work being performed. Machinery and equipment shall be arranged and stored to permit safe, efficient work activities and to provide ease in cleaning. Tools and accessories shall be safely stored out of traffic areas.

Sufficient waste containers and receptacles shall be provided in appropriate locations and emptied frequently and regularly. Work areas and floors shall be maintained free of debris, obstructions, foreign materials, or slippery substances such as oil, water, and grease.

Aisles, traffic areas, and exits shall be maintained free of materials and debris. Combustible materials shall be stored in approved containers and disposed of properly. Waste rags shall be stored in metal containers. All flammable liquids shall be stored in safety cans. Dangerous materials shall be stored outside of the work area.

Site workers are held accountable for keeping their work areas free of housekeeping hazards.

7.1.7.7 Using Mechanical and Flame Cutting Equipment

Cutting, welding, or similar operations that produce heat, sparks, or open flames shall be sufficiently isolated from any potential combustible source. The area surrounding the activity shall be inspected to ensure that no combustible materials are close by, or if they are close by and they are impractical to remove that they are shielded or otherwise protected.

Oil- and grease-free clothing shall cover the entire body. Flame-retardant/resistant aprons, vests, leggings, capes, and gauntlet gloves shall be worn as appropriate. Collars and cuffs of shirts and jackets shall be buttoned and pants cuffs turned up inside. Pockets should be eliminated or have button flaps. Welding helmets shall have the proper shade of welding lens. Safety goggles or spectacles with tinted lenses shall be worn under the welding helmet.

Sufficient ventilation shall be provided in the welding or cutting area. Shields shall be placed to protect others from welding arc rays. A fire extinguisher shall be assigned to the welding area.

7.1.7.8 Materials Handling

Gloves should be worn whenever material is lifted. Two or more workers may be required to lift a heavy or bulky item. 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 the item is set down. Material must be transported and stored in a stable manner to prevent falls, rolls, or slips. Material should be lifted with the legs and not the back. The movement of a long object must be controlled when it is carried through congested areas, on stairways, in passageways, or around blind corners. Pinchpoints should be avoided.
Whenever practical, a heavy item 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 should be provided.

In the winter, personnel must be protected from the effects of cold temperatures and wind, as well as from becoming wet during field operations.

The field management staff shall evaluate personnel and operations throughout each day for impact of exposure to the elements. Special care shall 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 from sweating; therefore, employees must be encouraged to drink more than

the amount required to satisfy thirst. Thirst satisfaction is not an accurate indicator of adequate salt and fluid replacement. Replacement fluids can be a 0.1% salt water solution. Commercial fluid- and nutrient-replacement beverages are also effective.

- Establishing a work regimen that will provide adequate rest periods for cooling down. This may require additional shifts for workers.

- Using cooling devices, such as Vortex tubes or cooling vests, that are worn beneath protective garments.

- Informing all employees of the importance of adequate rest, acclimation, and proper diet in the prevention of heat stress. All breaks are to be taken in a cool rest area (77° Fahrenheit [F] is best).

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, remove the patient to a warm, dry place and replace any wet clothing. If the patient is conscious and alert, gradually give the patient warm liquids, but no caffeine. Warm the patient's affected extremities with moist, lukewarm compresses; gradually increase the patient's temperature until normal circulation and temperature return. Seek medical attention for all but minor cold-stress cases.

7.1.7.10 Excavations

All excavations shall be performed from a stable ground position. Daily inspections of the excavation shall be made by a person trained in excavation safety. The inspector shall determine the likelihood of cave-in and remedial action, such as sloping or shoring, shall be taken if the walls appear unstable.

All spoil shall be at least 2 ft from the edge of the excavation to prevent its falling back into the excavation. The excavation shall be guarded on all sides by barricades or caution tape at least 2 ft from the edges.

All field team members shall participate in the Daily Tailgate Safety Meetings and be instructed on the following requirements:

- Before excavating, the existence and location of underground pipes, electrical equipment, and gas lines will be determined. This will be done, if possible, by contacting the appropriate utility company and/or client representative to mark the location of the lines. If the client'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 are permitted if the ambient airborne concentration of flammable vapors exceeds 10% of the LEL during the excavation. A combustible gas indicator will be used to make this determination.

- Operations must be suspended and the area vented if the airborne flammable concentration reaches 10%of the LEL in the area of an ignition source (i.e., internal combustion engine, exhaust pipe).

- If excavating equipment is located near overhead power lines, a 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 shall be 20 ft.

Trenches within the OU 1129 SWMUs must be excavated to a depth of less than 5 ft whenever possible; trenches with depths greater than 5 ft require protective systems such as sloping, benching, or shoring. In addition, trenches at depths of 4 ft or more must have a means of egress available every 25 ft. Air monitoring must also be conducted within the trench. Soil piles, tools, 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 of any activities taking place outside the excavation.

7.1.7.11 Underground Hazards

Field management must take any steps necessary to ensure that all below-ground utilities (i.e., electrical power sources, gas lines) have been located, and to ensure that all utilities to the site area have been neutralized. Drilling and digging at locations where utilities may be buried involve unacceptable risks.

Every effort will be made to notify utility companies and to obtain their assistance, along with that of laboratory personnel, in identifying subterranean hazards. Additionally, drilling and digging operations will progress only if field management has reasonable assurance that objects, utilities, product lines, and other obstacles in the dig area have been identified and located. A magnetometer or similar device will be employed to assist in identifying subterranean hazards that are not adequately identified by other sources. Drillers will use a hand (manual) posthole digger to dig down the first 3 ft 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 below-ground 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.

Excavation and digging activities will fully comply with Laboratory SOPs-04.01 through 04.04, and permits will be correctly completed and posted before any excavation or drilling operation begins.

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. Work areas regularly occupied by pedestrians will be delineated so that vehicle equipment operators will not encounter them. Delineation will be accomplished using barricades, warning signs, warning lights, traffic cones, and so forth.

If work takes place in or near heavy traffic areas, these areas will be appropriately marked with the aforementioned devices as necessary to protect personnel. Personnel will wear fluorescent orange and/or reflective clothing, vests, and so forth when working in and around traffic areas.

Sufficient parking will be provided. Vehicles not being actively used will be parked so that they do not interfere with traffic. When a vehicle is being maneuvered in a confined area with limited visibility, personnel positioned outside the vehicle will give assistance to the operator.

Pedestrian and civilian traffic have the right-of-way on site. Personnel on foot will be careful when around heavy equipment and when walking near roads. Ground personnel should always make eye contact and wait for a signal to proceed before passing close to or in front of operating equipment or moving vehicles.

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 supplying air to the respirators of ground employees be attached to vehicles or equipment.

7.1.7.13 Compressed Gases and Systems

Compressed gases will be used according to the supplier's instructions, Compressed Gas Association guideline documents, and requirements of this H&S Plan. Additionally, these gases will be used in a manner that prevents the development of a hazardous exposure potential to on-site personnel or bystanders.

Compressor hose segments will be secured using chains and/or locking pins. In addition to securing the segments, the pressurized hose will be connected to the compressor through a pressure-sensing device that will discharge the pressure if the hose pressure system fails (i.e., a hose is cut).

Personnel are required to wear safety glasses and gloves when handling/hooking up compressed gas cylinders or 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. 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 required. 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 supplying jackhammers will have a conductive pressure hose to limit the potential for electrical shock injuries to personnel in the event a previously unknown active electrical source is 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, such 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 conducting 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 the sampling of outfall. In this instance, the worker will be tied off before descending over the edge. All field team members will be informed of the potentially hazardous locations as well as of the 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 into the ground through 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 because electric current will run 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 a conducted 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 signal that lightning is about to strike and that a crouching position must be assumed immediately. The safe 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 being carried away by flood waters.

Side strikes injure more people than direct strikes. Side strikes are caused 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 CPR. 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 be damaged.

7.2 PPE

If engineering controls and work practices do not provide complete protection against hazards in OU 1129 SWMUs, 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 site. Protection from these hazards is afforded to the respiratory system, skin, eyes, face, hands, feet, head, body, and ears. Two important criteria for selecting this equipment are the potential hazards on the site and the type of work to be performed. These choices are also balanced with the hazards that are associated with the equipment itself such as reduced mobility, dexterity, vision, and communication, as well as heat stress. Field team members must also 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 upon 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 air-supplying respirator. Level B maintains the maximum respiratory protection with a downgrade in dermal protection. The distinguishing feature for Level C is modified respiratory protection through 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 ER Program SOP-02.01 and in the following text. Respiratory protection is addressed in ER Program SOP-02.02, Respirators. OU 1129 investigations will also be conducted according to Laboratory AR 12-1, Personal Protective Equipment; and Laboratory TB 1201, Eye and Face Protection; TB 1202, Protective Clothing; and TB 1203, Respiratory

Protective Equipment. In addition, according to the ER Program SOP-02.10, the site-specific special work permit for radioactive work will specify the appropriate protective clothing and equipment to be used on sites with known or suspected radioactive contamination.

7.2.1 Selection of PPE

This section details PPE to protect field team members from the various hazards discussed within this H&S Plan. PPE required at individual OU 1129 SWMUs depends on the types of work to be conducted and the known, suspected, or unknown contaminants present.

PPE must be selected that will protect employees from the specific hazards they are likely to encounter during work on site. Selection of the appropriate PPE is a complex process that takes into consideration a variety of factors. Key factors involved in this process are identification of the 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 is material-hazard specific, i.e., protective equipment materials will protect well against some hazardous substances and poorly, or not at all, against others. In many instances, protective equipment materials that will provide continuous protection from a particular hazardous substance cannot be found. In these cases the breakthrough time of the protective material should exceed the work duration.

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 the PPE selection becomes. As more information about the hazards and conditions becomes available, the field team leader can make decisions to upgrade or downgrade the level of PPE to match the tasks at hand.

The following are guidelines that the Field Team Leader can use to determine the selection of the appropriate PPE. As noted previously, the site information may suggest the use of combinations of PPE selected from the different protection levels. The following does not fully address the performance of the specific PPE material in relation to the specific hazards at the job site. PPE selection, evaluation, and reselection is an ongoing process until sufficient information about the hazards and PPE performance is obtained.

PPE is divided into four categories based on the degree of protection afforded:

Level A

Level A protection is worn when 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 potential high concentration of atmospheric vapors, gases, or particulates; site operations and work functions involve a high potential for splash, immersion, or exposure to unexpected vapors, gases, or particulates or materials that are harmful to skin or capable of being absorbed through the skin; substances with a high degree of hazard to the skin are known or suspected to be present and skin contact is possible; or operations are being conducted in confined, poorly ventilated areas.

Note: Level A protection will not be worn during the OU 1129 field investigation; therefore, no description of Level A PPE is given.

Level B

Level B protection will be specified for situations requiring selfcontained breathing apparatus (SCBA) and for those situations in which the identity and quantity of contaminants is unknown. These respirators will be used when

- oxygen levels are less than or equal to 19.5%;
- chemical concentrations exceed the PEL;
- the chemicals of concern do not have adequate warning properties;
- cartridges/canisters are not available for the chemicals and/or concentrations of concern; and
- the identity of the contaminant is unknown.

Level B protection will consist of the following:

- a full-face, positive-pressure SCBA (Mine Safety and Health Administration [MSHA]/NIOSH-approved);
- contaminant-resistant clothing for dust and splash protection against chemicals of concern such as Saranex or polyvinyl chloride (PVC);
- inner gloves of latex surgical material;
- outer gloves of rubber, PVC, or nitrile, dependent upon suspected contaminants;
- rubber steel-toed safety boots with disposable boot covers;
- hard hat for protection from overhead hazards, with hoods for splash protection; splash shields are optional, depending on activity and conditions; and
- hearing protection when the noise level exceeds 85 dBA.

In accordance with ER Program SOP-02.01, the Field Team Leader is responsible for workers adhering to the recommended level of PPE and may upgrade or downgrade the level of protection as additional information about site hazards becomes available. The factors involved in the upgrade or downgrade of levels of protection are listed in the ER Program SOP.

Level C

Level C protection will be considered in instances where a known chemi contaminant(s) has exceeded the specific permissible exposure limit. An ai

purifying respirator (APR) will be selected if the following criteria are met:

- oxygen levels are greater than 19.5 percent;
- chemical concentrations do not exceed the Immediately Dangerous to Life and Health (IDLH) levels;
- the chemical has adequate warning properties; and
- cartridges/canisters are designed for the chemicals and concentrations of interest.

Level C protection will include the following:

- full-face APR (MSHA/NIOSH-approved) with combination organic vapor/particulate cartridges or canisters capable of filtering out the chemicals of concern;
- contaminant-resistant clothing for dust and splash protection against chemicals of concern such as Saranex or PVC;
- inner gloves of latex surgical material;
- outer gloves of rubber, PVC, or nitrile, dependent upon suspected contaminants;
- rubber steel-toed safety boots with disposable boot covers in wet conditions;
- leather safety boots with disposable boot covers in dry conditions;
- hard hat for overhead hazards protection; splash shields are optional dependent upon activity and conditions;
- hearing protection where the noise level exceeds 85 dBA; and
- escape mask for respiratory protection in the event of a release or of respirator failure.

Level D

Level D is a basic work uniform, worn in most instances where the potential threat to human health is known or believed to be minimal. Level D protection will consist of the following:

- cotton or Tyvek coveralls;
- rubber, PVC, or nitrile outer gloves for chemical/particulate protection;
- leather gloves for abrasion protection;
- steel-toed safety boots for puncture/crush protection;

- optional boot covers for dusty or muddy conditions;
- hard hat with optional splash shield for protection from overhead splash hazards;
- safety glasses for splash and particulate protection;
- hearing protection (earplugs or earmuffs) if 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 PPE for Task-Specific Hazards

The previously mentioned guidelines will apply to all work performed in OU 1129. Specific health and safety considerations for the activities conducted under the SAPs in Section 7.0 are discussed in the following text. Specific PPE levels were selected based on available archival information as presented in Chapter 3 of this work plan (i.e., potential contaminants of concern, D&D and environmental survey results, and process/operations information).

7.2.2.1 Field Surveys

Field Surveys will require walk-throughs of potentially contaminated areas. The field surveys for the SWMUs within OU 1129 may be performed in Level D protective clothing.

7.2.2.2 Surface Sampling

Surface sampling will involve the collection of soil or sediment samples from the first 12 in. of soil. Site workers may wear Level C or D protection, depending on the conditions. Safety harnesses will be used by any member who will be working at the edge of a mesa. Under extremely dusty conditions, site workers will take measures to suppress the dust. The appropriate air monitoring must be performed when the sampling point is in a low-lying area.

7.2.2.3 Subsurface Sampling

The subsurface sampling program comprises a variety of activities that will 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 or toxic gases will be conducted at the borehole during drilling or coring. Excavation or trenching will be monitored where soil is being disturbed. Completed excavations and trenches will be periodically monitored for oxygen and flammable or toxic gases.

Once the installations are complete, the levels of protection may be downgraded if conditions permit.

7.3 Hazard Communication

In accordance with right-to-know legislation under OSHA 1910.120, site workers must be informed of potential hazards associated with the site before commencing work activities. The following sections describe the provisions for hazard communication to be observed during work in OU 1129.

7.3.1 Safety Meetings

Pre-entry briefings will be held before initiating any site activity as described in ER Program SOP-02.03, Pre-Entry Briefings for Site Personnel. Any visitors who will enter OU 1129 are expected to participate in briefings in accordance with ER Program SOP-02.04, Pre-Entry Briefings for Visitors. Safety meetings and safety inspections will also be conducted to ensure that the H&S Plan is being followed. These procedures and required documentation are described in ER Program SOP-02.05, Safety Meetings and Inspections.

7.3.2 Employee Information

The Site Safety Officer shall ensure that the following DOE and Laboratory forms are posted where Field Team Leaders 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;
- Laboratory Special Work Permit; and
- OSHA Job Safety and Health Protection Form.

The Laboratory health and safety standard concerning employees' right-to-know shall also be posted at the work site. Employees will be required to sign the Acknowledgement of On-Site Briefing Form in ER Program SOP-02.03, Pre-Entry Briefings for Site Personnel before initiation of field work activities.

7.3.3 Material Safety Data Sheets

Material Safety Data Sheets (MSDSs) describe the chemical/physical properties, exposure information, 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 attaching them to this H&S 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 on the basis of the nature and extent of contamination at the site as well as on safe accessibility. Three general areas will be defined in this H&S Plan: the exclusion zone, the contamination reduction zone (CRZ), and the support zone. Site access issues are also addressed in Section 7.0 of the IWP, Annex III, H&S Plan.

The Field Team Leader and/or the Site Safety Officer will walk the intended job site before the start of work. During the site walk, the following tasks will be accomplished:

- Determining how best to implement the H&S Plan (e.g., set up zones, establish site control, place decontamination area(s), etc.) and whether variances must be made to the plan. If variances are necessary, the requirements in Section 2.4 of this H&S Plan will be followed.

- Defining the job site, work to be done, and potential H&S impacts. Information gathered during the initial site entry and from the guidelines of the H&S Plan will be used to determine if changes in personnel protective protocols (e.g., levels of protection) need to be made.

- Assessing the work area and vicinity, especially noting areas, equipment, material, and conditions that can result in H&S hazards. Special priority will be given to identifying all suspected conditions that may pose inhalation or skin absorption hazards that are IDLH, and other conditions that may cause death or serious harm. Examples of such hazards include confined spaces, potentially explosive or flammable situations, visible vapor clouds, or the presence of biological indicators such as dead animals or vegetation. During this assessment, the Site Safety Officer or a qualified designee shall carry appropriate real-time area air-monitoring equipment (i.e., Hnu PID, Draeger tubes, LEL/oxygen meter, etc.) capable of detecting airborne concentrations of potential site contaminants at their respective PEL as well as other hazardous (i.e., flammable/oxygen-deficient) atmospheres.

- Assimilating information for the first day's Tailgate Safety Meeting (pre-entry briefing).

The Field Team Leader and the Site Safety Officer will use the information furnished by air monitoring with direct reading instruments and observation/testing of soils and sediments collected from boreholes and excavations to ensure continuing site control.

8.1 Exclusion Zone

The exclusion zone is the area in which contamination does or could occur. Due to the types of areas in which OU 1129 SWMUs are located, the implementation of 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/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 are wearing the appropriate PPE. Different zones with different levels of protection requirements can be established within the exclusion zone if necessary.

The hotline is the outer boundary of the exclusion zone. Dependent upon the location of the SWMU (i.e., isolated areas versus residential or commercial), the hotline will be marked in the most appropriate fashion. Barriers such as fences, barrier tape, or signs can be used depending on the circumstances.

8.2 CRZ

The CRZ 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 CRZ 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 is also located upwind of the exclusion zone, if possible. Personnel do not have to wear PPE in this area.

8.4 Site Control Procedures

To promote adequate site security, personnel safety, and smooth operation of the site activities, 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. This meeting will occur before work begins.

- A copy of this plan will be available at the job work site.

- Only authorized personnel will be permitted in the work area. These individuals must have successfully completed a medical exam and have been properly trained in specific health and safety hazards and the use of respiratory protective equipment. All visitors must report to the Field Team Leader.

- All personnel entering 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 of this H&S Plan and will depend on the degree of hazard.

- Food, beverages, and tobacco products 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.

- Before leaving the site at the end of each work shift, 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 site. A fire extinguisher will be at the work site and will be readily available for the team's use in case of an emergency. It will be located not more than 25 ft from the work activity. An eyewash capable of washing both eyes at once and delivering at least 0.4 gals. of water per minute for at least 15 min will be readily available. At least one eyewash will be maintained in the CRZ.

- Employee entrance and exit routes will be planned and emergency escape routes will be designated. A map showing emergency escape routes will be posted at the site.

- Work areas will be illuminated to a minimum of 20 footcandles. Supplementary lighting may be necessary at night, inside buildings and tanks, or in poorly lit areas.

- All operators of equipment used on site will be familiar with the requirements for inspection and operation of such equipment. Unfamiliar operations will be discussed with affected employees before work begins. The Field Team Leader will be responsible for checking the proficiency of the operator. Perimeter barricades will be placed around the equipment used in a fixed location. Audio and/or visual back-up alarms will be used on all heavy equipment on site.

- Personnel will be transported only by means prescribed for movement of personnel. When trucks or other heavy equipment enter or leave the site, an individual shall direct the driver.

- Electrical equipment will not be permitted in areas where a flammable atmosphere may exist. All static ignition sources will be identified and eliminated through use of bonding and grounding techniques.

MSDSs will be obtained for every chemical product used on site. This information will be stored in a central location and made readily available to all employees upon request. MSDSs, or applicable information, will be available with regard to materials used in the soil collection and drilling activities. All containers of any chemical products will be properly labeled to comply with the OSHA Hazard Communication Standard (29 CFR Part 1910.1200) (OSHA 1991, 0610).

All on-site personnel shall use the buddy system. Buddies shall maintain visual contact with each other. Personnel must observe each other for signs of heat stress or toxic exposure such as:

- changes in complexion and skin discoloration;

- changes in coordination or demeanor;

- excessive salivation and pupillary response; or

- changes in speech pattern.

Personnel shall inform the supervisor of nonvisual effects of toxic exposure such as:

- headaches, dizziness, or blurred vision;

- nausea or cramps; or

- irritation of eyes, skin, or respiratory tract.

Walking and working surfaces may become wet and slippery while employees are performing 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 and debris.

A designated break area will be upwind from the excavation area and outside the CRZ. The area must be clearly marked and no contaminated personnel or equipment will be permitted.

If the facility does not have a water supply available, potable water will be carried to the site for use in decontamination and employee cleanup activities. All refuse will be deposited in designated containers while on site. The Field Team Leader and the Site Safety Officer have the responsibility to ensure that the area is kept clean.

9.0 DECONTAMINATION PROCEDURES

This section outlines the procedures for an effective decontamination plan. Decontamination is the process of removing or neutralizing contaminants that have accumulated on equipment and personnel in a sequential fashion. The objectives of the decontamination process are to protect workers from exposure to the contaminants and to minimize the transfer of contaminants into clean areas.

The degree of expected contamination depends on the tasks to be conducted under the SAPs in this Work Plan. Contact with hazardous substances is possible; therefore, it will be assumed that all personnel and equipment engaged in field activities will be potentially contaminated and that the appropriate level of decontamination is required. The types of materials to be addressed by decontamination procedures for OU 1129 include the following:

- contaminated soil in the form of dust or mud;
- contaminated sediment and sludge; and
- contaminated liquid or aerosol resulting from splashing or spraying.

General guidelines for decontamination are cited in Sections 7.0 and 10.0 of the IWP, Annex III, H&S Plan. Decontamination procedures are also outlined in ER Program SOP-02.07, General Equipment Decontamination, and SOP-02.08, Personnel Decontamination. A decontamination plan will be developed and implemented before any personnel may enter areas where the potential for contamination exists. The elements of this plan must be documented on the Daily Activity Logs under ER Program SOP-01.01.01, Records. Personnel performing decontamination for the ER Program must certify that they have read and understood this procedure as well the procedures in the IWP.

9.1 Contamination Prevention

Minimizing contamination at the outset promotes effective decontamination. The following preventive measures are included in the ER Program SOPs for decontamination:

- avoid contact with hazardous substances as much as possible;
- use remote sampling, handling, and container-opening techniques;

- encase instruments and equipment with bags or coatings;
- bag or coat the exterior of sample containers; and
- use disposable garments and equipment where appropriate.

9.2 General Equipment Decontamination

The necessary supplies for equipment decontamination are listed in ER Program SOP-02.07. This check list includes solutions for decontamination, the appropriate cleaning supplies, and protective gear for personnel conducting decontamination. The level of protection required for decontamination support personnel will be adjusted according to the degree of contamination that is expected or determined.

All equipment used during the field procedures will be subject to decontamination procedures, except for disposable items. The types of equipment to be employed 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 site. The contents of the bags can be transferred to clean bags at the hotline and any residual contamination can be removed. The decontamination process must be designed to avoid contaminating the sample.

The steps for the decontamination process are presented in the SOP-02.07. Reusable protective equipment must be decontaminated using a soap and water wash and two successive rinses. All heavy equipment and vehicles that are suspected of contamination must be steam-cleaned using high-pressure washers. All decontamination rinsate must be collected in approved containers.

9.3 Personnel Decontamination

The necessary supplies and equipment for decontamination of personnel are listed in ER Program SOP-02.08. These check lists correspond to the level(s) of protection in use on site and call for solutions and cleaning supplies, air tanks/respirator cartridges, a rest area, and a shower facility.

Personnel decontamination procedures will be oriented to handle personnel in Levels B, C, and D protection depending on the sampling activities involved. Personnel decontamination should be performed for all levels of protection. The steps for personnel decontamination are outlined for Levels B, C, and D in the SOP-02.08. The degree of decontamination required will depend 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 will 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 proceed through a dry run before the decontamination line goes into operation.

Emergency decontamination may be necessary for persons who must evacuate the site under emergency conditions or because of injury. These procedures are detailed in Section 10.0 of the IWP, Annex III, H&S 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 that is 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 where 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 of as suspected hazardous waste. Arrangements will be made with the Laboratory for acquisition and disposal of drums containing soapy water, rinse water, methanol, and trash.

9.6 Decontamination Verification

The decontamination of any equipment or protective gear to be removed from a contaminated area to a controlled or uncontrolled area must be done with HS-1 approval and oversight. Protective clothing and equipment will be visually inspected for the effectiveness of decontamination. Screening procedures will be performed with a radiation detector in accordance with ER Program SOPs. Procedures for the decontamination and transport of the decontamination blank are also provided in ER Program SOP-01.02, Sample Containers and Preservation; SOP-01.03, Handling, Packaging, and Shipping of Samples; and SOP-01.04, Sample Control and Field Documentation.

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/toxic materials, and outlines pertinent requirements for notification and documentation of emergencies. Additional references for this section include Sections 6.0 and 13.2 of the IWP, Annex III, H&S Plan; ER Program SOP-02.09, Accident/Incident Reporting; 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 assistance from the Field Team Leader, shall 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 1129. These plans will be adjusted for conditions specific to each SWMU.

10.1.1 Emergency Contacts

This emergency contact form will be copied and posted in prominent locations 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 (especially potential IDLH atmospheres);
- site terrain (topography, buildings, barriers);
- site accessibility by road and air (with a current indication of detours);
- work zones/work crew locations;
- surrounding population/environment;
- shelters and safe areas; and
- evacuation routes.

10.1.3 Site Security and Control

In an emergency, the Field Team Leader (or a designee) is responsible for controlling the entry of personnel into hazardous areas and accounting for all individuals on 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 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 involves 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 1129 will depend on the area represented by the work zones and the tasks associated with that area. Where there is substantial distance between the workers providing support and the workers conducting sampling activities, two-way radio communication will be employed. A set of predetermined hand signals will be used if radio communi-

cation 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
- 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 site, the nearest public telephone will be located in advance. All site personnel must be informed of this location.

Communication protocols will be explained at the Daily Tailgate Safety Meetings and reviewed at least once a week for the duration of site operations.

10.1.5 Evacuation Routes/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. 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 (e.g., surrounded by a fence, located within a trench, bordered by steep cliffs), evacuation routes will be established in advance and illustrated on the site map.
In either case, all field team members will report to a designated checkpoint to be accounted for by the Field Team Leader. 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 re-stocking supplies. The type and amount of emergency equipment will be selected on the basis of the potential hazards.

10.2 Specific Emergencies

10.2.1 Fire/Explosion

Fire extinguishers may be effective for small, contained fires. One long blast of an air horn will be used to signal a minor fire or release. Field team members will meet and be counted at a designated checkpoint. For a major fire or explosion, evacuation will be signaled by two long blasts. Field team members will report to a specified location (such as evacuation vehicles) and proceed away from the fire. A designated 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/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 be counted by the Field Team Leader (or a designee). The Site Safety Officer will issue further instructions.

Two short blasts with an air horn will alert field team members of a major release involving hazardous or radioactive materials. Field team members will meet at a checkpoint predetermined on the basis of wind direction. A portable wind sock or streamer will be positioned at each site. When the horn is sounded, all field team members will move in an upwind direction, avoiding the plume. 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 Field Team Leader 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 should be reported to the Laboratory's Occupational Medicine Group, HS-2. The Los Alamos County Medical Center should be notified of life-threatening or serious exposures. If a field team member is exposed to hydrofluoric acid, a special paste must be obtained from HS-2 and applied to the affected area on the patient, and the hospital must be notified immediately.

10.2.3 Injuries

Trained personnel on site may treat minor injuries. Seriously injured victims should be transported to a medical facility as soon as possible. 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 10.0 of the IWP, Annex III, H&S Plan.

10.2.4 Vehicle Accidents/Property Damage

In addition to the required police report, DOE has established reporting requirements for a vehicle accident. These requirements are described in Section 10.4 of this H&S Plan. Injuries incurred in an accident will be treated in the manner described in Section 10.2.3 of this H&S Plan.

10.3 Provisions for Public Health and Safety

Emergency planning is presented in the Laboratory's ES&H Manual. The Laboratory identifies four situations in which hazardous materials may be released into the environment. These categories are founded, in part, on Emergency Response Planning Guideline (ERPG) concentrations. These concentrations were developed by the American Industrial Hygiene Association (AIHA) on the basis of 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 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.

- 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. Off-site releases of toxic materials 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. Off-site releases of radioactive materials 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 6.0 of the IWP, Annex III, H&S 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 OU PL, and the Laboratory HS Division Office according to DOE Order 5500.2B (DOE 1991, 0736), DOE-Albuquerque Operations Office (AL) Order 5000.3 and 5500.2B (DOE/AL 1991, 0734). The Laboratory HS Division Office is responsible for implementing notification and

reporting requirements according to DOE Order 5484.1.

10.5 Documentation

An unusual occurrences is defined as "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 would 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 detailed in Section 13.2 of the IWP, Annex III, H&S Plan.

The Laboratory principal investigator will submit the appropriate completed DOE Order Form 5484.X for any of the following accidents/incidents, according to Laboratory AR 1-1:

- 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 the 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, 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.

- Property damage losses of $1,000 or more must be reported. Accidents that cause damage to DOE property, regardless of fault, or accidents wherein DOE may be liable for damage to a second party, are reportable where damage is $1,000 or more. Include damage to facilities, inventories, equipment, and properly parked motor vehicles. Exclude damage resulting from a DOE-reported vehicle accident.

- Government motor-vehicle accidents resulting in damages of $150 or more or involving an injury, unless the government vehicles is not at fault; damage of less than $150 is sustained by the government vehicle; and no injury is inflicted on the government vehicle occupants. 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; or

- any person is injured and the driver of a government vehicle is at fault.

The ER Program H&S PL will work with the OUPL and the Field Team Leader to ensure that health and safety records are maintained with the appropriate Laboratory group as required by DOE orders. The reports are as follows:

- DOE AL Order 5000.3, Unusual Occurrence Reporting System

- DOE Form F 5484.3, Supplementary Record of Occupational Injuries and Illnesses, Attachment 1, 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 Order 5484.1 Chapter IV

- DOE Form F 5821.1, Radioactive Effluent/Onsite Discharges/ Unplanned Releases; Attachment 12, DOE Order 5484.1.

Copies of these reports will be stored with the appropriate Laboratory group. Specific reporting responsibilities are given in the following sections and in Chapter 1, General Administrative Requirements, of the Laboratory H&S Manual.

REFERENCES

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), December 21, 1988. "Radiation Protection for Occupational Workers," DOE Order 5480.11, Washington, DC. (DOE 1988, 0076)

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), May 1991. "Environmental Restoration Standard Operating Procedures," Vols. I, II, and III, Los Alamos, New Mexico. (LANL 1991, 0411)

LANL (Los Alamos National Laboratory), June 1, 1990. "Environment, Safety, and Health Manual," AR 10-3, Chemical, Hazardous, and Mixed Waste, Los Alamos, New Mexico. (LANL 1990, 0335)

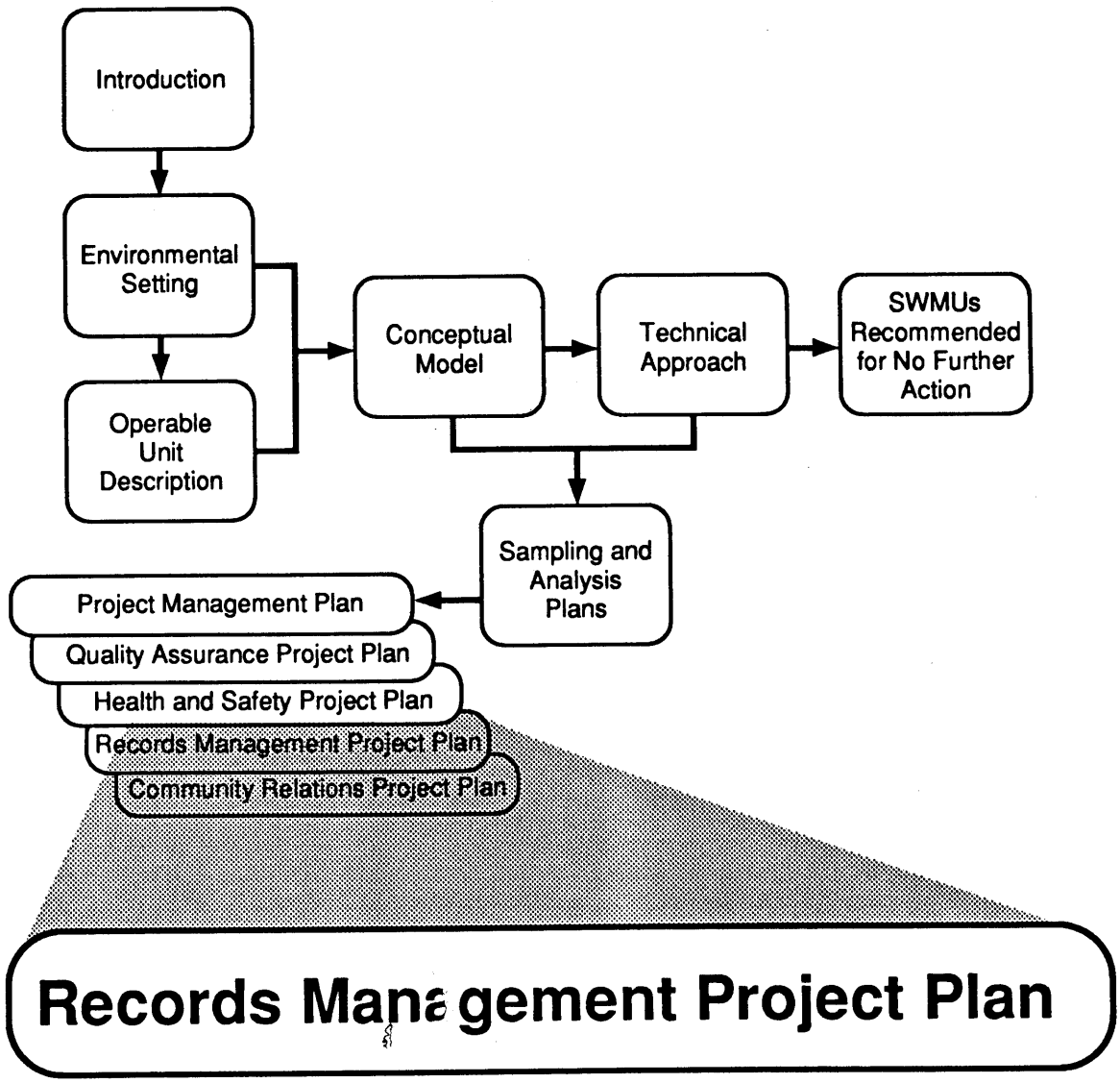
LANL (Los Alamos National Laboratory), November 1990. "Installation Work Plan for Environmental Restoration," Los Alamos National Laboratory Report LA-UR-90-3825, Los Alamos, New Mexico. (LANL 1990, 0144)

LANL (Los Alamos National Laboratory), November 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 (OSHA), US Coast Guard (USCG), and US Environmental Protection Agency (EPA), October 1985. "Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities," DHHS (NIOSH) Publication No. 85-115, prepared for the US Department of Health and Human Services, 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 1910.120, Washington, DC. (OSHA 1991, 0610)

ANNEX IV


Introduction
Environmental Setting
Operable Unit Description
Conceptual Model
Technical Approach
SWMUs Recommended for No Further Action
Sampling and Analysis Plans
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):

> ...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 2.0 of the program plan in the IWP describes the implementation of the records management program. Records management activities at Operable Unit (OU) 1129 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 identifying, submitting, reviewing, indexing, retaining, protecting, accessing, retrieving, and correcting (if necessary) records. 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 1129. 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 4.0 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.

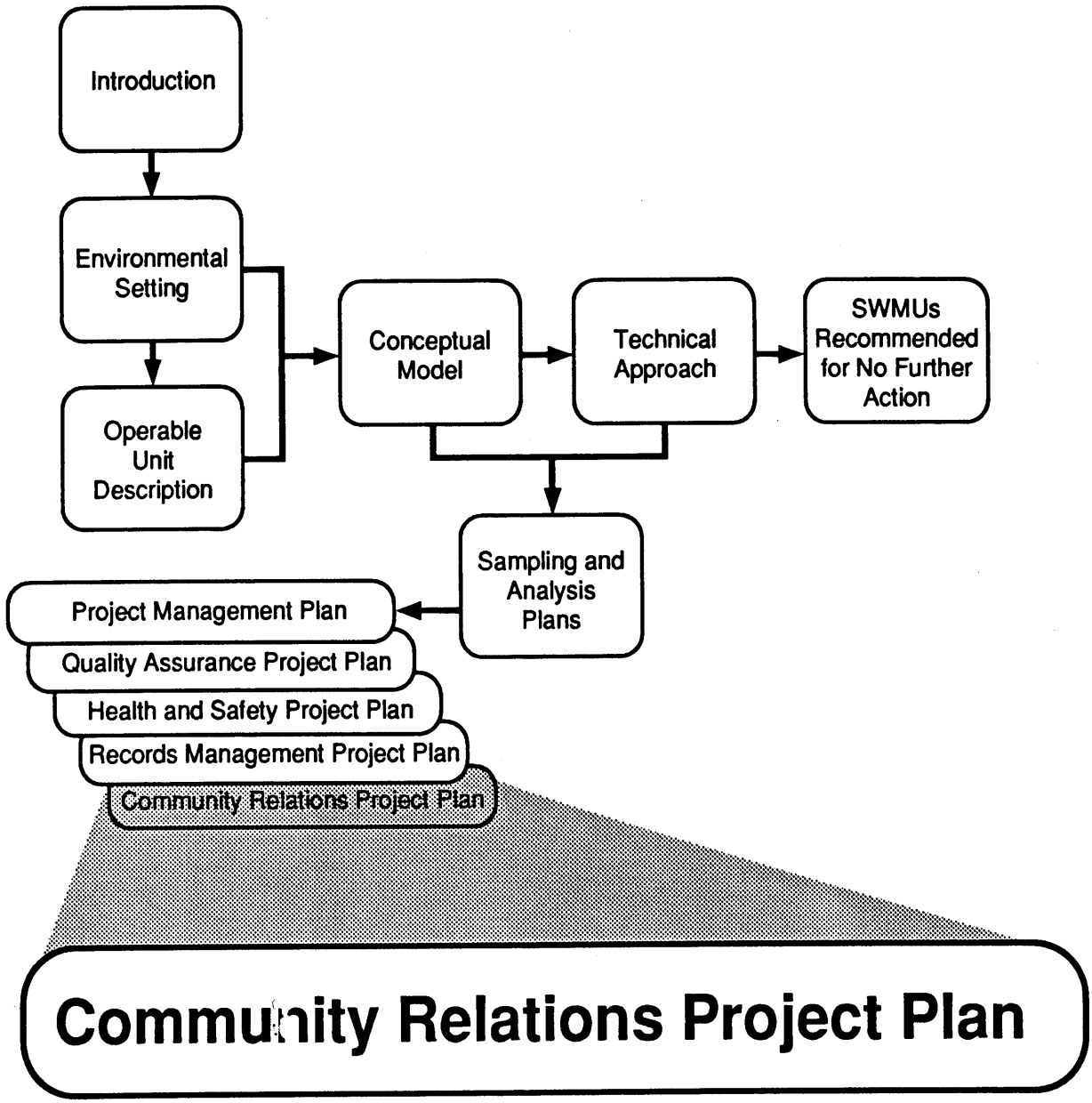
7.0 COORDINATION WITH THE COMMUNITY RELATIONS PROGRAM

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

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
Environmental Setting
Operable Unit Description
Conceptual Model
Technical Approach
SWMUs Recommended for No Further Action
Sampling and Analysis Plans
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) 1129 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 1129 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 (the 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 (NMEID 1989, 0595; 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 project plan.

All information concerning ER Program activities at OU 1129 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

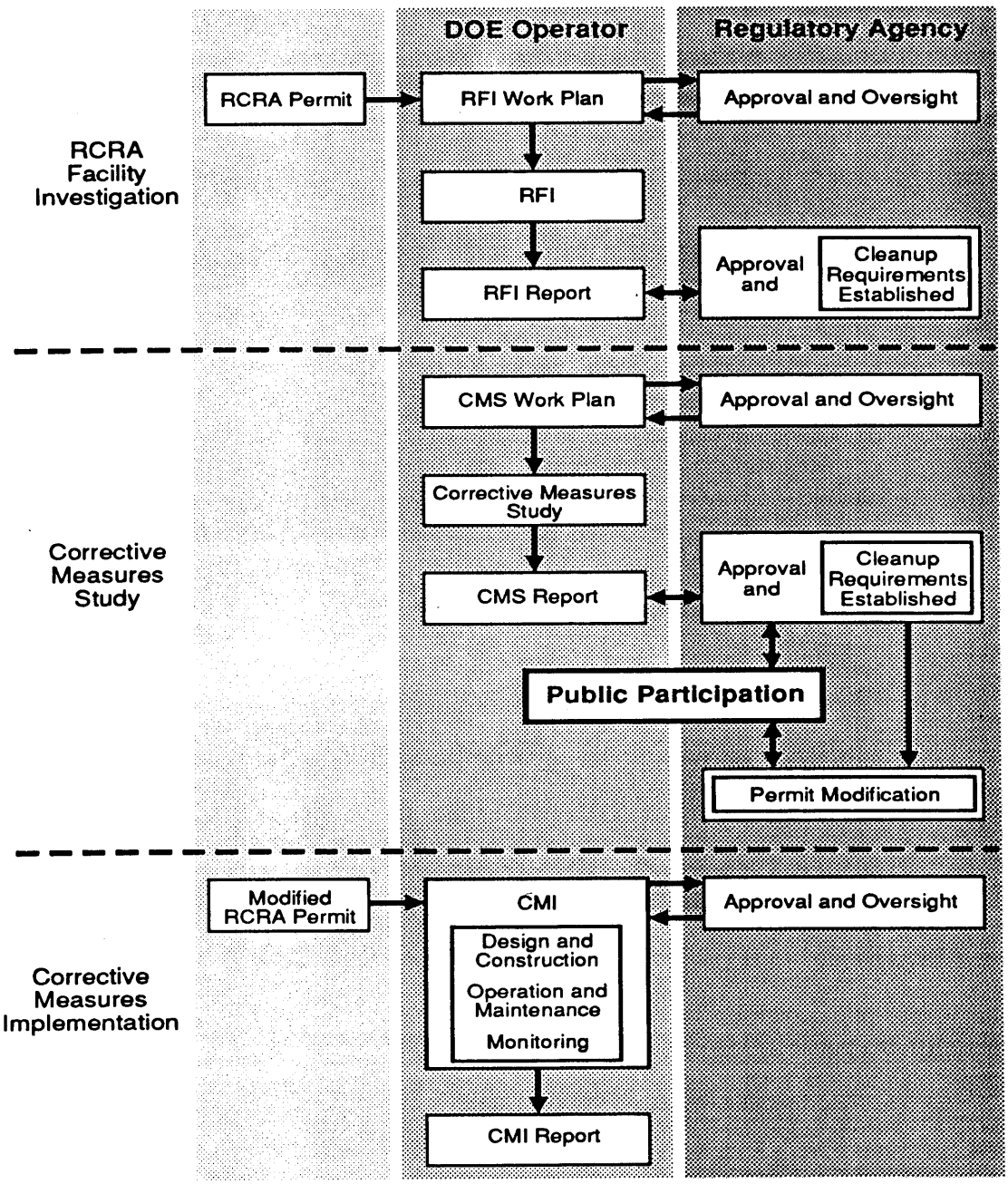


Figure V-1. Opportunities mandated by regulation for public participation during the corrective action process.

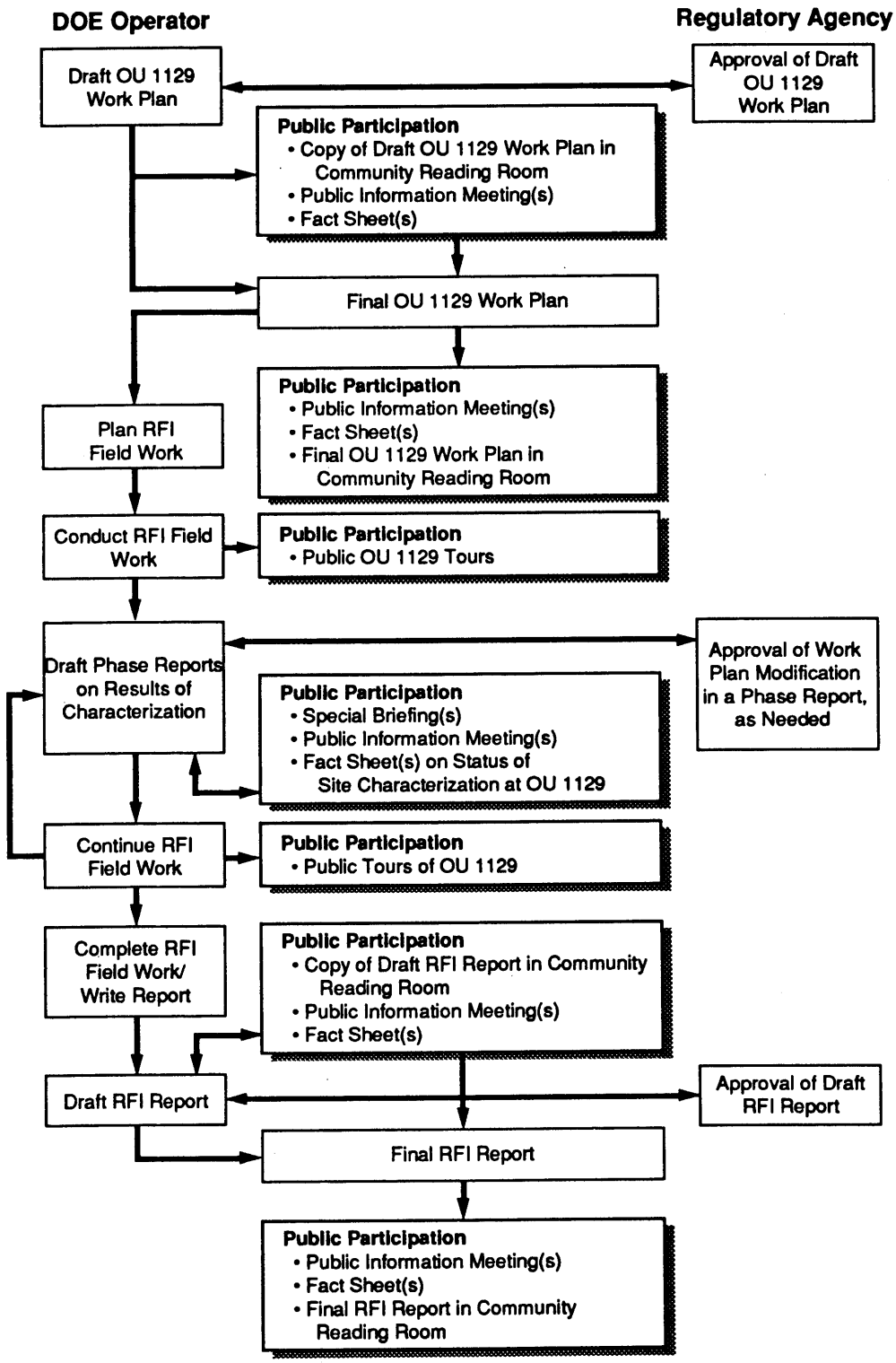


Figure V-2. Opportunities for public participation during the OU 1129 RFI.

2.0 COMMUNITY RELATIONS ACTIVITIES

The following subsections provide a brief description of community relations activities to be conducted at OU 1129 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 on or adjacent to OU 1129 and current and former workers at OU 1129 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 with map inset(s) that show(s) OU 1129 and summarizes site history and use, known contaminants of concern, and planned activities (Attachment I). 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 1129 will be available for public review in the ER Program's Community Reading Room.

2.3 ER Program Community Reading Room

As they are developed, documents and data associated with OU 1129 (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 1129 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. The Laboratory and the 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 1129 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 provide information on notifying property owners and residents of any releases that might move off the Laboratory site.

2.7 Informal Public Review and Comment on the Draft RFI Work Plan for OU 1129

The Laboratory will encourage public comment on the field sampling proposed in the draft Work Plan for OU 1129 after the Environmental Protection Agency has formally approved thie draft 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 1129.

REFERENCES

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)

NMEID (New Mexico Environmental Improvement Division), November 8, 1989. "Hazardous Waste Facility Permit," Permit No. NM 0890010515-1 issued to Los Alamos National Laboratory, Los Alamos, New Mexico, effective February 19, 1990, Santa Fe, New Mexico. (NMEID 1989, 0595)

ATTACHMENT I

Fact Sheet for Operable Unit 1129
(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 1129 consists of SWMUs identified in current Technical Areas (TAs) 5, 35, 48, 52, 55, and 63, and former TAs-4 and -42. No SWMUs have been identified in TA-66. All land within Operable Unit 1129 is currently owned by the Department of Energy (DOE) and managed by the University of California for DOE.

- Laboratory operations conducted at Operable Unit 1129 TAs included the use of firing sites, waste oil and wastewater treatment facilities, waste disposal areas, aboveground and underground storage tanks, an incinerator, decontamination areas, septic systems, sanitary waste treatment lagoons, outfalls, sumps and tanks, industrial waste lines, surface impoundments, oil spills, container storage areas, a calibration chamber, polychlorinated biphenyl (PCB) transformers, and soil contamination from operational releases. A breakdown of Laboratory activities at each TA is provided on the following page.

- Laboratory operations at Operable Unit 1129 began in 1944. Ongoing laboratory operations continue to date at TAs-35, -48, -52, -55, -63, and -66. Operations ceased at former TA-4 in 1946, at TA-5 in 1959, and at former TA-42 in 1969. TA-5 is currently used only for an electrical substation and as a buffer zone.

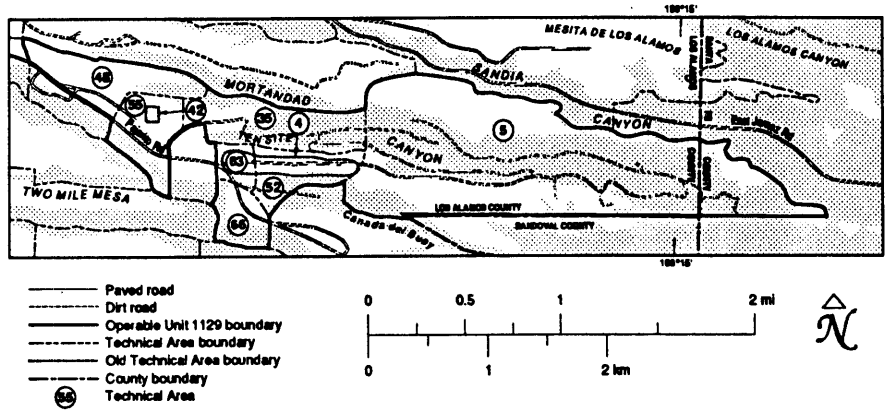
- Wastes that may have been present in the TAs that compose Operable Unit 1129 include radioactive materials, heavy metals, photo-processing chemicals, water treatment chemicals, various acids and bases, organic solvents, high explosives, waste oils, diesel fuel, and PCBs.

- The Laboratory will develop a Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) Work Plan by May 1992 that will outline procedures to verify past cleanups or determine the presence of residual contamination in Operable Unit 1129. This site investigation will define the type and extent of any contamination and identify any potential receptors.

- 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 idenfity releases from Laboratory operations that could pose a health risk to individuals living in the communities surrounding the Laboratory. No contamination is known to exist on private property that 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 is highly unlikely as the main aquifer is at least 700 feet below site surfaces.

Operable Unit 1129 Locator Map



BACKGROUND OF OPERABLE UNIT 1129

TA-4, also known as Alpha Site, was used from 1944 to 1946 as a firing site for munitions testing. The area formerly designated as TA-4 is currently located within the boundaries of TA-52 and TA-63.

TA-5, also known as Beta Site, was used as a firing site from 1944 to 1959. The area is now used as a buffer zone and is undeveloped except for a water supply well and an electrical substation.

TA-35, also known as Ten Site, was established in 1951 as a major laboratory facility, and has been used continuously for research and development since that time. TA-35 was previously used for radionuclide experimentation, nuclear reactor technology development, and tritium processing, and was also the site of a wastewater treatment plant. Current research is focused on nuclear safeguards and laser research and development.

TA-42, also known as the Incinerator Site, was established in 1951 to house an incinerator for volume reduction of radionuclide-contaminated waste. The incinerator was used only for one year because of operational problems, and the site was later used as a decontamination area. Former **TA-42** is now within the boundaries of **TA-55**.

TA-48, also known as the Radiochemistry Site, has been used since 1957 for research in radiochemistry and general chemistry.

TA-52, also known as the Reactor Development Site, was established in 1965 to house the Ultra-High-Temperature Reactor Experiment (UHTREX), a helium-cooled, uranium-fueled nuclear reactor that operated until 1968. The TA is now used for nuclear safeguards research and office space.

TA-55, also known as the Plutonium Processing Facility, began operations in 1978, and has since served as the primary laboratory for research and processing of plutonium. It is also used for research on other radionuclides including uranium and americium.

service area by the Laboratory's maintenance contractors.

TA-66, also known as the ATAC Facility, was established in 1989. It is leased by DOE to the DoD for use as office space.

PREVIOUS CLEANUP IN OPERABLE UNIT 1129

TA-4, TA-5, and **TA-42** have undergone overall site cleanups. Radiological contamination in **TA-4** and **TA-5** was partially cleaned up in 1960 and in 1985. Both TAs underwent decontamination and decommissioning (D&D) in 1985 as part of the Los Alamos Site Characterization Project. **TA-42** underwent D&D in 1978, at which time all structures were removed, and radioactively contaminated soils were excavated. potential hazardous chemical contamination has not been addressed at any of these sites.

Remediation has been conducted at several SWMUs at **TA-35, TA-48,** and **TA-52.** Several SWMUs at **TA-35** underwent D&D between 1981 and 1991. Other D&D efforts are planned for **TA-35.** The only D&D effort conducted at **TA-48** involved the removal of an abandoned septic system in 1986. All equipment associated with the UHTREX reactor and Waste Treatment Facility at **TA-52** underwent D&D during 1988-1989.

No D&D activities have been conducted to date at **TA-55, TA-63,** or **TA-66.**

FUTURE ACTION AND PROPOSED TIME FRAME

The RFI Work Plan, which describes the characterization activities and verification sampling, will be completed for Operable Unit 1129 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 1996 and be completed by 1998.

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 investigations and throughout the entire cleanup process. If you have additional questions about Operable Unit 1129 or about the Laboratory's Environmental Restoration Program, please do not hesitate to visit, call, or write:

Community Relations Project Leader
Environmental Restoration Program
Los Alamos National Laboratory
Box 1663, MS M314
2101 Trinity Drive, Suite 20
Los Alamos, NM 87545
505-665-2127

APPENDIX A

OPERABLE UNIT 1129
SUMMARY OF ARCHIVAL RELEASE INFORMATION FOR SWMUS REQUIRING SAMPLING

for the

LOS ALAMOS NATIONAL LABORATORY
ENVIRONMENTAL RESTORATION PROGRAM

TABLE A-1

SUMMARY OF ARCHIVAL RELEASE INFORMATION FOR SWMUs REQUIRING SAMPLING

SWMU No.	TYPE	ASSOCIATED STRUCTURES/ DESCRIPTION/ LOCATION	HAZARDOUS CONSTITUENTS RELEASED		ENVIRONMENTAL SURVEYS/ANALYTICAL DATA/REMEDIAL EFFORTS
			KNOWN	SUSPECTED	
4-001	Firing Site TA-4-18	Firing pit was located on the north side of Puye Road, approximately 2200 ft east of TA-52-1. Used for surface implosion test shots.	Shrapnel and debris were released in the pit and surrounding area from test shots. Some materials were contaminated with uranium.	High explosives (HE), natural and depleted uranium, lead, and beryllium were used in test shots. No uranium has been found at TA-4, however, and it is unlikely that HE residue is still present.	The pit was cleared of all debris, backfilled and contoured in 1985. The site was to be decontaminated for radioactivity at that time, but no above-background radioactivity was detected. In a 1988 survey, beta-gamma activity at the pit was measured at 354 cpm (background is 109 cpm). A piece of shrapnel found in the pit had beta-gamma activity of 1,318 cpm. Gamma exposure measured at the surface was 19 µR/hr (background 14 µR/hr). The site has not been characterized for nonradioactive contamination.
4-002	Surface Disposal Site	Located on north-facing slope of Mortandad Canyon, north of firing pit.	Debris from test shots was bulldozed off the mesa.	Uranium, beryllium, lead, aluminum, and HEs from test shots may be present.	This site was not addressed during 1985 decontamination and decommissioning (D&D). There have been no known surveys for radioactive or nonradioactive contamination.

TABLE A-1 (continued)

SUMMARY OF ARCHIVAL RELEASE INFORMATION FOR SWMUs REQUIRING SAMPLING

SWMU No.	TYPE	ASSOCIATED STRUCTURES/ DESCRIPTION/ LOCATION	HAZARDOUS CONSTITUENTS RELEASED		ENVIRONMENTAL SURVEYS/ANALYTICAL DATA/REMEDIAL EFFORTS
			KNOWN	SUSPECTED	
4-003(a)	Outfall	Served TA-4-7, the laboratory/darkroom; located on the south side of TA-4-7.	No known releases	Outfall was possibly used for discharge of photo-processing chemicals, possibly contaminated with uranium.	There have been no known surveys for nonradioactive contamination at this outfall site.
4-003(b)	Outfall	Served TA-4-3; located 20 ft north of TA-4-3.	No known releases	Unknown	Radiological surveys in 1953 and 1985 detected no above-background radiation. The drain pipe was removed in 1985. In a 1988 survey, 224-cpm beta-gamma activity was detected (background is 109 cpm). Gamma exposure at the surface was essentially at background. The site has not been characterized for nonradioactive contamination.
4-004	Soil Contamination Below Former Building TA-4-7	Located south of Puye Road, just inside TA-52 fence; TA-4-7 was the former laboratory/ darkroom for TA-4.	No known releases	Photo-processing chemicals, possibly contaminated with uranium, and other unspecified chemicals may be present	A 1988 radiation survey measured 240-cpm beta-gamma activity (background is 109 cpm) at the former site of TA-4-7. Gamma exposure at the surface was essentially at background. The site has not been surveyed for nonradioactive contamination.

TABLE A-1 (continued)

SUMMARY OF ARCHIVAL RELEASE INFORMATION FOR SWMUs REQUIRING SAMPLING

SWMU No.	TYPE	ASSOCIATED STRUCTURES/ DESCRIPTION/ LOCATION	HAZARDOUS CONSTITUENTS RELEASED		ENVIRONMENTAL SURVEYS/ANALYTICAL DATA/REMEDIAL EFFORTS
			KNOWN	SUSPECTED	
C-4-001	Potential Release Sites (Soil Contaminatio n Beneath Former Buildings)	Potential soil contamination may be present beneath former buildings TA-4-1, TA-4-2, TA-4-3, TA-4-4, TA-4-5, TA-4-6, TA-4-8, and TA-4-13.	No known releases	Unknown	Sites were surveyed for radioactivity in 1985. No above-background radioactivity was detected.
5-001 (a) (b) (c)	Firing Sites: TA-5-7, TA-5-15, Unnumbered Far-Firing Point.	Steel barricade Firing Pits No. 1 and No. 2, and a third firing pit, were used for implosion test shots at TA-5.	Shrapnel, debris, and depleted uranium were released from test shots into the firing pit and surrounding areas. Some metal debris was contaminated with uranium. Radioactive contamination from uranium used in the test shots was found to a depth of 15 ft.	HE, natural uranium, beryllium, lead, and cadmium were used in test shots and may be present.	Radioactive HE and toxic contamination were not found in a 1959 survey, and a 1976 survey yielded no detectable radioactivity at the pits. In 1985, uranium oxide was visible in an area surrounding the firing pits, and radioactivity at 20 to 40 mR/hr was measured at Firing Pit No. 2. Radioactively contaminated soils were removed in 1985, but there have been no attempts to assess nonradioactive contamination at the site.

TABLE A-1 (continued)

SUMMARY OF ARCHIVAL RELEASE INFORMATION FOR SWMUs REQUIRING SAMPLING

SWMU No.	TYPE	ASSOCIATED STRUCTURES/ DESCRIPTION/ LOCATION	HAZARDOUS CONSTITUENTS RELEASED		ENVIRONMENTAL SURVEYS/ANALYTICAL DATA/REMEDIAL EFFORTS
			KNOWN	SUSPECTED	
5-002	Canyonside Disposal	Located on north-facing slope of Mortandad Canyon, north of the firing pits.	Debris from test shots was bulldozed off the mesa.	Uranium, beryllium, lead, aluminum, cadmium, and HE from test shots may be present.	Visible debris was cleaned up during the 1985 Los Alamos Site Characterization Project (LASCP), but radioactivity was not assessed. There have been no known surveys for radioactive or nonradioactive contamination.
5-003	Calibration Chamber	35-ft-deep shaft, lined with lead bricks, used to calibrate thermoluminescent dosimeters (TLDs).	No known releases	Lead may be present	The chamber was backfilled before 1985; the lead bricks were left in place.
5-004	Decommissioned Septic System TA-5-13	Received waste from the Laboratory Building, TA-5-1; removed before 1985 LASCP; removal confirmed in 1985.	No known releases	Unknown chemicals are suspected	A 1959 survey measured no detectable radiation or HE; also, no radioactivity was detected during 1985 D&D operations.
5-005(a)	French Drain	Ran northward to Mortandad Canyon from the Control Building, TA-5-4.	No known releases	Uranium, and possibly other radionuclides and hazardous chemicals may be present.	Drain and associated soils were removed in 1985. Radioactivity up to 20 mR/hr was detected in 1985 at the former site of the Control Building, and may have been released through the French drain. There have been no known surveys of nonradioactive contamination associated with this outfall.

TABLE A-1 (continued)

SUMMARY OF ARCHIVAL RELEASE INFORMATION FOR SWMUs REQUIRING SAMPLING

SWMU No.	TYPE	ASSOCIATED STRUCTURES/ DESCRIPTION/ LOCATION	HAZARDOUS CONSTITUENTS RELEASED		ENVIRONMENTAL SURVEYS/ANALYTICAL DATA/REMEDIAL EFFORTS
			KNOWN	SUSPECTED	
5-005(b)	Outfall	Served shop and darkroom TA-5-5; located south of Puye Road, south of the former location of TA-5-5.	No known releases	Unknown	Contamination from HE was found in 1959 in the shop served by the outfall. Radioactive and toxic contaminants were not found. There have been no known surveys of radioactive or nonradioactive contamination at this outfall site.
5-006(a)	Soil Contamination Below Former Building TA-5-1	Laboratory Building	No known releases	HE was detected in 1959; whether it is still present at site is unknown.	Contamination from HE found in 1959. No detectable radioactivity was found in surveys in 1959, 1973, 1976, and 1985. Beta-gamma activity of 220 cpm (background 116 cpm) was detected in 1988. Gamma exposure was only slightly above background in 1988. Soils have not been characterized for nonradioactive contamination.

TABLE A-1 (continued)

SUMMARY OF ARCHIVAL RELEASE INFORMATION FOR SWMUs REQUIRING SAMPLING

SWMU No.	TYPE	ASSOCIATED STRUCTURES/ DESCRIPTION/ LOCATION	HAZARDOUS CONSTITUENTS RELEASED		ENVIRONMENTAL SURVEYS/ANALYTICAL DATA/REMEDIAL EFFORTS
			KNOWN	SUSPECTED	
5-006(b)	Soil Contamination Below Former Building TA-5-4	Control Building	No known releases	Uranium oxide, probably from test shot fallout, was visible in the area, but was cleaned up in 1985 LASCP. Metals from test shots may also be in the area.	Radioactivity up to 20 mR/hr was measured at the site in 1985. Beta-gamma activity was measured at 254 cpm (background is 116 cpm) in a 1988 survey. Gamma exposure was essentially at background. There have been no known surveys for nonradioactive contamination.
5-006(c)	Soil Contamination Below Former Building TA-5-5	Shop and darkroom	No known releases	HE and photo-processing chemicals may have been released. HE may no longer exist in that form.	Contamination from HE was found in the shop in 1959. Beta-gamma activity at 228 cpm (background is 116 cpm) was detected in a 1988 survey. Gamma exposure was essentially at background levels. Soils have not been characterized for nonradioactive contamination.
5-006(d)	Soil Contamination Below Former Building TA-5-6	Laboratory Building	No known releases	HE was detected in 1959, but may no longer exist in that form.	Beta-gamma activity at 246 cpm (background is 116 cpm) was measured in a 1988 survey. Gamma exposure was essentially at background. Soils have not been characterized for nonradioactive contamination.

TABLE A-1 (continued)

SUMMARY OF ARCHIVAL RELEASE INFORMATION FOR SWMUs REQUIRING SAMPLING

SWMU No.	TYPE	ASSOCIATED STRUCTURES/ DESCRIPTION/ LOCATION	HAZARDOUS CONSTITUENTS RELEASED		ENVIRONMENTAL SURVEYS/ANALYTICAL DATA/REMEDIAL EFFORTS
			KNOWN	SUSPECTED	
5-006(e)	Soil Contamination Below Former Building TA-5-19	Platform	No known releases	Uranium oxide from test shot fallout was visible in the area and was removed in 1985. Metals from test shots may also be present.	There is no survey data for this structure. Soils have not been characterized for nonradioactive contamination.
5-006 (f) and (g)	Soil Contamination Below Former Buildings TA-5-2 and TA-5-3	Magazines	No known releases	HE was detected at the sites in 1959, but may no longer exist in that form.	In a 1988 survey, beta-gamma activity was measured at 204 and 238 cpm for SWMU Nos. 5-006(f) and 5-006(g), respectively (background is 116 cpm). Gamma exposure was essentially at background for both sites. Soils have not been characterized for nonradioactive contamination.

TABLE A-1 (continued)

SUMMARY OF ARCHIVAL RELEASE INFORMATION FOR SWMUs REQUIRING SAMPLING

SWMU No.	TYPE	ASSOCIATED STRUCTURES/ DESCRIPTION/ LOCATION	HAZARDOUS CONSTITUENTS RELEASED		ENVIRONMENTAL SURVEYS/ANALYTICAL DATA/REMEDIAL EFFORTS
			KNOWN	SUSPECTED	
5-006(h)	Soil Contamination Below Former Building TA-5-9	X-Unit Chamber	Radioactivity up to 40 mR/hr was measured beneath the X-unit chamber in 1985. The contamination was probably from uranium used in test shots.	Metals from firing shots may also be present.	The X-unit chamber was removed, along with affected soil, tuff, and vegetation, in 1985 LASCP. Contaminated materials were removed to a depth of 15 ft, until no further radioactivity was detected. Soil samples were taken to confirm the removal of all radioactivity. Soils have not been characterized for nonradioactive contamination.
C-5-001	Potential Release Sites (soil contamination beneath former buildings)	Potential soil contamination may be present beneath former buildings TA-5-8 and TA-5-21.	No known releases	Unknown	Sites were surveyed for radioactivity in 1985. No above-background radioactivity was detected.

TABLE A-1 (continued)

SUMMARY OF ARCHIVAL RELEASE INFORMATION FOR SWMUs REQUIRING SAMPLING

SWMU No.	TYPE	ASSOCIATED STRUCTURES/ DESCRIPTION/ LOCATION	HAZARDOUS CONSTITUENTS RELEASED		ENVIRONMENTAL SURVEYS/ANALYTICAL DATA/REMEDIAL EFFORTS
			KNOWN	SUSPECTED	
35-001	Material Disposal Area-W (Sodium Disposal Tanks) TA-35-43	Located on south edge of mesa, south of TA-35-2; consists of two vertical tubes filled with contaminated sodium coolant from the Los Alamos Molten Plutonium Reactor Experiment (LAMPRE) reactor.	No known releases	Tanks may have leaked sodium coolant contaminated with radionuclides (^{239}Pu, ^{137}Cs, ^{60}Co, ^{60}Ni, ^{59}Ni, ^{22}Na).	Tops of tanks read 10 mR/hr immediately after emplacement in 1964; site was entombed in concrete in 1980. TLDs measure gamma activity outside the concrete structure as part of Los Alamos National Laboratory (LANL) Environmental Surveillance Program.
35-003 (a-c)	Underground Storage Tanks (USTs) for Radioactive Waste TA-35-4, -5, and -6	Three 600-gal. tanks between TA-35-2 and -7, on the east side of TA-35-3.	No known releases from these USTs, but there is known contamination associated with Phase Separator Pit, 35-003(n).	Tanks handled liquid radioactive waste that contained ^{140}La, ^{140}Ba, ^{137}Cs, ^{90}Sr, ^{89}Sr, ^{90}Y, ^{106}Ru, ^{235}U, and ^{239}Pu. Waste may also have contained solvents and other chemicals.	There have been no known surveys or samples taken from the soils adjacent to or beneath these tanks. Tanks are planned for removal as an institutional corrective measure.

TABLE A-1 (continued)

SUMMARY OF ARCHIVAL RELEASE INFORMATION FOR SWMUs REQUIRING SAMPLING

SWMU No.	TYPE	ASSOCIATED STRUCTURES/ DESCRIPTION/ LOCATION	HAZARDOUS CONSTITUENTS RELEASED		ENVIRONMENTAL SURVEYS/ANALYTICAL DATA/REMEDIAL EFFORTS
			KNOWN	SUSPECTED	
35-003 (d)	Radioactive Waste Holding Tanks TA-35-10	Contained four 50,000-gal. tanks located east of TA-35-7, used for storage and decay of radioactive liquid waste from the radioactive lanthanum project and other projects in TA-35-2.	There were numerous releases of radioactive liquid waste from TA-35-10 to Ten Site Canyon and underlying soils in the 1950s. Known radionuclides released include ^{140}La, ^{137}Cs, ^{90}Sr, ^{239}Pu, ^{90}Y, ^{89}Sr, and ^{140}Ba.	Wastewater released from TA-35-10 may also have included other radionuclides (e.g., ^{235}U) and other hazardous chemicals and solvents.	TA-35-10 was removed in 1985. At that time, 37 of 86 subsurface soil samples collected contained >75 pCi/g beta, with a maximum of 356 pCi/g from $^{90}Sr/^{90}Y$. Most samples were collected from depths of 18 to 20 ft. Soils were removed to this depth. The extent of contamination remaining is unknown.
35-003 (e) (f) (g)	Storage Tank TA-35-36, Flocculator Tank TA-35-37, Regenerant Tank TA-35-38	SWMU No. 35-003(e) was a 25,000-gal. tank east of TA-35-7; SWMU Nos. 35-003(f and g) were at the southeast corner of TA-35-7.	No known releases	Tanks handled liquid radioactive waste that contained ^{140}La, ^{140}Ba, ^{137}Cs, ^{90}Sr, ^{89}Sr, ^{90}Y, ^{106}Ru, ^{235}U, and ^{239}Pu. Waste may also have contained solvents and other chemicals.	The storage tank SWMU No. 35-003(e) was removed in August 1981; the flocculator and regenerant tanks were removed in 1980. No survey or analytical data are available concerning soils beneath these tanks.

TABLE A-1 (continued)

SUMMARY OF ARCHIVAL RELEASE INFORMATION FOR SWMUs REQUIRING SAMPLING

SWMU No.	TYPE	ASSOCIATED STRUCTURES/ DESCRIPTION/ LOCATION	HAZARDOUS CONSTITUENTS RELEASED		ENVIRONMENTAL SURVEYS/ANALYTICAL DATA/REMEDIAL EFFORTS
			KNOWN	SUSPECTED	
35-003 (h)	Retention Tank TA-35-31	Located northeast of TA-35-7, removed in 1984.	No known releases	Tanks handled liquid radioactive waste that contained ^{140}La, ^{140}Ba, ^{137}Cs, ^{90}Sr, ^{89}Sr, ^{90}Y, ^{106}Ru, ^{235}U, and ^{239}Pu. Waste may also have contained solvents and other chemicals.	The tank was removed in 1985; no radioactivity was encountered in soils beneath the tank.
35-003 (i), (j and k)	Surge Tanks TA-35-78, Storage Tanks (aboveground) TA-35-96, and -97	Surge tanks were formerly located near the northwest corner of TA-35-243. Storage tanks were formerly located on the west side of TA-35-29. These tanks were not associated with the wastewater treatment plant.	No known releases	Surge tanks handled manifold gas. Storage tanks are believed to have handled oil. Tanks did not manage radionuclide-contaminated waste.	Surge tanks were relocated to TA-35-27 in 1974. No information is available on their removal. Storage tanks were removed after 1985.

TABLE A-1 (continued)

SUMMARY OF ARCHIVAL RELEASE INFORMATION FOR SWMUs REQUIRING SAMPLING

SWMU No.	TYPE	ASSOCIATED STRUCTURES/ DESCRIPTION/ LOCATION	HAZARDOUS CONSTITUENTS RELEASED		ENVIRONMENTAL SURVEYS/ANALYTICAL DATA/REMEDIAL EFFORTS
			KNOWN	SUSPECTED	
35-003 (l) (q)	Pump Pit TA-35-8, Pipe Trench TA-35-9	Located east of TA-35-7, northwest side of TA-35-10.	No known releases	Structures handled liquid radioactive waste that contained ^{140}La, ^{140}Ba, ^{137}Cs, ^{90}Sr, ^{89}Sr, ^{90}Y, ^{106}Ru, ^{235}U, and ^{239}Pu. Waste may also have contained solvents and other chemicals.	Structures were removed in 1984; no radioactivity was detected at that time.
35-003 (m)	Sludge Tank TA-35-22	Located near the southeast corner of TA-35-7; used for storage of radioactive sludge precipitated chemically from tanks in TA-35-10.	Soils beneath and around sludge tank were contaminated with ^{137}Cs and ^{90}Sr. Cracks in tuff at 10-ft depth also contain beta/gamma activity.	Soils may also be contaminated with other radionuclides (e.g., ^{239}Pu and ^{235}U) and other hazardous chemicals and solvents.	The tank was removed in 1981. Soils beneath and around the tank contained beta-gamma activity up to 46,000 d/m/g from ^{137}Cs and ^{90}Sr. Soils were excavated to a 10-ft depth. Cracks in tuff at 10- ft depth contained gross-beta activity as high as 5,000 pCi/g. Contaminated tuff was left in place and the pit was backfilled.

TABLE A-1 (continued)

SUMMARY OF ARCHIVAL RELEASE INFORMATION FOR SWMUs REQUIRING SAMPLING

SWMU No.	TYPE	ASSOCIATED STRUCTURES/ DESCRIPTION/ LOCATION	HAZARDOUS CONSTITUENTS RELEASED		ENVIRONMENTAL SURVEYS/ANALYTICAL DATA/REMEDIAL EFFORTS
			KNOWN	SUSPECTED	
35-003 (n)	Phase Separator Pit TA-35-3	Located between TA-35-7 and TA-35-2.	The phase separator pit is known to be contaminated with ^{137}Cs and ^{90}Sr.	Soils may also be contaminated with other radionuclides (e.g., ^{239}Pu and ^{235}U) and other hazardous chemicals and solvents.	Surveys conducted in June 1990 found up to 10,000 dpm/60 cm^2 surface radioactivity inside the concrete pit. Pit and contaminated soils are scheduled to be removed as an institutional corrective measure.
35-003 (o)	Manhole TA-35-12	Located near the east wall of TA-35-7.	Gross-beta contamination exists at a 9-ft depth along the east wall of TA-35-7.	Radioactive contamination may be accompanied by hazardous chemicals and solvents.	Manhole and Line 90A were removed in 1985, along with 66 m^3 of soil. 7-nCi/g gross-beta activity was left in place at that time.
35-003 (p)	Air Filter Building TA-35-7	Located east of TA-35-2.	The Air Filter Building is known to have released air contaminated with ^{137}Cs and ^{90}Sr and other radionuclides to the atmosphere.	Ion-exchange columns and tanks located at southeast corner of TA-35-7 may have released radioactive contamination to the soil.	Filters, ion-exchange columns, and piping were removed in 1980. The building was decontaminated at that time.

TABLE A-1 (continued)

SUMMARY OF ARCHIVAL RELEASE INFORMATION FOR SWMUs REQUIRING SAMPLING

SWMU No.	TYPE	ASSOCIATED STRUCTURES/ DESCRIPTION/ LOCATION	HAZARDOUS CONSTITUENTS RELEASED		ENVIRONMENTAL SURVEYS/ANALYTICAL DATA/REMEDIAL EFFORTS
			KNOWN	SUSPECTED	
35-003 (r)	Receiving Canyon	Small tributary of Ten Site Canyon located immediately east of TA-35-7	The canyon is contaminated with radioactivity from spills and releases from TA-35-10 in the 1950s. Known constituents include ^{137}Cs, ^{90}Sr, ^{239}Pu.	The canyon is also suspected of contamination by hazardous chemicals and solvents, and other radionuclides (e.g., ^{235}U).	Numerous surveys and soil sampling efforts have detected radioactivity in the canyon since the 1950s. In 1988, 100 µR/hr activity was detected in the canyon immediately east of the former location of TA-35-10, and 80 µR/hr was detected 50 ft east of there.
35-003 (misc.)	Industrial Waste Lines	Connected various portions of wastewater treatment plant at east end of TA-35.	Trenches from which radioactive liquid waste lines were removed contain up to 1,100-pCi/g gross-beta activity, primarily from $^{90}Sr/^{90}Y$.	Other radionuclides (e.g., ^{235}U and ^{239}Pu), plus solvents and other hazardous chemicals are suspected.	Industrial waste lines were removed in 1981 and 1985. Contaminated soils were removed at that time, but up to 1,100 pCi/g beta activity was left in trenches at depths of 18 to 20 ft.
35-004 (a)	Container Storage Area (active)	Located at east and south sides of TA-35-25.	Stained soils were observed in 1988.	Area is used for storage of oils and solvents.	None

TABLE A-1 (continued)

SUMMARY OF ARCHIVAL RELEASE INFORMATION FOR SWMUs REQUIRING SAMPLING

SWMU No.	TYPE	ASSOCIATED STRUCTURES/ DESCRIPTION/ LOCATION	HAZARDOUS CONSTITUENTS RELEASED		ENVIRONMENTAL SURVEYS/ANALYTICAL DATA/REMEDIAL EFFORTS
			KNOWN	SUSPECTED	
35-004 (b)	Container Storage Area (active)	Located at the northeast corner of TA-35-85.	Stained soils and concrete were observed in 1988.	Area is used for storage of oils, solvents, alcohol, and acetone.	None
35-004 (g)	Container Storage Area (active)	Located at south side of TA-35-67	Stains on asphalt and underlying soils were observed in 1988 and 1991.	Area is used for storage of oils, Freon™, solvents, and vacuum pumps.	Acetone, some metals, and alpha- and gamma-emitters were detected in soil samples collected in 1987.
35-004 (h)	Container Storage Area (inactive)	Formerly located at the northeast corner of TA-35-7, near Manhole TA-35-11.	Stained soils were reported in 1988; no stains were observed in 1991.	Area was reportedly used for storage of oils, solvents, Freon™, and capacitors.	None
35-004 (i)	Container Storage Area (inactive)	Formerly located near the west end of TA-35-244.	No known releases	Area was used for storage of oils, solvents, capacitors, and Freon™.	None
35-004 (j)	Container Storage Area (active)	Located at loading dock on the southwest side of TA-35-128.	Oil stains were observed on asphalt in 1988 and 1991.	Area is used for storage of oils, solvents, capacitors, and Freon™.	None

TABLE A-1 (continued)

SUMMARY OF ARCHIVAL RELEASE INFORMATION FOR SWMUs REQUIRING SAMPLING

SWMU No.	TYPE	ASSOCIATED STRUCTURES/ DESCRIPTION/ LOCATION	HAZARDOUS CONSTITUENTS RELEASED		ENVIRONMENTAL SURVEYS/ANALYTICAL DATA/REMEDIAL EFFORTS
			KNOWN	SUSPECTED	
35-004 (m)	Container Storage Area (inactive)	Located along fence on south side of TA-35-86.	Oil stains were observed on asphalt in 1991.	Area was used for storage of oils, Freon™, and solvents.	None
35-004 (o)	Container Storage Area (active)	Located on north dock, outside TA-35-213.	No known releases	Area is used for storage of solvents and other unspecified chemicals.	None
35-008	Canyonside Area Disposal	Located on north side of TA-35-85.	No known releases	Possibly paint and solvents were released	None
35-009 (a)	Septic System TA-35-14, -15, and -16	Located on the southwest side of TA-35-25; system consisted of a tank, dosing chamber, and distribution box; discharged to a drain field and outfall on south rim of mesa.	No known releases	Possibly industrial wastes, including radionuclides, were released.	None; system was abandoned in 1975.

TABLE A-1 (continued)

SUMMARY OF ARCHIVAL RELEASE INFORMATION FOR SWMUs REQUIRING SAMPLING

SWMU No.	TYPE	ASSOCIATED STRUCTURES/ DESCRIPTION/ LOCATION	HAZARDOUS CONSTITUENTS RELEASED		ENVIRONMENTAL SURVEYS/ANALYTICAL DATA/REMEDIAL EFFORTS
			KNOWN	SUSPECTED	
35-009 (b)	Septic System TA-35-76 and -77	System located south of TA-35-67; consisted of a tank and distribution box; discharged to drainfield and outfall on south rim of mesa.	No known releases	Possibly industrial wastes, including radionuclides, were released.	None; system was abandoned in 1975.
35-009 (c)	Septic System TA-35-44, and -45	System located north of TA-35-2; consisted of a tank and distribution box; discharged to a leach field and two outfalls on north rim of mesa.	No known releases	Possibly industrial wastes, including radionuclides, were released.	None; system was abandoned in 1990.
35-009 (d)	Septic Tank TA-35-65	Located east of TA-35-33; discharged to leach field and outfall in Mortandad Canyon.	No known releases	Possibly industrial wastes, including radionuclides, were released.	None; system was abandoned in 1990.
35-009 (e)	Sanitary Waste Drain Line	Discharged from TA-35-25 to outfall in Ten Site Canyon; status is unknown.	No known releases	Possibly industrial wastes, including radionuclides, were released.	None
35-010 (a-c) (d) (e)	Sanitary Lagoons TA-35-144, -145, -146 Sand Filters, TA-35-215, Discharge Outfall	Located in tributary of Ten Site Canyon approximately 300 feet east of TA-35-7.	No known releases	Possible releases of industrial wastes include radionuclides, solvents, photo-processing chemicals, and other chemicals.	None

TABLE A-1 (continued)

SUMMARY OF ARCHIVAL RELEASE INFORMATION FOR SWMUs REQUIRING SAMPLING

SWMU No.	TYPE	ASSOCIATED STRUCTURES/ DESCRIPTION/ LOCATION	HAZARDOUS CONSTITUENTS RELEASED		ENVIRONMENTAL SURVEYS/ANALYTICAL DATA/REMEDIAL EFFORTS
			KNOWN	SUSPECTED	
35-014 (a)	Soil Contamination from Operational Releases	Soils located along south side of TA-35-2, beneath exhaust stack.	Atmospheric releases of tritium, ^{239}Pu, ^{235}U, ^{90}Sr are known.	No other suspected constituents	No known soil sampling efforts, but peach trees at site indicate very low levels of radionuclide uptake (^{3}H, ^{239}Pu, ^{235}U, ^{90}Sr).
35-014 (b)	Oil Spill	Leaking drum located near the southwest corner of the northeast wing of TA-35-2.	Drum leaked polychlorinated biphenyl (PCB) contaminated oil.	No other suspected constituents	Oil spilled contained 50.4 µg/g PCBs. Drum was removed, but it is not known if all contaminated soil was removed.
35-014 (c)	Oil Spill	Stained area 10 by 20 ft, at southeast corner of TA-35-29.	A release of dielectric oil is visible.	No other suspected constituents	Oil spilled was reportedly PCB-free.
35-014 (d)	Oil Spill	Oil-stained area at southwest corner of TA-35-29.	A release of dielectric oil is visible.	Oil may have contained PCBs.	None
35-014 (e_1)	Oil Spill	Located at mesa edge near the center of the north side of TA-35-85.	A release of dielectric oil is visible.	Oil may have contained PCBs.	Soil samples showed detectable concentrations of PCBs. Stained soils have been bulldozed off the mesa into a dirt pile on the canyon edge. Vegetation beneath the dirt pile is dead.

TABLE A-1 (continued)

SUMMARY OF ARCHIVAL RELEASE INFORMATION FOR SWMUs REQUIRING SAMPLING

SWMU No.	TYPE	ASSOCIATED STRUCTURES/ DESCRIPTION/ LOCATION	HAZARDOUS CONSTITUENTS RELEASED		ENVIRONMENTAL SURVEYS/ANALYTICAL DATA/REMEDIAL EFFORTS
			KNOWN	SUSPECTED	
35-014 (e_2)	Oil Spill	Spills from former Waste Oil Impoundment (SWMU No. 35-005a) into canyon northeast of TA-35-85.	A release of dielectric oil is known.	A possible release of lead and radionuclides is suspected.	Oils spilled from impoundment were sampled in 1988 and were free of PCBs, but contained above-background alpha activity and lead.
35-014 (f)	Oil Spill	Oil-saturated soil located along east side of TA-35-188	A release of dielectric oil is known.	Oil may have contained PCBs.	Soil samples collected in 1990 contained between 2.0-mg/kg and 22,500 mg/kg total petroleum hydrocarbons (TPH). No attempt was made to remediate the site.
35-014 (g_1)	Oil Spill	4-ft-long by 2-ft-wide stain located in the discharge area of the outfall (SWMU No. 35-016[n]) northeast of TA-35-207.	A release of dielectric oil is known.	Oil may have contained PCBs.	None
35-014 (g_2)	Oil Spill	Several small oil stains on asphalt located near fence south of TA-35-86, at former Container Storage Area, (SWMU No. 35-004[m]).	Oil leaks from containers are visible.	Solvents and Freon™ containers, as well as oil, were stored at this site.	None

TABLE A-1 (continued)

SUMMARY OF ARCHIVAL RELEASE INFORMATION FOR SWMUs REQUIRING SAMPLING

SWMU No.	TYPE	ASSOCIATED STRUCTURES/ DESCRIPTION/ LOCATION	HAZARDOUS CONSTITUENTS RELEASED		ENVIRONMENTAL SURVEYS/ANALYTICAL DATA/REMEDIAL EFFORTS
			KNOWN	SUSPECTED	
35-014 (g_3)	Oil Spill	Large stained area located on south rim of mesa, from TA-35-278 and -279 southward into canyon; spill came from tank farm west of TA-35-86 (SWMU No. 35-015(a)).	An oil spill is visible; oils contained PCBs, volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), and radionuclides.	No other suspected constituents.	Metals, PCBs, SVOCs, VOCs, and alpha- and gamma-emitters were detected in samples collected from the spill area in 1987.
35-015 (a)	Decommis-sioned Waste Oil Treatment Facility, TA-35-149, -150, -151, -152, -153, and -154	Formerly located on the west side of TA-35-86; included tanks, grease trap, and oil treatment unit.	Dielectric oils were extensively released from this facility to underlying and surrounding soils.	Spills (SWMU No. 35-014(g_3)) from this facility contained PCBs, VOCs, SVOCs, metals, and alpha- and gamma-emitters. Similar constituents are suspected here.	The facility was removed in 1988 or 1989. It is not known if contaminated soils were removed at that time. Most of the area is now paved with asphalt. It is not known if environmental surveys have been conducted at this site.
35-015 (b)	Decommis-sioned Waste Oil Treatment Facility	Formerly located on the west side of TA-35-29.	Spills of dielectric oil to soils in the area are visible.	PCBs, metals, and radionuclides are suspected.	Radiation surveys in 1988 detected gamma activity 50% above background.

TABLE A-1 (continued)

SUMMARY OF ARCHIVAL RELEASE INFORMATION FOR SWMUs REQUIRING SAMPLING

SWMU No.	TYPE	ASSOCIATED STRUCTURES/ DESCRIPTION/ LOCATION	HAZARDOUS CONSTITUENTS RELEASED		ENVIRONMENTAL SURVEYS/ANALYTICAL DATA/REMEDIAL EFFORTS
			KNOWN	SUSPECTED	
35-016 (a)	Outfall (inactive)	Discharged noncontact cooling water from TA-35-34.	No known releases	Unknown	None
35-016 (b)	Outfall (active)	National pollutant discharge elimination system (NPDES) permitted outfall; discharges photo-processing wastes from TA-35-87. Waste is passed through a silver/cyanide recovery process.	No known releases	Photo-processing chemicals (e.g., silver, cyanide) are susptected	Discharge is sampled according to permit requirements; there are no known soil characterization efforts.
35-016 (c)	Outfalls (inactive)	Two formerly permitted outfalls that discharged noncontact cooling water from TA-35-67.	No known releases	Unknown	None
35-016 (d)	Outfall (inactive)	Formerly permitted outfall that discharged noncontact cooling water from TA-35-46.	No known releases of hazardous constituents	Unknown	None

TABLE A-1 (continued)

SUMMARY OF ARCHIVAL RELEASE INFORMATION FOR SWMUs REQUIRING SAMPLING

SWMU No.	TYPE	ASSOCIATED STRUCTURES/ DESCRIPTION/ LOCATION	HAZARDOUS CONSTITUENTS RELEASED		ENVIRONMENTAL SURVEYS/ANALYTICAL DATA/REMEDIAL EFFORTS
			KNOWN	SUSPECTED	
35-016 (e)	Outfall (inactive)	Formerly permitted outfall that discharged noncontact cooling water from TA-35-85.	No known releases	Unknown	None
35-016 (f)	Storm Drain (active)	Drain discharges storm run-off near TA-35-85.	No known releases	Oil spills containing PCBs have occurred in the source area of this drain (SWMU No. 35-014 (e_1)).	None
35-016 (g)	Outfall (active)	NPDES-permitted outfall that discharges noncontact cooling water from TA-35-213.	No known releases	According to the SWMU report, this outfall is suspected of containing tritium.	Discharge is sampled according to permit requirements; there are no known soil characterization efforts.
35-016 (h)	Storm Drains (active)	Drains discharge storm water and brine from deionizer in TA-35-213.	No known releases	According to the SWMU report, this outfall is suspected of containing tritium.	None
35-016 (i)	Storm Water Discharge Channel (active)	Channel Discharges storm run-off from TA-35 parking lot east of TA-35-85.	No known releases	Unknown	None

TABLE A-1 (continued)

SUMMARY OF ARCHIVAL RELEASE INFORMATION FOR SWMUs REQUIRING SAMPLING

SWMU No.	TYPE	ASSOCIATED STRUCTURES/ DESCRIPTION/ LOCATION	HAZARDOUS CONSTITUENTS RELEASED		ENVIRONMENTAL SURVEYS/ANALYTICAL DATA/REMEDIAL EFFORTS
			KNOWN	SUSPECTED	
35-016 (j)	Storm Drains (active)	Drains discharge runoff and electropolishing wastewater from TA-35-125.	No known releases	Electropolishing chemicals are suspected.	None
35-016 (k)	Outfall (inactive)	Formerly permitted outfall that discharged noncontact cooling water from gas laser TA-35-29.	No known releases	Unknown	None
35-016 (l)	Storm Drains (active)	Drains discharge storm runoff from TA-35-29.	No known releases	Oil spills are present in the source areas for these storm drains.	Concrete catch basins contained 50% above-background gamma radiation in a 1988 survey.
35-016 (m)	Outfall (inactive)	Formerly permitted outfall that discharged treated cooling tower water from TA-35-33.	Water treatment chemicals were released.	No other suspected constituents	None
35-016 (n)	Storm Drains (active)	Drains discharge storm water run-off from TA-35-86.	Dielectric oil spills are present at the outfall and in the source area for these storm drains (SWMU No. 35-014[g]).	PCBs, metals, VOCs, SVOCs, and radionuclides are expected.	None

TABLE A-1 (continued)

SUMMARY OF ARCHIVAL RELEASE INFORMATION FOR SWMUs REQUIRING SAMPLING

SWMU No.	TYPE	ASSOCIATED STRUCTURES/ DESCRIPTION/ LOCATION	HAZARDOUS CONSTITUENTS RELEASED		ENVIRONMENTAL SURVEYS/ANALYTICAL DATA/REMEDIAL EFFORTS
			KNOWN	SUSPECTED	
35-016 (o)	Storm Drains (active)	Drains discharge into Mortandad Canyon at the north edge of the mesa, north of TA-35-2.	No known releases	Storm drains are suspected of receiving industrial wastewater from floor drains in TA-35-2, including radionuclides and PCB-contaminated oil.	None
35-016 (p)	Outfall (active)	Unpermitted outfall that discharges noncontact cooling water from TA-35-27.	No known releases	Unknown	None
35-016 (q)	Storm Water Collection Basins	Located on south rim of mesa, south of TA-35-34.	SVOCs, PCBs, metals, and radionuclides exist	No other constituents	PCBs, metals, SVOCs, and alpha- and gamma-emitters were detected in 1987 in a U.S. Department of Energy (DOE) Environmental Survey.
35-017	Soil Contamination from Reactor Operations	Los Alamos Power Reactor Experiment (LAPRE) I and Los Alamos Molten Plutonium Reactor Experiment (LAMPRE) reactors were in the basement of TA-35-2 at the south side of the building.	"Enriched uranium soup" was spilled at the canyon edge in 1956 from the LAPRE I reactor.	No other constituents	Surveys in 1956 indicated alpha, beta, and gamma activity from ^{235}U. Most activity had decayed away within six months.

TABLE A-1 (continued)

SUMMARY OF ARCHIVAL RELEASE INFORMATION FOR SWMUs REQUIRING SAMPLING

SWMU No.	TYPE	ASSOCIATED STRUCTURES/ DESCRIPTION/ LOCATION	HAZARDOUS CONSTITUENTS RELEASED		ENVIRONMENTAL SURVEYS/ANALYTICAL DATA/REMEDIAL EFFORTS
			KNOWN	SUSPECTED	
35-018 (a)	Leaking PCB Transformer	Transformer is located at station TA-35-32 near the southwest corner of TA-35-29.	PCB-oil leaked from the transformer onto concrete pad.	PCBs in soils at the base of transformer pad are suspected	None
35-018 (b)	Leaking PCB Transformer	Formerly located in the basement of TA-35-2.	Transformer leaked PCB-oil in basement, but there are no known releases to the environment.	Transformer was found to be contaminated with plutonium (source unknown).	Transformer was removed in August 1991.
35-C-001 35-C-002	USTs for Diesel Fuel TA-35-18, and -19	Located near the southeast corner of TA-35-2.	No known releases	Diesel fuel is suspected.	Tanks were removed in 1988. There was no visible evidence of contamination. It is not known if soil samples were collected at that time. Soils in the vicinity of these tanks may have been excavated in 1991 during the LAPRE II removal project.
35-C-003	UST for Fuel Oil TA-35-20	Located on the north side of the south wing of TA-35-2.	No known releases	Fuel oil is suspected.	Tank was removed in 1988 with no visible evidence of contamination. It is not known if samples were collected at that time.

TABLE A-1 (continued)

SUMMARY OF ARCHIVAL RELEASE INFORMATION FOR SWMUs REQUIRING SAMPLING

SWMU No.	TYPE	ASSOCIATED STRUCTURES/ DESCRIPTION/ LOCATION	HAZARDOUS CONSTITUENTS RELEASED		ENVIRONMENTAL SURVEYS/ANALYTICAL DATA/REMEDIAL EFFORTS
			KNOWN	SUSPECTED	
35-C-004	Oil Spill	Located south of TA-35-125, through storm water drain into canyon.	Shell Dela dielectric oil is known.	No other suspected constituents	Spill was cleaned up with absorbent materials. Analyses of oil indicated PCB concentration was below detection limit.
35-C-007	Spill	Vegetation kill reported east of TA-35 near sanitary lagoons.	Known release, but composition of substance is unknown.	Unspecified chemicals are suspected.	Samples were collected; however, no record of corrective action or analytical results is available.
42-001 (a)	Incinerator	Formerly located at the north side of TA-42-1; used from 1951 to 1952 to reduce the volume of radionuclide-contaminated waste; associated parts included the dust collector, Venturi scrubber, ash separator, and exhaust stack.	No known releases	Radionuclides and other hazardous constituents may have been released to the atmosphere because of problems with the incinerator's off-gas cleanup system.	The incinerator underwent decontamination and decommissioning (D&D) in 1978. Soil samples collected in 1991 at the former incinerator site indicated background levels of alpha, beta, and gamma radiation. VOCs, SVOCs, and PCBs were not detected. Toxic characteristic leaching procedure (TCLP) metals were below US Environment Protection Agency (EPA) guidelines.

TABLE A-1 (continued)

SUMMARY OF ARCHIVAL RELEASE INFORMATION FOR SWMUs REQUIRING SAMPLING

SWMU No.	TYPE	ASSOCIATED STRUCTURES/ DESCRIPTION/ LOCATION	HAZARDOUS CONSTITUENTS RELEASED		ENVIRONMENTAL SURVEYS/ANALYTICAL DATA/REMEDIAL EFFORTS
			KNOWN	SUSPECTED	
42-001 (b) (c)	Ash Holding Tanks TA-42-2, TA-42-3	Formerly located north of TA-42-1 near the canyon edge; used to hold ash and sludge that remained after incineration; underground pipes connected these tanks to TA-42-1.	No known releases from SWMU No. 42-001(b); soils beneath SWMU No. 42-001(c) contained gross-alpha activity that exceeded DOE guidelines (see Environmental Surveys column). Alpha activity is primarily from ^{239}Pu.	No other suspected constituents are.	When the ash holding tanks underwent D&D in 1978, tank SWMU No. 42-001(b) was found to contain dry sludge with 130-nCi/g ^{239}Pu. Wet sludge in SWMU No. 42-001(c) contained 1,000 nCi/g ^{239}Pu. Soil samples collected from the area of SWMU No. 42-001(c) in 1991 reported background levels of beta and gamma activity. Surface soils contained alpha activity at 59 to 97 pCi/g, and subsurface alpha activity was found to be >75 pCi/g. PCBs and TCLP metals were below EPA guidelines. No VOCs or SVOCs were detected.

TABLE A-1 (continued)

SUMMARY OF ARCHIVAL RELEASE INFORMATION FOR SWMUs REQUIRING SAMPLING

SWMU No.	TYPE	ASSOCIATED STRUCTURES/ DESCRIPTION/ LOCATION	HAZARDOUS CONSTITUENTS RELEASED		ENVIRONMENTAL SURVEYS/ANALYTICAL DATA/REMEDIAL EFFORTS
			KNOWN	SUSPECTED	
42-002 (a, and b)	Decontamination Facilities	TA-42-1 was used from 1957 to 1969 as a site to decontaminate equipment. Objects too large to be decontaminated in TA-42-1 were cleaned at the end of the asphalt driveway outside TA-42-1.	Wastewater containing radionuclides, solvents, and acids entered the septic system that served TA-42-1. Similar constituents washed down the embankment on the northwest side of the parking lot on the west side of TA-42-1.	No other suspected constituents.	TA-42-1 underwent D&D in 1978. At that time, there were no attempts to assess or clean up contamination at the former parking lot area. Soil samples collected in 1991 contained gross-beta and gamma activity and VOCs below detection limits. SVOCs and PCBs were below EPA guidelines. Gross-alpha activity exceeded DOE guidelines values at 61 to 130 pCi/g.
42-003	Septic System TA-42-4	Located northeast of TA-42-1; consisted of septic tank, drain line from TA-42-1, filter trench, tile drain field, and an outfall into Mortandad Canyon.	Liquid waste containing plutonium, uranium, and associated fission products, tritium, solvents, acids, and greases was released to and discharged from this septic system.	No other suspected constituents.	1991 soil samples collected at 10-, 15-, 20-, and 25-ft-below tank gross contained alpha activity <75 pCi/g; gross-beta and gamma activity were at background. VOCs and PCBs were not detected, SVOCs were below EPA guidelines.

TABLE A-1 (continued)

SUMMARY OF ARCHIVAL RELEASE INFORMATION FOR SWMUs REQUIRING SAMPLING

SWMU No.	TYPE	ASSOCIATED STRUCTURES/ DESCRIPTION/ LOCATION	HAZARDOUS CONSTITUENTS RELEASED		ENVIRONMENTAL SURVEYS/ANALYTICAL DATA/REMEDIAL EFFORTS
			KNOWN	SUSPECTED	
48-001	Air Exhaust System	Several exhaust hoods in TA-48-1 are connected to a central exhaust system. Exhaust is routed through a Venturi scrubber system before atmospheric release. Poor performance of the Venturi system along with operation of the system with clogged or missing filters led to release of improperly filtered exhaust.	Hydrochloric, hydrofluoric, nitric, and perchloric acids, plus pCi to µCi levels of plutonium, uranium, and mixed fission products were released.	No other suspected constituents	Surface and subsurface soil samples collected in 1991 from two areas near TA-48-1 (one on the northwest side and one on the east side) were analyzed for gross-alpha, -beta, and -gamma activity, TCLP metals, VOCs, SVOCs, and PCBs. All constituents were at background or below DOE guidelines except alpha activity. Gross-alpha activity, up to 45 pCi/g, was detected in surface soils on the east side of TA-48-1.
48-002 (a)	Container Storage Area (inactive)	200 flasks of mercury were stored at this area on the south side of TA-48-1; flasks were removed in 1989.	No known releases are suspected.	Mercury, possibly contaminated with radionuclides, is suspected.	None
48-002 (b)	Container Storage Area (inactive)	Unlabeled drums were stored at a loading dock on the south side of TA-48-1. All materials were removed before a 1991 Environmental Restoration (ER) Program site visit.	Spills and leaks from drums (contents unknown) were noted in 1988.	Unspecified chemicals, solvents, oils are suspected.	Spills were reported in the area (1988).

TABLE A-1 (continued)

SUMMARY OF ARCHIVAL RELEASE INFORMATION FOR SWMUs REQUIRING SAMPLING

SWMU No.	TYPE	ASSOCIATED STRUCTURES/ DESCRIPTION/ LOCATION	HAZARDOUS CONSTITUENTS RELEASED		ENVIRONMENTAL SURVEYS/ANALYTICAL DATA/REMEDIAL EFFORTS
			KNOWN	SUSPECTED	
48-002 (c)	Container Storage Area (active)	Drums, lead pigs, and batteries were stored on the asphalt on the east side of TA-48-1. Only a few batteries remained in 1991; no drums remain on site.	No known releases	Unspecified chemicals, decontamination waste, pump oils, metals, and radionuclides are suspected.	There are no known surveys of this immediate area. Soil samples collected in 1991 from a site on the east side of this storage area yielded above-background alpha activity (up to 45 pCi/g) as the only hazardous constituent.
48-002 (e)	Container Storage Area (inactive)	Former satellite storage area located on the east side of TA-48-1; removed in 1989 or 1990.	No known releases	VOCs and SVOCs from waste solvents and cutting oils, possibly contaminated with metals and radionuclides are suspected	There are no known analytical surveys of this area. Rust stains were noted on the pavement in 1991. Surface soil samples collected in 1991 from a site on the east side of TA-48-1 contained above-background alpha activity (up to 45 pCi/g) as the only hazardous constituent.
48-003	Septic System TA-48-5 and -6	Inactive septic system formerly located northeast of TA-48-1, under present site of TA-48-44; formerly used for disposal of sanitary waste from TA-48-1.	No known releases	Hazardous chemicals and radionuclides may have been released to this system from TA-48-1.	System was decommissioned in 1986. 14-mR/hr gamma activity was detected 3 ft from the surface of the former filter bed in 1988.

TABLE A-1 (continued)

SUMMARY OF ARCHIVAL RELEASE INFORMATION FOR SWMUs REQUIRING SAMPLING

SWMU No.	TYPE	ASSOCIATED STRUCTURES/ DESCRIPTION/ LOCATION	HAZARDOUS CONSTITUENTS RELEASED		ENVIRONMENTAL SURVEYS/ANALYTICAL DATA/REMEDIAL EFFORTS
			KNOWN	SUSPECTED	
48-005	Industrial Waste Lines	Waste lines 34, 36, 37, 38, 39, 40, and 41 carried liquid waste from TA-48-1 to TA-45 before the opening of TA-50.	A release of radioactive liquid waste from a broken line at the northwest corner of TA-48-1 was documented in 1982.	Acids, radionuclides, and other hazardous chemicals and solvents may have leaked from the lines. Line 37 had an outfall into Mortandad Canyon north of the northwest corner of TA-48-1.	All sections of industrial waste lines outside the TA-48 fence were removed in 1981 and 1984. Sections inside the fence remain at depths of 10 to 11 ft. Soils in the line trenches were monitored for radioactivity only at that time. The extent of hazardous chemical contamination has not been assessed.
48-006	Septic System TA-48-32	Two active 1,000-gallon tanks northwest of TA-48-29, outside the TA-48 fence; serve 6 transportable office trailers.	No known releases	No other suspected constituents.	None
48-007 (a)	Outfall (active)	NPDES-permitted outfall that discharges treated cooling water from two towers on TA-48-1; discharges into surface impoundment on the east side of TA-48 (SWMU No. 48-010).	Water treatment chemicals (biocide, and corrosion and scale inhibitors) are known to have been released.	No other suspected constituents	Discharge is sampled according to permit requirements. There are no known soil sampling efforts.

TABLE A-1 (continued)

SUMMARY OF ARCHIVAL RELEASE INFORMATION FOR SWMUs REQUIRING SAMPLING

SWMU No.	TYPE	ASSOCIATED STRUCTURES/ DESCRIPTION/ LOCATION	HAZARDOUS CONSTITUENTS RELEASED		ENVIRONMENTAL SURVEYS/ANALYTICAL DATA/REMEDIAL EFFORTS
			KNOWN	SUSPECTED	
48-007 (b)	Outfall (active)	NPDES-permitted outfall that discharges noncontact cooling water into Mortandad Canyon on the north side of TA-48-1.	No known release of hazardous constituents	Unknown	Discharge is sampled according to permit requirements. There are no known soil sampling efforts.
48-007 (c)	Outfall (active)	NPDES-permitted outfall that discharges noncontact cooling water into Mortandad Canyon on the north side of TA-48-1.	No known releases	Unknown	Discharge is sampled according to permit requirements. There are no known soil sampling efforts.
48-007 (d)	Outfall (active)	Newly permitted NPDES outfall that discharges noncontact cooling water from TA-48-1 into the surface impoundment on the east side of TA-48 (SWMU No. 48-010).	No known releases	Unknown	Discharge is sampled according to permit requirements. There are no known soil sampling efforts.
48-007 (e)	Outfall (inactive)	Formerly permitted outfall that discharged noncontact cooling water from TA-48-8 into Mortandad Canyon northwest of TA-48-1.	No known releases	Possible release of hazardous chemicals and solvents (alcohol, acetone, benzene) is suspected.	There are no known sampling efforts.

TABLE A-1 (continued)

SUMMARY OF ARCHIVAL RELEASE INFORMATION FOR SWMUs REQUIRING SAMPLING

SWMU No.	TYPE	ASSOCIATED STRUCTURES/ DESCRIPTION/ LOCATION	HAZARDOUS CONSTITUENTS RELEASED		ENVIRONMENTAL SURVEYS/ANALYTICAL DATA/REMEDIAL EFFORTS
			KNOWN	SUSPECTED	
48-007 (f)	Outfall (active)	NPDES-permitted outfall that discharges noncontact cooling water from TA-48-46 into Mortandad Canyon.	No known releases	Unknown	Discharge is sampled according to permit requirements. There are no known soil sampling efforts.
48-009	Soil Contamination from Air Compressor	Crankcase oil is released from a compressor located on the east side of TA-48-1. Trail of oil-stained asphalt extends about 40 ft eastward toward a run-off channel.	The release of 2 to 3 gal. of crankcase oil every 2 to 3 months since 1989 is known	No other suspected constituents	Oil was sampled in 1989 and did not contain PCBs.
48-010	Surface Impoundment	An unlined pond excavated into tuff east of TA-48-1 receives cooling water from two outfalls, SWMU Nos. 48-007(a) and 48-007(d). Water comes from TA-48-1 and is discharged into a tributary of Mortandad Canyon.	Pond receives and discharges water treatment chemicals (biocide, and scaling and corrosion inhibitors) from outfall SWMU No. 48-007(a).	Pond may also have received radionuclides and hazardous chemicals from storm run-off from paved area on east side of TA-48-1. Run-off from container storage areas (SWMU Nos. 48-002[c and e]) may also enter the pond.	Extent of contamination has not been characterized.

TABLE A-1 (continued)

SUMMARY OF ARCHIVAL RELEASE INFORMATION FOR SWMUs REQUIRING SAMPLING

SWMU No.	TYPE	ASSOCIATED STRUCTURES/ DESCRIPTION/ LOCATION	HAZARDOUS CONSTITUENTS RELEASED		ENVIRONMENTAL SURVEYS/ANALYTICAL DATA/REMEDIAL EFFORTS
			KNOWN	SUSPECTED	
48-011	Shaft Containing Lead Shield	A 2-by-3-ft stainless-steel cylinder filled with lead was accidentally dropped down a 3-ft-diameter, 65-ft-deep shaft in 1976 or 1977.	No known releases	Inorganic lead is suspected.	Numerous attempts to remove the cylinder failed. Stainless-steel casing may have broken open on impact and is a possible source of lead contamination.
52-001 (a)	Filter Pit TA-52-14	Located on the east side of TA-52-1; formerly contained high efficiency particulate air (HEPA) and charcoal filter banks to remove radionuclides from helium reactor coolant.	No known releases	Mixed fission products and ^{60}Co are suspected.	1988 documentation indicates that the filter pit was contaminated beyond residual radioactivity guidelines. In 1989, the inside of the pit was decontaminated below residual guidelines and backfilled. It is not known if soils beneath the pit were sampled or removed.
52-001 (b) (c)	Heat Dump Building TA-52-15 Heat Dump Pad TA-52-16	Located near the southeast corner of TA-52-1; housed fans and coils for cooling the secondary reactor coolant	No known releases	Mixed fission products are suspected.	A 1988 Ultra-High-Temperature Reactor Experiment (UHTREX) radiological characterization indicated radioactivity did not exceed background. In 1989, radiation levels were found to exceed background levels. The Heat Dump Building and Pad were removed in 1989. Surveys conducted during removal detected no above-background radiation.

TABLE A-1 (continued)

SUMMARY OF ARCHIVAL RELEASE INFORMATION FOR SWMUs REQUIRING SAMPLING

SWMU No.	TYPE	ASSOCIATED STRUCTURES/ DESCRIPTION/ LOCATION	HAZARDOUS CONSTITUENTS RELEASED		ENVIRONMENTAL SURVEYS/ANALYTICAL DATA/REMEDIAL EFFORTS
			KNOWN	SUSPECTED	
52-002 (a)	Septic System TA-52-3	Active system consisting of a tank and distribution box located on the north side of Puye Road, north of TA-52-1; installed in 1965 to serve UHTREX facility.	No known releases	Solvents, chemicals, and radionuclides may have been released to the system from TA-52-1.	The area did not exceed background levels for radiation in a 1988 survey; there are no known soil characterization surveys.
52-002 (b)	Septic System TA-52-34(a and b) TA-52-97, and TA-52-98	Active system consists of four tanks and a seepage pit near Cañada del Buey, south of TA-52-44 and -45. Tanks are routinely pumped.	No known releases	No suspected constituents	The area did not exceed background radiation levels in a 1988 survey; there are no known soil characterization surveys.
52-002 (f)	Septic System TA-52-99	Active system consists of a tank and seepage pit on the southeast side of TA-52-36. Tanks are pumped routinely.	No known releases	No suspected constituents	The area did not exceed background radiation levels in a 1988 survey; there are no known soil characterization surveys.

TABLE A-1 (continued)

SUMMARY OF ARCHIVAL RELEASE INFORMATION FOR SWMUs REQUIRING SAMPLING

SWMU No.	TYPE	ASSOCIATED STRUCTURES/ DESCRIPTION/ LOCATION	HAZARDOUS CONSTITUENTS RELEASED		ENVIRONMENTAL SURVEYS/ANALYTICAL DATA/REMEDIAL EFFORTS
			KNOWN	SUSPECTED	
52-003 (a)	Waste Treatment Facility and Pumping Station	Facility was located on the north side of Puye Road, north of TA-52-1. Liquid waste from TA-52-1 entered the facility through Line 66 and was transported from the treatment facility to TA-50 by Line 65. The facility included several tanks that were used for neutralization of industrial waste.	No known releases	Radionuclides, acids, and other chemicals in the waste stream from the UHTREX facility may have leaked from the facility.	The building, all tanks, and industrial waste lines were removed in 1989. The area was excavated to solid tuff and backfilled. The results of soil samples collected from the site of TA-52-2 are not yet available. Soil samples collected along waste line 65 did not exceed background for beta-gamma activity, but 12 samples did exceed DOE guidelines values for alpha activity. Concentrations of several metals (Ba, Cr, Mg, Ni, V, and Zr) were above background levels.
C-52-001 C-52-002	Soil Contamination from Transformer Substation, TA-52-9	Located near TA-52-10 on north side of Puye Road.	Oil stains were observed on the concrete substation pad, but there have been no known releases to surrounding soils.	PCBs may be present on concrete pad and surrounding soils.	No active leaks were observed during inspection in 1985. There have been no known soil sampling efforts.

TABLE A-1 (continued)

SUMMARY OF ARCHIVAL RELEASE INFORMATION FOR SWMUs REQUIRING SAMPLING

SWMU No.	TYPE	ASSOCIATED STRUCTURES/ DESCRIPTION/ LOCATION	HAZARDOUS CONSTITUENTS RELEASED		ENVIRONMENTAL SURVEYS/ANALYTICAL DATA/REMEDIAL EFFORTS
			KNOWN	SUSPECTED	
55-002 (c)	Radioactive Waste Container Storage Area (active)	Outdoor storage area located southwest of TA-55-4.	No known releases	Transuranic (TRU) solid waste and radioactive liquid waste are suspected.	No known environmental surveys have been conducted.
55-009	Monitoring Sump TA-55-71	Located outside on northeast side of TA-55; formerly used to monitor sanitary waste from TA-55 for radionuclide content before treatment at TA-35 lagoons.	No known releases	Chemicals and solvents	There are no known environmental surveys. Radionuclides were never detected in the waste stream by the monitoring device.
55-011 (a-e)	Drains and Outfalls TA-55-79, -82, -83, -78 and -81	Catch basins, drains,and outfalls around perimeter of TA-55.	No known releases	TRU radionuclides, solvents, and metals are suspected.	In 1984 and 1985, composite samples were collected, during a pre-operational survey, from each suspected outfall and analyzed for PCBs, some organic compounds, metals, and radioactive contaminants. None were detected.
63-001(a) (52-002 [e]) is the same SWMU)	Septic System TA-63-12	Active system consisting of a tank and seepage pit is located near the northeast corner of TA-63-3. Tank is pumped regularly.	No known releases	Hazardous chemicals and solvents may have been released to the system from shops at TA-63.	No known environmental surveys have been conducted at TA-63.

TABLE A-1 (concluded)

SUMMARY OF ARCHIVAL RELEASE INFORMATION FOR SWMUs REQUIRING SAMPLING

SWMU No.	TYPE	ASSOCIATED STRUCTURES/ DESCRIPTION/ LOCATION	HAZARDOUS CONSTITUENTS RELEASED		ENVIRONMENTAL SURVEYS/ANALYTICAL DATA/REMEDIAL EFFORTS
			KNOWN	SUSPECTED	
63-001 (b)	Septic System TA-63-14	Active system consisting of a tank and seepage pit is located at the northeast corner of TA-63-1. Tank is pumped regularly.	No known releases	Hazardous chemicals and solvents may have been released to the system from shops at TA-63.	No known environmental surveys have been conducted at TA-63.
63-002	Container Storage Area (active)	Located on gravel area within fence east of TA-62-4.	No known releases	Drums of solvents, chemicals, and Methyl Ethyl Ketone (MEK) are stored here.	None

APPENDIX B

OPERABLE UNIT 1129
FIELD OPERATIONS PLAN

for the

LOS ALAMOS NATIONAL LABORATORY
ENVIRONMENTAL RESTORATION PROGRAM

1.0 INTRODUCTION

This plan includes procedural information that will be used during the field investigation of Operable Unit (OU) 1129. The information is intended to assist field personnel and promote consistency between field teams and tasks. Table B-1 contains a listing of the Los Alamos National Laboratory Environmental Restoration Program Standard Operating Procedures (LANL-ER-SOPs) that are applicable to the OU 1129 sampling and analysis program. Field personnel will be familiar with the SOPs applicable to their sampling and analysis plans (SAPs), and all SOPs in Section .01 of the LANL-ER-SOPs (i.e., SOP-01.XX) before field investigation. Table B-2 provides the subsections of the SWMU Aggregate SAPs within Chapter 7.0 of the Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) Work Plan for OU 1129.

TABLE B-1

ENVIRONMENTAL RESTORATION STANDARD OPERATING PROCEDURES (SOPs) APPLICABLE TO THE OU 1129 SAMPLING AND ANALYSIS PROGRAM

SOP NUMBER	TITLE
SOP-01.01	General Instructions for Field Investigations
SOP-01.02	Sample Containers and Preservation
SOP-01.03	Handling, Packaging, and Shipping of Samples
SOP-01.04	Sample Control and Field Documentation
SOP-01.05	Field Quality Control Samples
SOP-01.06	Management of RFI-Generated Waste
SOP-02.07	General Equipment Decontamination
SOP-02.11	Training and Medical Surveillance (To Be Written)
SOP-03.02	General Surface Geophysics (To Be Written)
SOP-03.03	Soil Gas Sampling (To Be Written)
SOP-04.01	Drilling Methods and Drill Site Management
SOP-04.03	Test Pit Logging, Mapping, and Sampling
SOP-06.03	Sampling for Volatile Organics
SOP-06.09	Spade and Scoop Method for Collection of Soil Samples
SOP-06.10	Hand Auger and Thin-Wall Tube Sampler
SOP-06.13	Surface Water Sampling
SOP-06.14	Sediment Material Collection
SOP-06.15	Coliwasa Samples for Liquids and Slurries
SOP-06.18	Collection of Sand, Packed Powder, or Granule Samples Using the Hand Auger
SOP-06.19	Weighted Bottle Sampler for Liquids and Slurries in Tanks
SOP-10.01	Screening of PCBs in Soil
SOP-10.02	Portable GC for Field Screening of VOCs (DRAFT)
SOP-10.03	Portable GC/MS for Field Screening
SOP-12.01	Field Logging, Handling, and Documenting Borehole Samples

TABLE B-2

LOCATIONS OF SWMU OR SWMU AGGREGATE SAPs IN THE OU 1129 RFI WORK PLAN

SWMU Aggregate	SWMUs Within Aggregate	SAP Phase	SAP Subsection
A	4-001 and 4-002	I	7.5
B	5-001(a,b) and 5-002	I	7.6
C	5-004 and 5-005(a)	I	7.7
D	35-003(a-i), 35-003(r), and 35-003(misc)	I	7.8
E	35-008	I	7.9
F	35-009(a-d)	I	7.10
G	35-010(a-e)	I	7.11
H	35-014(a,b)	I	7.12
I	35-003(j,k), 35-014(d), 35-015(a), and 35-015(b)	I	7.13
J	42-001(a-c), 42-002(a-b), and 42-003	I	7.14
K	48-001	I	7.15
L	48-002(a,b)	I	7.16
M	48-003	I	7.17
N	48-005	I	7.18
O	52-002(a) and 52-003(a)	I	7.19
P	63-001(a,b)	I	7.20

2.0 GENERAL FIELD OPERATIONS AND SAMPLING METHODS

2.1 Level I Field Screening

Level I data collection includes field screening for initial site characterization and monitoring for health and safety (H&S) purposes using portable instruments.

The Radiation Protection and Industrial Hygiene groups (HS-1 and HS-5, respectively) at Los Alamos National Laboratory (the Laboratory) will provide instrumentation required for Level I field screening and H&S monitoring. These groups will provide an operator who will be responsible for the calibration and maintenance of the instruments. The operator will also ensure that the calibration equipment and operating manuals are readily available because some field instruments must be calibrated each time they are turned on. The Field Team Leader (FTL) should contact HS-1, HS-5, or both to acquire the appropriate instrumentation to be used at a specific site before the implementation of the field work (LANL 1991, 0411).

2.2 Soil/Rock Field Sampling Methods

Soil and rock samples are obtained using a variety of equipment. The proper equipment to be used is specified in the individual SAPs and was chosen on the basis of the site conditions and data objectives.

Chapter 7.0, Sampling and Analysis Plans, in the OU 1129 RFI Work Plan, contains tables entitled, "Phase I Sample Summary," that provide information on the sampling and analysis and quality assurance/quality control (QA/QC) program. Chapter 7.0 should be consulted before the field investigation and will be a useful reference for field personnel during the actual field investigation.

Soil samples will be prepared in accordance with LANL-ER-SOPs 01.02, "Sample Containers and Preservation;" 01.03, "Handling, Packaging, and Shipping of Samples;" 04.01, "Drilling Methods and Drill Site Management;" 04.03, "Test Pit Logging, Mapping, and Sampling;" 06.10, "Hand Auger and Thin-Wall Tube Sampler;" and 06.18, "Collection of Sand, Packed Powder, or Granule Samples Using the Hand Auger" (LANL 1991, 0411).

The following subsections describe the types of equipment that will be used to investigate soil and rock at OU 1129.

2.2.1 Stainless-Steel Trowel

A stainless-steel trowel is used to obtain shallow samples from the surface of the soil or from soil-sampling equipment in the following manner:

- Homogenize entire sample in a stainless-steel mixing bowl with the stainless-steel trowel, using the procedure described in Section 5.1, Duplicate Samples.
- Place equal portions into sample containers.
- Handle, package, and ship sample as specified in Section 4.0, Equipment Decontamination, of this plan and LANL-ER-SOP-01.03, "Handling, Packaging, and Shipping of Samples."
- Discard sample waste as specified in LANL-ER-SOP-01.06, "Management of RFI-Generated Waste."
- Consult LANL-ER-SOP-04.01, "Drilling Methods and Drill Site Management," for information on proper site preparation and borehole abandonment, if applicable.

2.2.2 Hollow-Stem Auger/Split-Spoon Sampler

Split-spoon sampling is a sampling method used with auger drilling. The procedure for drilling using a hollow-stem auger is described in detail in LANL-ER-SOP-04.01, "Drilling Methods and Drill Site Management."

A hollow-stem auger is used to advance the borehole to the top of the interval from which soil samples are obtained with a split-spoon sampler. The split-spoon sampler can be used to obtain a soil sample that is 1.5 in. in diameter by a maximum of 1.5 ft in length, depending on recovery. If the sample recovery is insufficient to provide adequate sample volume, additional samples must be obtained before drilling. Blow counts for 6-in. intervals must be recorded as described in LANL-ER-SOP-04.01. The split-spoon method is preferred to obtain relatively undisturbed or "grab" samples of the soil. Samples can be obtained from any depth, starting at the surface.

Once the split-spoon sampler is recovered from the borehole, the following procedure is used for recovering samples from the split-spoon sampler:

- Record all the information specified in Section 4.3, Decontamination of Sampling Equipment for Radionuclides.
- Screen samples immediately upon opening the sampler with the instruments specified in the SAPs, and record on boring log. The information can provide a real-time contamination profile and is required to monitor H&S.
- Remove samples from the split spoon and homogenize entire sample in a stainless-steel mixing bowl with a stainless-steel trowel, using the procedure described in Section 5.1, Duplicate Samples.
- Place equal portions into sample containers.
- Handle, package, and ship sample as specified in Section 3.0 of this plan, and LANL-ER-SOP-01.03, "Handling, Packaging, and Shipping of Samples."
- Discard sample waste as specified in LANL-ER-SOP-01.06, "Management of RFI-Generated Waste."
- Consult LANL-ER-SOP-04.01 "Drilling Methods and Drill Site Management" for information on proper site preparation and borehole abandonment.

2.2.3 Hand Auger

Hand augers are useful for sampling most types of soil, except cohesionless material, gravelly, or very compacted soils. The depth limitation for hand auger sampling is 5 ft. Hand augers are useful for sampling locations in which a drill rig cannot be used. However, this method of sampling is not recommended if volatile organic compounds (VOCs) in the soil are a concern because disturbance of the soil through the augering action can result in the loss of any VOCs present to the atmosphere. In addition, the sample acquired from an auger is not a discrete sample, but a composite, i.e., the sample is mixed soil from different depths within the borehole.

Hand augers must be constructed of stainless steel (and cannot be coated or painted) to reduce the chance for false positive analyses and for ease of decontamination. The auger can be used to penetrate soil or retrieve soil from a shallow borehole. Once the hand auger is recovered from the borehole, the following

procedure is used to collect the sample (refer to LANL-ER-SOP-06.10, "Hand Auger and Thin-Wall Tube Sampler," for this sampling procedure in more detail).

- Place the soil in a stainless-steel mixing bowl.
- Homogenize the sample with a stainless-steel trowel (see Section 5.1, Duplicate Samples).
- Place equal amounts of the sample in appropriate sample containers.
- Refer to LANL-ER-SOP-01.03, "Handling, Packaging, and Shipping of Samples."
- Discard all excess sample material in accordance with LANL-ER-SOP-01.06, "Management of RFI-Generated Waste."

2.2.4 Test Pitting/Trenching

Test pits or trenches are used for exploratory work in areas in which active utilities are not present. This method is useful to obtain a picture of the soil profile and investigate the contents of the soil horizon to determine effectiveness of previous decontamination efforts. The procedure for this method is as follows:

- Obtain samples for metals and radionuclide analyses from either the floor or wall of the trench (only if the trench is less than 4 ft deep because of safety considerations), or from the soil brought to the surface by the backhoe bucket.
- Log and sample test pits according to methods provided in LANL-ER-SOP-04.03, "Test Pit Logging, Mapping, and Sampling."
- Package and handle the samples as indicated in LANL-ER-SOP-01.03, "Handling, Packaging, and Shipping of Samples."

2.2.5 Split-Barrel Core Sampler

The hollow-stem auger/split-barrel core sampling method is useful for obtaining soil or rock samples from the subsurface. Core sampling is an effective method for retrieving samples of the soil and tuff underlying OU 1129.

Split-barrel core samples are collected with a drill rig. Hollow-stem augers can be advanced to the top of the sample interval. A wire line can be used to retrieve the core from the core barrel instead of using hollow-stem augers. The coring tool is run within the hollow-stem auger and the sample is collected by dry-spinning the core tube through the sample interval. The core barrel retrieves approximately 5 ft of core and the diameter of core depends on the size of the core barrel used. Core samples can be collected up to the depth capabilities of the drilling. Field information to be collected during coring should include tool length and diameter, start and end time of coring, sample depth, rock quality designations, or sample recovery (in percent).

Upon retrieval of the core, the procedure to collect the sample is as follows:

- Immediately screen the sample with an organic vapor analyzer (OVA) or photoionization detector (PID) for volatile organics and perform a radiation survey.
- Record the results of each survey on the daily activity log.
- Break the core with a clean stainless-steel tool or gloved hands into individual samples that will fit into standard, wide-mouth glass sample containers.
- Seal with Teflon®-lined jar lids.
- Follow standard guidance for "Handling, Packaging, and Shipping of Samples," as described in LANL-ER-SOP-01.03.
- Discard sample waste according to LANL-ER-SOP-01.06, "Management of RFI-Generated Waste."

2.2.6 Field Documentation for Soil/Rock Sampling

Field geologists must prepare accurate logs of the soil and/or rock profile during the field investigation. Pertinent information on field boring logs typically includes the following:

- Unified Soil Classification Service (USCS) code;
- Rock type and mineralogy;
- Soil and/or rock characteristics, i.e., color, moisture, texture, hardness, density, degree of fracturing, and consistency;
- Rate of penetration;
- Blow counts per 6 in./rock quality designation (in percent);
- Sample recovery/sample length;
- Sample number;
- Monitoring instrument readings;
- OU number, Technical Area (TA) number, solid waste management unit (SWMU) and SWMU aggregate, boring number, field geologist's name and signature, drilling contractor's name, names of other personnel, and drilling rig type; and
- Date, time, and conditions.

Other field and sample documentation to be used for this investigation may be found in LANL-ER-SOP-12.01, "Field Logging, Handling, and Documenting Borehole Samples."

2.3 Liquid and Sludge Field Sampling Methods

Samples can be obtained using a variety of equipment, which is described in the subsections to follow. The proper equipment to be used is specified in Chapter 7.0 of the Work Plan and was chosen on the basis of the site conditions and data objectives. Field procedures for sampling have been described to provide rationale for the sampling method and are intended to promote consistency in sampling techniques between field personnel.

Sludge samples will be prepared in accordance with LANL-ER-SOPs 01.02, "Sample Containers and Preservation;" 01.03, "Handling, Packaging, and Shipping of Samples;" 01.15, "Coliwasa Sampler for Liquids and Slurries;" and 06.19, "Weighted Bottler Sampler for Liquids and Slurries in Tanks."

Sections 2.3.1, Composite Liquid Waste Sampler (Coliwasa), and 2.3.2, Weighted Bottle Sampler, describe the procedures that will be used to collect liquid and sludge samples at OU 1129.

2.3.1 Composite Liquid Waste Sampler (Coliwasa)

The Coliwasa is designed to obtain samples of free-flowing liquids or slurries, or liquids or slurries in containers. It permits representative sampling of single- or multi-phase liquids of varying physical and chemical characteristics.

Procedures describing the use of the Coliwasa are presented in LANL-ER-SOP-06.15, "Coliwasa Sampler for Liquids and Slurries." The sampler will be decontaminated after each use according to LANL-ER-SOP-02.07, "General Equipment Decontamination."

2.3.2 Weighted Bottle Sampler

The weighted bottle sampler is used to sample liquids in storage tanks, wells, sumps, bodies of surface water, and free-flowing streams of liquids. The sampler has the advantage that it remains unopened until it is at the desired sampling depth.

The sampler consists of a glass or Teflon® bottle, a weight, a bottle stopper, and a line that is used to lower and raise the sampler and open the bottle during sampling.

The weighted bottle sampler has the following limitations:

- The exterior of the weighted bottle sampler is exposed to hazardous materials and must be handled carefully to avoid cross-contamination from the immediate area.
- The weighted bottle sampler cannot be used to collect liquids that are incompatible with the bottle, weight, or line.
- The weighted bottle sampler is difficult to use in very viscous liquids.

Detailed procedures describing the use of the weighted bottle sampler are presented in LANL-ER-SOP-01.19, "Weighted Bottle Sampler for Liquids and Slurries in Tanks." The sampler will be decontaminated after each use according to LANL-ER-SOP-02.07, "General Equipment Decontamination."

2.4 Field Measurements for Liquid Samples

For aqueous liquid samples, field measurements such as electrical conductivity, temperature, and pH readings are conducted. This information is used to partially quantify conditions of the sample at the time of sampling. Instruments measure electrical conductivity in milliohms or microohms and temperature in degrees Celsius (C). The instruments are calibrated at the beginning and end of each field day as per the operating instructions provided with the instrument. The instrument is operated and stored in accordance with the operations manual.

Electrical conductivity, temperature, and pH readings are taken in the following manner. If excess liquid remains in the sampling device after the required sample bottles have been filled, the excess liquid is decanted into a glass jar or beaker of sufficient size to accommodate the instrument probes. If insufficient liquid is available in the sampling device after the required sample bottles have been filled, a second sample of liquid is obtained to take readings from the same approximate depth as the original sampler.

3.0 SAMPLE MANAGEMENT

3.1 Sample Identification

Upon request and in advance of sample collection, the Laboratory Sample Coordination Facility (SCF) will distribute pages of stickers with unique sample numbers. The stickers with numbers will be affixed to the sample label, which is attached to the appropriate container and also to the sample documentation, for easier cross-reference and minimal error. LANL-ER-SOP-01.04, "Sample Control and Field Documentation," contains detailed information on sample identification.

3.2 Sample Handling, Packaging, and Shipping

3.2.1 Sample Handling

Sample handling includes selection of sample containers, preservation procedures, and sample holding times before laboratory analysis. Table B-3 contains Level III sample handling requirements for various environmental media and analytical parameters. The SCF will provide sample labels, sampling and shipping containers, Chain-of-Custody/Request for Analysis (COC/RFA) forms, custody seals and packaging materials. All environmental samples will be transported directly from OU 1129 to the SCF located in Room 190 of Building OH-1 at TA-59. Samples can be delivered to the SCF during any workday between the hours of 8:00 a.m. and 12:00 p.m., and 1:00 p.m. and 5:00 p.m. Arrangements can be made for off-hours delivery by contacting the SCF in advance (LANL 1991, 0553). Samples that contain above-background levels of radioactivity require special handling.

TABLE B-3

SUMMARY OF LEVEL IV SAMPLE HANDLING REQUIREMENTS FOR OU 1129

Media	Analysis	SW-846 Analytical Method	Container Type[a]	Number of Containers Per Sample	Sample Volume	Preservative	Holding Times
Solid	Volatile Organics	8240	4 oz CWM	1	5 g	4°C	14 days
Solid	Semivolatile Organics	8270	16 oz CWM	1	10 g	4°C	7 days to extraction/ 40 days after extraction
Solid	PCBs/ Pesticides	8080	8 oz CWM	1	10 g	4°C	7 days to extraction/ 40 days after extraction
Solid	Chlorinated Hydrocarbons	8120	8 oz CWM	1	10 g	4°C	7 days to extraction/ 40 days after extraction
Solid	Purgeable Aromatic Hydrocarbons	8020	4 oz CWM	1	5 g	HCL, pH<2	14 days
Solid	Metals	6010/7000	8 oz CWM	1	10 g	HNO_3, pH<2	6 months
Solid	Mercury	7471	8 oz CWM	1	10 g	HNO_3, pH<2	28 days
Solid	Radionuclides	—	—	—	750 ml	—	—
Solid	Misc. Analytes	—	—	—	—	—	—
Solid	Cyanide	9010	4 oz CWM	1	10 g	NaOH, pH>12	14 days
Water/ Wastewater	Volatile Organics	624/1624	40 ml GVV	1	40 ml	4°C	14 days
Water/ Wastewater	Semivolatile Organics	625/1625	2-1/2 L AJ	1	1 L	4°C	7 days to extraction/ 40 days after extraction
Water/ Wastewater	PCBs/Pesticides	608	2-1/2 L AJ	1	1 L	4°C	7 days to extraction/ 40 days after extraction
Water/ Wastewater	Metals	200/200.7	500 ml HDPE	1	200 ml	HNO_3, pH<2	6 months
Water	Mercury	245.1	250 ml HDPE	1	100 ml	HNO_3, pH<2	28 days

Source: EPA (1986, 0921).

[a]CWM = clear wide mouth; GVV = glass voa vial; AJ = amber jug.

The SCF will validate samples for proper sample volume, container, preservative, and labeling. After the samples are validated, the SCF staff will ship the samples to the Health and Environmental Chemistry Group (EM-9) or the participating ER Program Level III laboratories for chemical analysis. The SCF is responsible for scheduling the laboratories for analysis based on sample handling capacity, existing sample backlog, and the required turnaround time for analytical results (LANL 1991, 0553). The FTL is the prime contact with the SCF for coordinating all sampling activities.

3.2.2 Sample Packaging

All environmental samples to be shipped off the Laboratory site will be packaged at the site and transported to the SCF for validation in accordance with all applicable Laboratory, Environmental Protection Agency (EPA), and Department of Transportation (DOT) regulations or requirements. These samples will then be transported under chain-of-custody procedures to assigned laboratories for chemical analysis (LANL 1991, 0553).

Sample labels with unique numbers will be affixed to each sample in accordance with LANL ER-SOP-01.04, "Sample Control and Field Documentation." At a minimum, the information contained on the label will consist of the following: sample number (obtained from the sample sticker sheet); signature of collector; date and time of collection; sample preservation; requested analysis; and collection location (LANL 1991, 0411; EPA 1986, 0291).

Custody seals will also be affixed to sampling and shipping containers. These seals are used to detect any unauthorized tampering from the time of sample collection to analysis (EPA 1986, 0291). Seals must be signed and dated by field personnel and placed on the container in such a way that the seal would break if the sample container opened. Seals must be affixed to sampling and shipping containers before they leave the custody of sampling personnel, which is before being transported to the SCF (EPA 1986, 0291). Custody seals will not be placed directly on top of a Teflon® septa of a 40-ml vial unless the septa has a protective overcap.

Packaging of low-concentration environmental samples before transport to the SCF and for eventual shipment to Group EM-9 or EPA-certified laboratories will be conducted as follows (LANL 1991, 0411; EPA 1986, 0291):

- Collect sample in glass or polyethylene container containing a Teflon®-lined cap, as specified in Table B-3.
- Clean and dry the sample container so that the sample label can be affixed to the container.
- Remove all coarse fragments and organic material from soils before placing them in the sample containers.
- Fill Teflon® septa containers (40 ml) for liquid VOC analysis to zero headspace, and those for solid VOC analysis as much as possible. Liquids for analyses other than VOC will not be completely filled, to allow sufficient air space.
- Seal and label sample container according to LANL-ER-SOP-01.04, "Sample Control and Field Documentation."

- Package samples individually in 4-ml-thick Ziploc bags.
- Seal drainage spout inside and outside of shipping container with tape and line the container with a large plastic trash bag.
- Place samples in shipping containers with noncombustible, insulating, absorbent, cushioning material (i.e., vermiculite or "bubble pack").
- Fill shipping container with ice (contained in double-bagged Ziploc bags) to preserve the samples at 4°C.
- Place COC/RFA form in Ziploc bag and tape to interior of cooler lid (LANL-ER-SOP-01.04).
- Affix custody seals at opposite ends of shipping container lid and seal lid shut with strapping tape.
- Affix "Environmental Samples" and "This End Up" labels to shipping containers.
- Find additional package techniques in LANL-ER-SOP-01.03, "Handling, Packaging, and Shipping of Samples."

Packaging of high-concentration environmental samples before transport to the SCF and for eventual shipment to Group EM-9 or EPA-certified laboratories is conducted as follows:

- Seal high-concentration samples in Ziploc bags.
- Place samples in Ziploc bags and then into clean aluminum paint cans filled with vermiculite.
- Seal paint cans with lips or strapping tape.
- Label the paint can with the number of the sample contained inside.
- Find additional package techniques in LANL-ER-SOP-01.03, "Handling, Packaging, and Shipping of Samples."

3.2.3 Sample Shipping

The SCF is responsible for seeing that samples are shipped from the SCF to Group EM-9 or the contractor laboratory for analysis in accordance with EPA SW-846 Guidance, Laboratory ER Program SOPs, and DOT regulations. The FTL is responsible for complying with DOT regulations when shipping samples from the site to the SCF and notifying the SCF when it will be receiving samples that require analysis. The SCF will coordinate with Group EM-9 or EPA-approved laboratories selected by the Laboratory to create an analytical schedule for OU 1129. This helps to ensure that analysis is conducted within holding times for the parameters requested.

The FTL is responsible for reporting the following to the SCF:

- Sampler name and telephone number;
- Sample numbers, media, and location;
- Date of sample collection/shipment;
- Suspected hazards associated with the sample(s);
- Special handling instructions or deviations from regular analytical procedures; and
- Project status (i.e., final shipment).

All radiological samples will undergo Level I field screening by Group HS-1 to determine whether radioactivity is above- or below-background levels. Samples that are below background will be transported for analyses to the SCF. Above-background radiological samples will be transported to Group EM-9 or licensed contractor laboratories for analyses (LANL 1991, 0411). Refer to LANL-ER-SOP-01.03, "Handling, Packaging, and Shipping of Samples," for radiological sample management practices.

3.3 Field/Sample Documentation

Documentation of all field and sample collection activities is necessary to ensure the defensibility of collected data and to verify the quality of work performed in the field. Records management of all forms to be completed as part of site investigations at OU 1129 is the responsibility of the Operable Unit Project Leader (OUPL) and the FTL. Forms required to be completed during daily site activities include the daily activity log; the sample collection log; the COC/RFA form; and variance logs (as necessary).

The FTL is responsible for assuring that field/sample documentation is complete and accurate to validate and document all site activities. The LANL-ER-SOP-01.01, "General Instructions for Field Investigation," and LANL-ER-SOP-01.04, "Sample Control and Documentation," discuss specific steps for field documentation procedures.

3.3.1 Daily Activity Log

The daily activity log is used to record any pertinent information concerning activities at the site. The log is used to describe problems, resolutions, supplies used, H&S issues, changes to plans or specifications, etc. This log should be completed as events occur in the field throughout the day. The FTL or a designated field team member is responsible for the completion of this form. The daily activity log should include the following information:

- Signature and title of preparer;
- Date of entry;

- Site location;
- Sample numbers and unique sample stickers;
- Sample recovery/quality;
- Data collected from Level I or II field instruments;
- Listing of personnel;
- Hazards encountered;
- Weather conditions;
- Health and safety issues;
- Equipment list;
- Site visitors;
- Time of each activity;
- Material use (including instrument serial numbers);
- Downtime, standby time;
- Field calibration data;
- Description of general field conditions encountered;
- Decontamination practices; and
- Any other pertinent information.

3.3.2 Sample Collection Log

The sample collection log documents sample number, type, location, and other general descriptive information about each sample taken.

This form serves as the primary cross-reference document for chain-of-custody records. The FTL is responsible for the completion of the sample collection log. The LANL-ER-SOP-01.04, "Sample Control and Documentation," contains information on proper completion of the sample collection log. Entries to be included on the log are the following:

- Signature and title of preparer;
- Date and sample time;
- Location of sampling event;
- Records of photos and sketches;

- Site work plan;
- Sample identification, which includes the following:

  (i) sample sticker(s),

  (ii) sample number(s),

  (iii) control number(s) from COC/RFA forms,

  (iv) sample location,

  (v) sample media and collection method,

  (vi) sample containers,

  (vii) sample volume, and

  (viii) preservation used;
- Calibration of equipment;
- Level I and II field results; and
- Certificate of sample container cleanliness.

In addition to the sample collection log, a master collection log can be used to track samples from the field to the SCF and the final laboratory destination. The master collection log is a nonmandatory form that promotes improved organization of large numbers of samples. The FTL will complete this log for the site investigation. The log can be a manual accounting type form or an electronic spread sheet on a lap-top computer. The information to be placed on this form includes the following:

- Signature and title of preparer;
- Date/time of sample collection;
- Location of sampling event;
- Site work plan; and
- Sample identification, which includes the following:

  (i) sample sticker(s),

  (ii) sample type(s),

  (iii) sample location(s),

  (iv) date sample shipped,

  (v) QC samples,

  (vi) control numbers from COC/RFA forms,

(vii) carrier/waybill number, and

(viii) date samples received.

3.3.3 Chain-of-Custody/Request for Analysis Form

The COC/RFA form serves as the primary documentation of a sample's history from collection and shipping through analysis and disposal. The form maintains a record of sample collection and the transfer of samples to the laboratory, and also identifies possible hazards of the samples. The field personnel collecting the samples complete the COC/RFA form, which is to be kept with the sample through the entire process of packaging and transportation to the SCF. The COC/RFA form must be filled out completely and accurately, and must have all requisite signatures. An error or omission could be costly because the sample may need to be retaken or because the results of all analyses performed on the samples on a particular COC/RFA form may be invalidated. Instructions for proper completion of the COC/RFA form are provided in the LANL-ER-SOP-01.04, "Sample Control and Documentation." Requirements for this form include the following:

- Provide data or sample location, date, unique sample stickers, and the exact name and address of the analytical laboratory to be used.
- Be sure all samples in the shipment are accurately listed on the form with unique sample number, date and time sample was collected, sample container, type and preservatives used.
- Accurately list the type of test and analytical method to be performed on each sample, Method 8240 for VOC analysis.
- Obtain the required signature, date, and time from both the person delivering the samples (relinquished by) and the person obtaining the samples (received by). A sample is considered in one's custody when one or more of the following criteria is satisfied:

  (i) The sample is in one's actual possession;

  (ii) The sample is in one's view after being in one's physical possession;

  (iii) The sample is in one's physical possession and is then locked up or securely stored to prevent tampering (as in a secured refrigerator).

- Determine if the samples are a possible hazard and indicate the sample disposal procedure.
- Note that three copies of the COC/RFA form exist. Instructions are provided for the destination of each copy at the bottom of the form.

- Ensure that one member of the listed sample team on the COC/RFA is the person who relinquishes the samples to the SCF. If this is not followed, the chain-of-custody will be broken.

3.3.4 Variance Log

The variance log is used to document when planned and approved field procedures cannot be implemented because of unanticipated conditions at the work site. Work plans cannot foresee all conditions encountered during a field program, and therefore, the variance log is used to record all program changes that occur at the site. The FTL or designated contractor FTL will initiate and chronologically maintain variance log records. All project variances require the approval of the OUPL. Verbal approval can be provided to the FTL and field team members. The variance log will specify the date and nature of the variance, the applicable document, and personnel initiating the variance. The only contractor who can write a variance is the laboratory conducting the analysis. Some laboratory variance logs are only reported with the data packages.

Formal approval of the variance log must be in writing. The OUPL will be provided with a copy of all entries made in the log. Upon receipt, the OUPL will review copies of the logs and, when in agreement, indicate approval by signing and dating each variance. Originals of the variance log will be kept on site until the field work is complete. Variances to SOPs, ER Program guidance, and SAPs will be approved before implementing the deviating action.

3.3.5 Photograph Log

Photographs can be used to supplement the documentation of field activities. Pictures of site conditions, equipment, sampling activities, or work results provide a permanent record of project operations. Photographs will be taken with a 35-mm camera equipped with a data bank signifying time and date. Sample locations can be identified by writing the sample number, using a black marker, on duct tape or a stake placed next to the location. Two photographs of sample locations should be taken whenever possible: one that is the sample area in relation to its surroundings, and one that is a close-up showing details of the sample location. A record of photographs taken should be kept in the daily activity log. The following items should be recorded for each photograph:

- Date and time;
- Signature or initials of photographer;
- Name and/or location number of site;
- General compass direction in which the photograph was taken;
- Description of the subject;
- Location from which picture was taken; and
- Sequential number of photograph and the roll number.

4.0 EQUIPMENT DECONTAMINATION

Decontamination of sampling equipment is required before use at each sample location. All reusable field equipment that comes in contact with the sample media must be properly decontaminated following procedures discussed in this section and in LANL-ER-SOP-02.07, "General Equipment Decontamination."

4.1 Standard Decontamination Materials

The following list includes the standard decontaminating materials that are acceptable for use during field sampling operations and their general applications:

- Tap water: Used as an initial rinse.
- Hot water: General rinse used to remove gross contamination (steam cleaner).
- Deionized water: Used for secondary and final rinses.
- Organic-free water: Tap water that has been treated with activated carbon and deionizing units. Used for secondary and final rinses.
- Phosphate-free detergent: General detergent wash (Alconox®) used for cleaning sampling equipment.
- Pesticide-grade isopropanol or methanol: Used for general decontamination.
- 10% nitric acid/deionized water: Solution used for metals decontamination.

Decontamination procedures will incorporate a combination of these solutions to thoroughly clean and rinse all field equipment that comes in contact or is closely associated with samples during the sampling program. Wire-wrapped brushes will not be used for any decontamination purposes. Cleaning solutions will not be reused for equipment decontamination.

4.2 Decontamination of Sampling Equipment for Inorganic and Organic Compounds

The following procedures will be implemented to decontaminate equipment for metals, volatile organics, semivolatile organics, organochlorine pesticides, and polychlorinated biphenyls (PCBs):

- Don two pair of clean gloves.
- Wash equipment thoroughly with laboratory detergent (Alconox®) and hot water (if available) using plastic (wire-free)

brushes to remove any particulate matter or surface film. Change outer gloves.

- Rinse equipment with hot tap water (if available), otherwise, use standard tap water. Change outer gloves.
- For Teflon® or glass equipment only, rinse with a 10% nitric acid/deionized water solution. Change outer gloves.
- Rinse equipment thoroughly with deionized water. Change outer gloves.
- Rinse or spray equipment twice with methanol and allow to air dry. Change outer gloves.
- Wrap equipment with aluminum foil, with the inside of the foil roll against the equipment.

During each decontamination step, the equipment should not come in contact with the ground or other contaminated equipment. Clean, heavy-duty plastic sheets should protect decontaminated equipment from the resting surfaces during the drying period. Decontaminated equipment should be protected with plastic to prevent cross-contamination. If any equipment is accidentally cross-contaminated after cleaning, all of the decontamination steps should be repeated. Decontamination procedures will be documented in the daily activity log.

4.3 Decontamination of Sampling Equipment for Radionuclides

The following steps will be implemented to decontaminate equipment used for radioactive material sampling:

- Don two pair of clean gloves.
- Wash equipment thoroughly with laboratory detergent (Alconox®) and hot water using wire-free brushes to remove gross contamination. Change outer gloves.
- Rinse with hot tap water, if available; otherwise, use standard tap water. Change outer gloves.
- Rinse equipment with deionized water. Change outer gloves.
- Scan the equipment with a radiation detector provided by the Laboratory's HS-1 and/or HS-5 groups.
- Wrap in aluminum foil (inside of the roll against equipment).

If measurements are above background, repeat these steps.

4.4 Decontamination of Drilling Rigs

The following procedure will be used to decontaminate large drilling rigs:

- Clean the drilling rig and all ancillary equipment near the drilling platform area with hot (>170°F) pressurized water from a steam cleaner.
- Inspect hydraulic lines near the drilling platform or drill mast to make sure hydraulic fluid or oil leaks are not present. Repair leaks if they are observed.
- Clean all drilling pipe, stabilizers, reamers, hoist lines, and drill subs tools using a steam cleaner. All equipment, which goes downhole or contacts samples, must be thoroughly steam cleaned, dried, and wrapped in clear plastic for protection. Pack interior of hollow-stem augers with plastic for protection.

Decontamination of drilling equipment will take place at a centralized area within the OU or TA. The decontamination area should be designed to contain or collect all liquids generated by cleaning operations. Decontamination areas are typically lined with heavy-duty plastic to prevent the release of effluents from the site. All materials used in decontamination must be placed in containers for proper disposal, as described in LANL-ER-SOP-01.06, "Management of RFI-Generated Waste." The folded mast and other equipment should be covered with plastic when moving a drilling rig from the borehole to the decontamination area.

4.5 Decontamination of Miscellaneous Equipment

The following procedure will be used to decontaminate miscellaneous equipment:

- Wipe all field equipment such as pH meters, conductivity meters, and temperature probes with a clean damp cloth.
- Rinse the probes with deionized water before use or storage. The probes should remain moistened with the instrument manufacturer's solution.
- Refer to the instrument instruction manuals for proper cleaning and storage.

All ice chests and sample shipping containers will be washed with laboratory detergent and tap water, rinsed with tap water, and allowed to air dry before use.

5.0 QUALITY CONTROL SAMPLES

The OU 1129 field sampling program requires the collection of QC samples to assess field and laboratory procedures. Field QC samples are collected to determine if extraneous contaminants originated from the sampling, handling, or shipping procedures. QC samples are also used as part of the analytical laboratory QA/QC Program. Table B-4 provides a summary of field QC sample requirements for the

OU 1129 field program. Tables V.2 and X.2 in the Laboratory Environmental Restoration (ER) Quality Assurance Project Plan (QAPjP) present the type and frequency of the required laboratory QC procedures (Appendix T of the IWP [LANL 1991, 0553]). Additional information regarding QA/QC for the Laboratory ER program can be obtained in the QAPjP and LANL-ER-SOP-01.05, "Field Quality Control Samples." The field QC samples that will be collected and used for OU 1129 are discussed in the following sections.

TABLE B-4

SUMMARY OF FIELD QC SAMPLE REQUIREMENTS

QC Sample Type	Environmental Sample Matrix	QC Sample Matrix	Minimum Sample Frequency (1 per each analytical batch or)
Bottle Blank	Soil	Water	1 per 20 samples
	Water	Water	1 per 20 samples
Duplicate	Soil	Soil	1 per 20 samples
		Water	1 per 10 samples
	Water		
Rinsate Blank	Soil	Water	1 per 20 samples
		Water	1 per 10 samples
	Water		
Trip Blank	Soil	Water	1 per shipping cooler
	Water	Water	1 per shipping cooler
Glove, Wipe, and Solvent Blank	Glove, Wipe, Solvent	Glove, Wipe, Solvent	1 per 20 samples
Smear Blank	Paper Smear	Paper Smear	1 per sample event
Method Blank[a]	Soil	Water	1 per 20 samples
	Water	Water	
Reagent Blank[b]	Soil	Water	1 per 20 samples
	Water	Water	

[a] Analysis is performed using only the reagents and solvents used in the analytical method.

[b] Composed of an organic or aqueous solution that contains all the reagents in the same volume as used in the processing of the samples.

5.1 Duplicate Samples

Field duplicate samples monitor sample variability and determine total random error for organic, inorganic, and radiological parameters. These samples will be collected simultaneously from the same soil or water source under identical conditions. The samples will be divided equally into two or more portions in the field and placed in separate containers. The samples will be sent to the SCF for analysis of the parameters specified in the SAPs.

Duplicate soil samples should be collected using the following procedure:

- Carefully extract the soil sample from the sampling tool using clean equipment and gloved hands.
- Carefully and rapidly extract the soil sample from the sampling tool as above. Attempt to work in a cool, dry, protected area.
- For those samples that do not require VOC analysis, homogenize samples in a stainless-steel mixing bowl using a stainless-steel trowel to remove coarse fragments and organic material. The mixing bowls and tools will have to be changed or cleaned if multiple duplicate samples are collected.

The procedure for homogenization of soil samples is the following:

- Remove soil from sampling device and place in stainless-steel mixing bowl.
- Use stainless-steel trowel to mix and remove coarse fragments and organic material (e.g., sticks, grass, etc.).
- Cut into fourths, homogenize each fourth.
- Homogenize whole bowl.
- Cut into fourths and take portions out of sections and place small, but equal amounts in sample containers.
- Repeat above until adequate volume is placed in containers.
- Divide the sample into equal portions and place each in separate, properly sized, previously unopened, precleaned sample containers obtained from the SCF.
- Seal, label, and process each duplicate sample as unique, blind samples for laboratory analysis.

The procedure for homogenization of water samples is the following:

- Don clean gloves before sample handling.
- Carefully pour water sample from sampling equipment into the required number of laboratory-cleaned, duplicate sample containers, accounting for both required field and duplicate samples. Be sure that sample preservatives (if necessary) are included in the sample containers.
- Quickly seal sample containers making sure zero headspace is obtained.
- Handle, package, and ship samples to the SCF, as described in LANL-ER-SOP-01.03, "Handling, Packaging, and Shipping of Samples."

5.2 Blank Samples

5.2.1 Bottle Blank Samples

Bottle blanks monitor sampling procedures and ambient conditions at the site for water and soil samples that may cause sample contamination. Organic-free or deionized water obtained from the laboratory is taken into the field in sealed containers. It is transferred into the appropriate sample containers at a predesignated sampling location, and preserved with the appropriate reagent(s). Bottle blanks are required for both soil and water when analyzing for volatiles, semivolatiles, metals, and mercury. Bottle blanks monitor sampling is performed as follows:

- Obtain a sealed container of organic-free or deionized water from the analytical laboratory and place in the sample cooler to be transported to the field.
- Organize sample preparation area to be used during site sampling.
- Prepare organic-free or deionized water and remove from the sample cooler.
- Don clean gloves.
- Carefully fill all appropriate size containers for each analytical method to be performed on the investigative samples from the newly opened water container.
- Preserve samples as required and seal each vial with a Teflon®-lined cap.
- Seal, label, and place bottle blank samples in the cooler in which other samples from the site will be held.
- Deliver to the SCF with the field samples and analyze for the appropriate constituents.

5.2.2 Trip Blank Samples

Trip blanks monitor sample contamination for VOCs in water and soil samples, which may occur during storage and transportation of the sample to the laboratory. Before each daily sampling event, trip blanks are prepared and kept with the investigative samples throughout the sample collecting event and shipment to the laboratory. They are not to be opened before reaching the laboratory. Trip blanks are required only for volatile organic analysis. The procedure for obtaining trip blanks is as follows:

- Obtain two 40-ml VOA vials filled with organic-free or deionized water with zero headspace from the analytical laboratory. The vials should be tightly sealed and are not to be opened.
- Properly seal, label, and package the trip blanks and place

them in the sample coolers before the daily sampling event. Cool samples to 4°C. Do not identify trip blanks to the analytical laboratory as trip blanks when the sample matrix is water.

- Transport trip blanks to the field and make sure they are kept with all the samples collected for the day.

- Prepare the cooler and samples for transportation to the SCF. Never ship trip blanks inside coolers containing anything but low-concentration samples. If required, ship in a separate cooler under the same waybill.

5.2.3 Rinsate Blank Samples

Rinsate blanks monitor sampling device decontamination effectiveness and consequent sample cross-contamination that may result from inadequate cleaning procedures. These samples are collected by running organic-free or deionized water over and through the sample collection device, or the surface in contact with the sample after it has been cleaned, into a sample container. The sample is then delivered to the laboratory for the same analyses required for the field samples. The procedure for obtaining rinsate blanks is as follows:

- Obtain a sealed container of organic-free or deionized water from the SCF in a container one size larger than the rinsate sample volume.

- Prepare and organize sample containers and preservatives for the equipment blank samples, as shown in Table B-3.

- Don appropriate gloves and remove previously decontaminated sample collection equipment from the protective plastic or foil.

- Tilt the equipment so the organic-free deionized water can gently flow across the surface of the sampling device.

- Slowly pour the organic-free or deionized water so it will flow across the sampling surface of the device while collecting the sample in the containers at the fluid run-off point. Be sure that the equipment and sample collection is not exposed to exhaust fumes from machinery, dust, or other factors that could cause contamination.

- Seal, label, and package samples for proper shipment to the laboratory. Equipment blanks should remain blind to the analytical laboratory.

- Pour out any remaining organic-free water so that it cannot be used to collect another rinsate sample.

- Carefully protect the sampling device with foil until needed.

5.2.4 Glove, Wipe, and Solvent Blank Samples

The glove, wipe, and solvent blanks are collected to determine if cross-contamination of a sample could occur from the sorbent pads, solvent, or gloves used during a PCB wipe sampling effort.

- Obtain 4-in. by 4-in., 100% cotton, sterile gauze pads from a group of pads with the same lot numbers. Don clean, disposable gloves from the box of gloves to be used during sampling.
- In a clean area (Laboratory or sample preparation room), place the number of wipes necessary for the sampling event, accounting for one blank pad and any extras, into a clean, wide-mouth glass jar. Use only clean tweezers or forceps to transfer the pads. Immediately seal container with the remaining pads.
- Carefully saturate the pads to be used for sampling with an appropriate solvent.
- Using clean tweezers or forceps, transfer one saturated pad into a separate, clean, wide-mouth jar. Immediately seal the jar holding the remaining pads with a Teflon®-lined lid.
- Place a clean disposable glove from the lot of gloves to be used for sampling into the jar with the single saturated pad. Use a Teflon®-lined lid to seal the jar.
- Label, package, and transport the blank sample with the investigative wipe samples collected from the remaining saturated pads.
- Perform laboratory analyses for PCBs (Method 8080).

5.2.5 Radiation Smear Blank Samples

Radiation smear blanks are collected to determine the potential for cross-contamination from the pads used for sampling. Smear blanks are easily collected during the smear sampling in the field in the following manner:

- Take a single, dry, unused, sample pad, using clean gloves or tweezers, and place in an appropriate paper sample container.
- Seal, label, and transport the blank with the other investigative samples collected during the sampling event.
- Analyze the blank and investigative samples using identical analytical methods.

5.2.6 Method Blanks

A method blank is a volume of deionized, distilled laboratory water for water samples, or a purified solid matrix for soil/sediment samples carried through the entire analytical procedure. The volume or weight of the blank must be approximately equal to the sample volume or sample weight processed. A method blank should be performed with each group of samples or every 20 samples, whichever is more frequent. Analysis of the blank verifies that method interferences caused by contaminants in solvents, reagents, glassware, and other laboratory hardware are identified and minimized.

5.2.7 Reagent Blanks

Reagent blanks are usually an organic or aqueous solution that is as free of analytes as possible. The reagent blank contains all the reagents in the same volume as used in the processing of the environmental samples. The reagent blank must be carried through the complete sample preparation procedure and contains the same reagent concentrations in the final solution as in the sample solution used for analysis. The purpose of the reagent blank is to correct for possible contamination resulting from the preparation or processing of the environmental samples. One reagent blank will be analyzed with each analytical batch or every 20 samples, whichever is greater.

REFERENCES

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)

EPA (US Environmental Protection Agency), November 1986. "Test Methods for Evaluating Solid Wastes; Physical/Chemical Methods," SW-846, Revision 0, Washington, DC. (EPA 1986, 0291)

VADOSE ZONE MODELING INPUT FILES AND GRAPHS

SUMMARY OF INPUT FILES BY SCENARIO

SUMMARY OF INPUT FILES AND RUN DURATION BY SCENARIO FOR VADOSE ZONE MODELING	Scenario 1 Spill of 55 gal. of benzene (LNAPL) on TA-35 Mesa soil	Scenario 2 Spill of 55 gal. of 1,1,2,2 tetrachloroethane on TA-35 Mesa soil (DNAPL)	Scenario 3 TA-35 wastewater treatment plant effluent with 0.1% DNAPL discharged into Ten Site Canyon soils
VARIABLE GROUP	INPUT DATA/FILE	INPUT DATA/FILE	INPUT DATA/FILE
Time	20 years	20 years	30 years
Climate	SCLIM002	SCLIM002	SCLIM002
Soil	SSOIL005	SSOIL005	SSOIL006
Chemical	SCHEM003	SCHEM004	SCHEM004
Application	SAPPL009	SAPPL010	SAPPL008

SCLIM002 INPUT CLIMATE PARAMETERS USED IN ALL SCENARIOS

VARIABLE	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
TA	10.17	3.28	-0.67	-1.61	0.11	3.11	7.56	12.72	18.39	20.11	18.78	15.7
(MONTHLY MEAN AIR TEMP., C)												
NN	.4	.4	.5	.5	.5	.5	.45	.4	.35	.5	.3	.3
(MONTHLY MEAN CLOUD COVER FRACTION, DIMENSIONLESS)												
S	.5	.5	.6	.65	.5	.45	.4	.3	.3	.5	.5	.45
(MONTHLY MEAN RELATIVE HUMIDITY, DIMENSIONLESS)												
A	.25	.26	.27	.28	.27	.27	.26	.25	.25	.25	.25	.25
(SHORT WAVE ALBEDO FRACTION, DIMENSIONLESS)												
REP	0	0	0	0	0	0	0	0	0	0	0	0
(MONTHLY MEAN EVAPOTRANSPIRATION, CM/DAY; 0 = CALCULATED BY SESOIL)												
MPM	3.86	2.44	2.44	2.16	1.73	2.57	2.18	2.87	2.84	6.08	9.98	4.14
(RAIN DEPTH, CM/MONTH)												
MTR	.28	.23	.29	.29	.34	.28	.25	.27	.16	.18	.17	.26
(MEAN DURATION OF INDIVIDUAL STORM EVENTS, DAYS)												
MN	1.83	1.32	1.67	1.13	1.72	1.52	1.11	1.5	1.27	3.44	3.69	2.44
(NUMBER OF STORM EVENTS)												
MT	30.4	30.4	30.4	30.4	30.4	30.4	30.4	30.4	30.4	30.4	30.4	30.4
(LENGTH OF THE RAINY SEASON, DAYS; DEFAULT VALUE)												

*Data from 1989 LANL Environmental Surveillance Report (Environmental Protection Group 1990, 0497) for span 1911-1989.

SOIL INPUT PARAMETERS

Variable	Scenario 1 SSOIL005	SCENARIO 2&3 SSOIL006
Soil Type	Clay loam	Gravelly loamy sand
RS - Average bulk density (g/cm^3)	1.50	1.50
K1 - Average intrinsic permeability (cm^2)	0.00	0.00
C - Disconnectedness index (unitless)	5.50	3.90
N - Effective porosity (dimensionless)	0.45	0.35
OC - Organic carbon content (%)	2.90	0.00
CEC- Ratio of cation exchange capacity	0.00	0.00
FRN- Ratio of Freundlich exponent	1.00	1.00

CHEMICAL INPUT PARAMETERS

Variable	Scenario 1 SCHEM003	Scenario 2&3 SCHEM004
Chemical	Benzene	1,1,2,2 Tetrachloroethane
SL - Water Solubility at 25_C, mg/L	1790.00	2962.00
DA - air dispersivity	0.1076520	0.0734
H - Henry's Law constant, atm m^3/mol	0.00555	0.000455
KOC- adsorption coefficient	31.00	79.00
MWT- mol. wt.	78.00	168.00

SESOIL APPLICATION, SCENARIO 1 (SAPPL009 Input Parameters)
VARIABLES AND VALUES USED

Benzene Spill on TA-35 Mesa Top Soil Profile
(NOTE: Variables defined on previous tables)

ILYS	IYRS	AR	L	ISPILL	D1	D2	D3	NSUBL1
3.00	1.000	0.0	36.00	1	8.00	22.00	300.00	1
NSUBL2	NSUBL 3	PH1	PH2	PH3	K11	K12	K13	
1	1	7.40	7.40	7.40	0.43E	0.14E-07	0.10E	

One-time Pollutant Loading for Layer 1 Year 1 (Monthly Inputs)

POLIN1	0.72E+6	0	0	0	0	0	0	0	0	0	0	0
TRANS1	0	0	0	0	0	0	0	0	0	0	0	0
SINK1	0	0	0	0	0	0	0	0	0	0	0	0
LIG1	0	0	0	0	0	0	0	0	0	0	0	0
VOLF1	0	0	0	0	0	0	0	0	0	0	0	0
ISR	0	0	0	0	0	0	0	0	0	0	0	0
ASL	0	0	0	0	0	0	0	0	0	0	0	0

Layer 2 Year 1

Variable	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
OLIN2	0	0	0	0	0	0	0	0	0	0	0	0
TRANS2	0	0	0	0	0	0	0	0	0	0	0	0
SINK2	0	0	0	0	0	0	0	0	0	0	0	0
LIG2	0	0	0	0	0	0	0	0	0	0	0	0
VOLF2	0	0	0	0	0	0	0	0	0	0	0	0

Layer 3 Year 1

Variable	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
POLIN3	0	0	0	0	0	0	0	0	0	0	0	0
TRANS3	0	0	0	0	0	0	0	0	0	0	0	0
SINK3	0	0	0	0	0	0	0	0	0	0	0	0
LIG3	0	0	0	0	0	0	0	0	0	0	0	0
VOLF3	0	0	0	0	0	0	0	0	0	0	0	0

SESOIL APPLICATION, SCENARIO 2 (SAPPL010 Input Parameters)
VARIABLES AND VALUES USED

55 Gal. (208L) One-Time Spill of DNAPL on TA-35 Mesa Top Soils
(NOTE: Variables defined on previous tables)

ILYS	IYRS	AR	L	ISPILL	D1	D2	D3
3.00	1	250000 0	36.00	1	8.00	24.02200	0.0
NSUBL2	NSUBL3	PH1	PH2	PH3	K11	K12	K13
1	1	7.40	7.40	7.40	0.43E-07	0.14E-07	0.10E-07

One-time Pollutant Loading for Layer1 Year 1 (Monthly Inputs)

POLIN1	0.13E7	0	0	0	0	0	0	0	0	0	0	0
TRANS1	0	0	0	0	0	0	0	0	0	0	0	0
SINK1	0	0	0	0	0	0	0	0	0	0	0	0
LIG1	0	0	0	0	0	0	0	0	0	0	0	0
VOLF1	0	0	0	0	0	0	0	0	0	0	0	0
ISR	0	0	0	0	0	0	0	0	0	0	0	0
ASL	0	0	0	0	0	0	0	0	0	0	0	0

Layer 2 Year 1

Variable	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
POLIN2	0	0	0	0	0	0	0	0	0	0	0	0
TRANS2	0	0	0	0	0	0	0	0	0	0	0	0
SINK2	0	0	0	0	0	0	0	0	0	0	0	0
LIG2	0	0	0	0	0	0	0	0	0	0	0	0
VOLF2	0	0	0	0	0	0	0	0	0	0	0	0

Layer 3 Year 1

Variable	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
POLIN3	0	0	0	0	0	0	0	0	0	0	0	0
TRANS3	0	0	0	0	0	0	0	0	0	0	0	0
SINK3	0	0	0	0	0	0	0	0	0	0	0	0
LIG3	0	0	0	0	0	0	0	0	0	0	0	0
VOLF3	0	0	0	0	0	0	0	0	0	0	0	0

SESOIL APPLICATION, SCENARIO 3 (SAPPL008 Input Parameters)

Average Monthly Discharges of 0.1% 1,1,2,2 Tetrachloroethane
into Ten Site Canyon soils

ILYS (no. layers)	IYRS (no. years)	AR (area, cm^2)	L (constant)	ISPILL (1=spill; 0=cont. input)	D1 (depth of layer 1, cm)	D2 (depth of layer 2, cm)
2.0	10.00	0.75E+07	36.00	0	400.0	20000.0
NSUBL1 (layer 1)	NSUBL2 (layer 2)	PH1 (pH layer 1)	PH2 (pH layer 2)	K11 (intrinsic perm cm^2, layer 1)	K12 (intrinsic perm cm^2, layer 2)	
1	1	7.40	7.40	0.15E-06	0.10E-07	

Monthly Pollutant Loading Factors for Layer 1 Year 1 - Year 10

POLIN1	20590
TRANS1	0.00
SINK1	0.00
LIG1	0.00
VOLF1	0.00
ISR	0.00
ASL	0.00

where POLIN1 = monthly pollutant load for layer 1 in $\mu g/cm^2$/month
other variables are volatilitization, run-off, ligand mass, and other removals of pollutant not accounted for by the model

Monthly Pollutant Loading for Layer 2 Year 1 - Year 10

POLIN2	0.00
TRANS2	0.00
SINK2	0.00
LIG2	0.00
VOLF2	0.00

where POLIN2 = monthly pollutant load for layer 1 in $\mu g/cm^2$/month
other variables are volatilitization, run-off, ligand mass, and other removals of pollutant not accounted for by the model

COMMENTS ON AQUEOUS SPECIATION AND MOBILITY OF STRONTIUM AT LOW TEMPERATURES

Patrick Longmire, INC-4
Los Alamos National Laboratory 1/29/92

The purpose of this discussion is to illustrate the importance of complexing reactions on the solubility of strontium. This discussion is based on a thermodynamic equilibrium perspective. Chemical analyses of contaminant source terms are required to further define the potential of radionuclide-organic complexing. Results of the model simulations suggest that strontium complexing with EDTA can have significant effect on the mobility of this species in the subsurface.

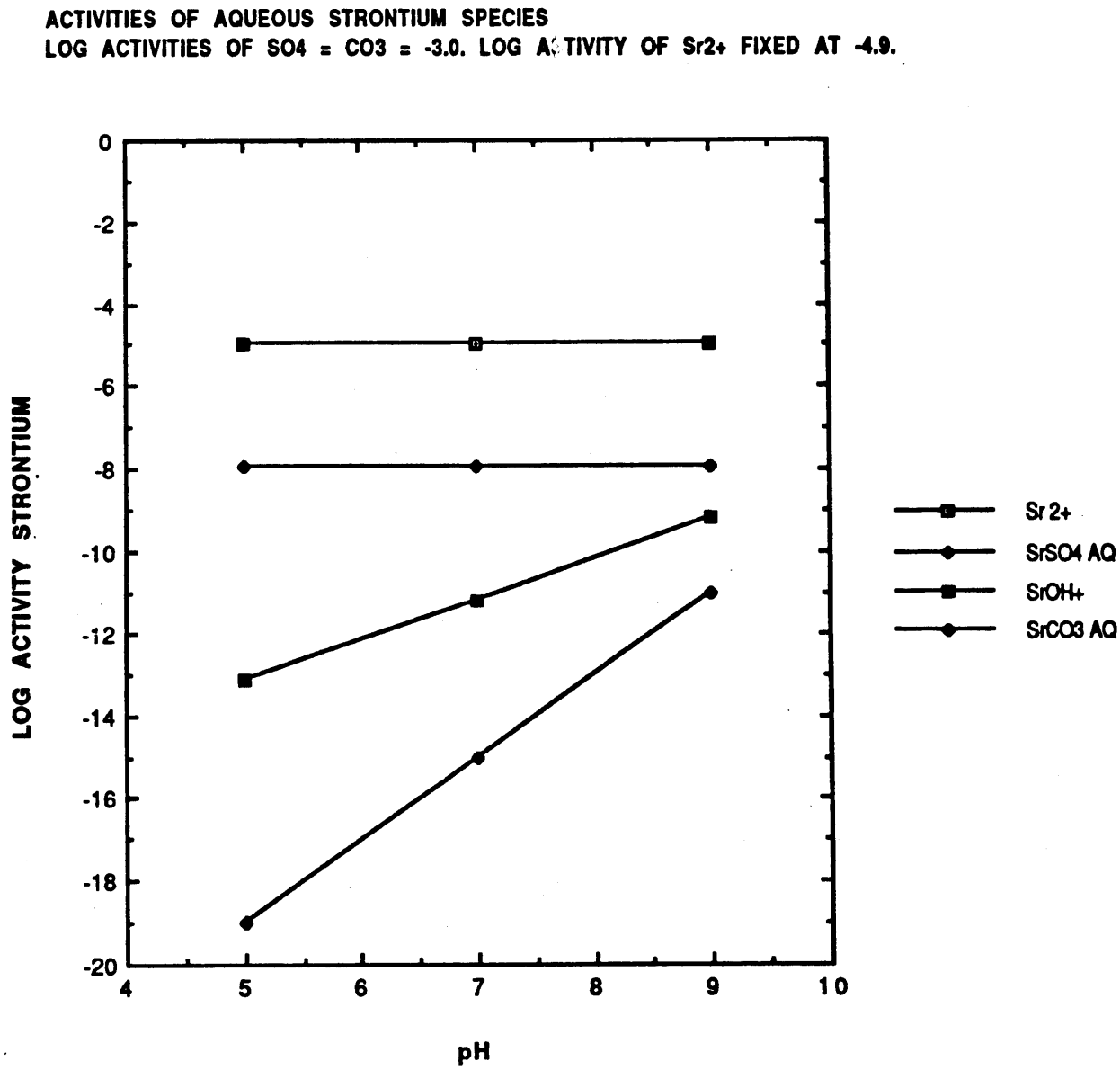
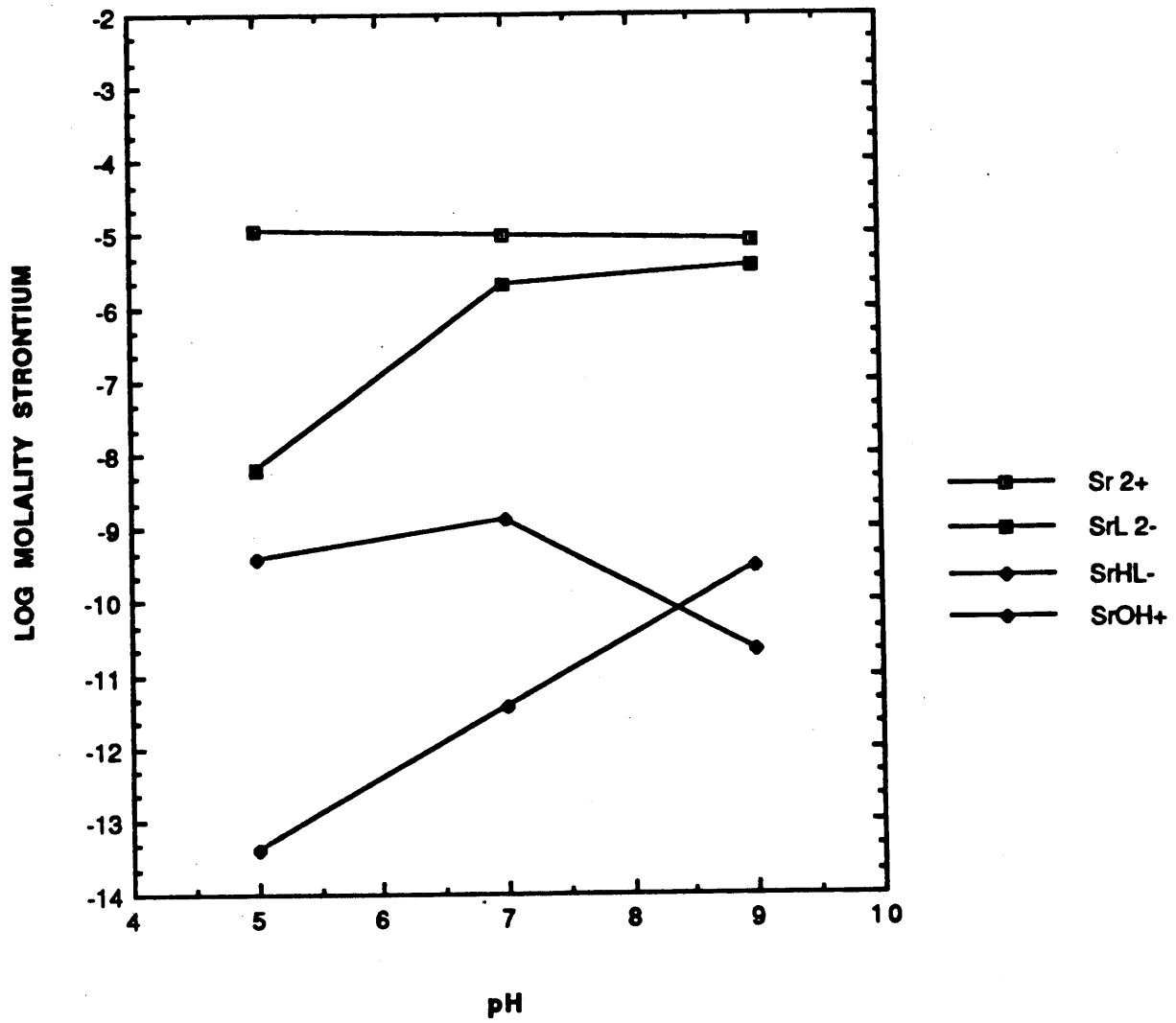
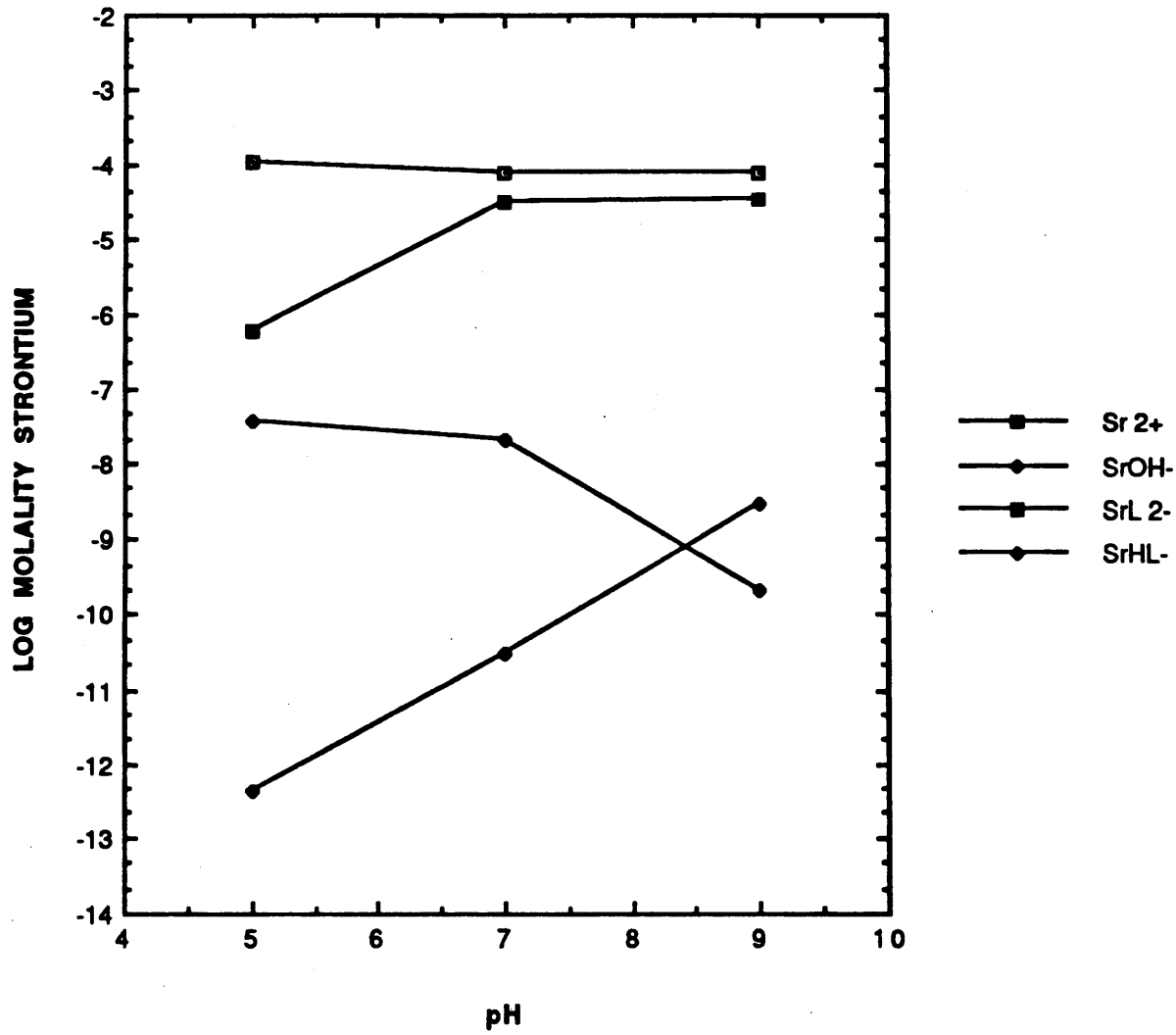


Figure C-2. The species, Sr^{2+} is predicted to be the dominant cation in an organic ethylenediaminetetroacetic acid (EDTA) -free solution between pH 5 through 9. Strontium sulfate is predicted to be the next dominant species; this ion pair becomes more dominant at higher activities of SO_4^{2-}. The leachate, however, may not contain SO_4^{2-} greater than 1 millimolar (96 mg/L) concentrations. Cation exchange processes should remove free, or uncomplexed Sr^{2+}, from solution without organic ligands present. The exchange process is mainly dependent on chemistry and the aqueous solution of soil particles. Therefore, Sr^{2+} is predicted to be relatively immobile between pH values 6 through 9 without EDTA present (Brookins 1984, 04-0269).



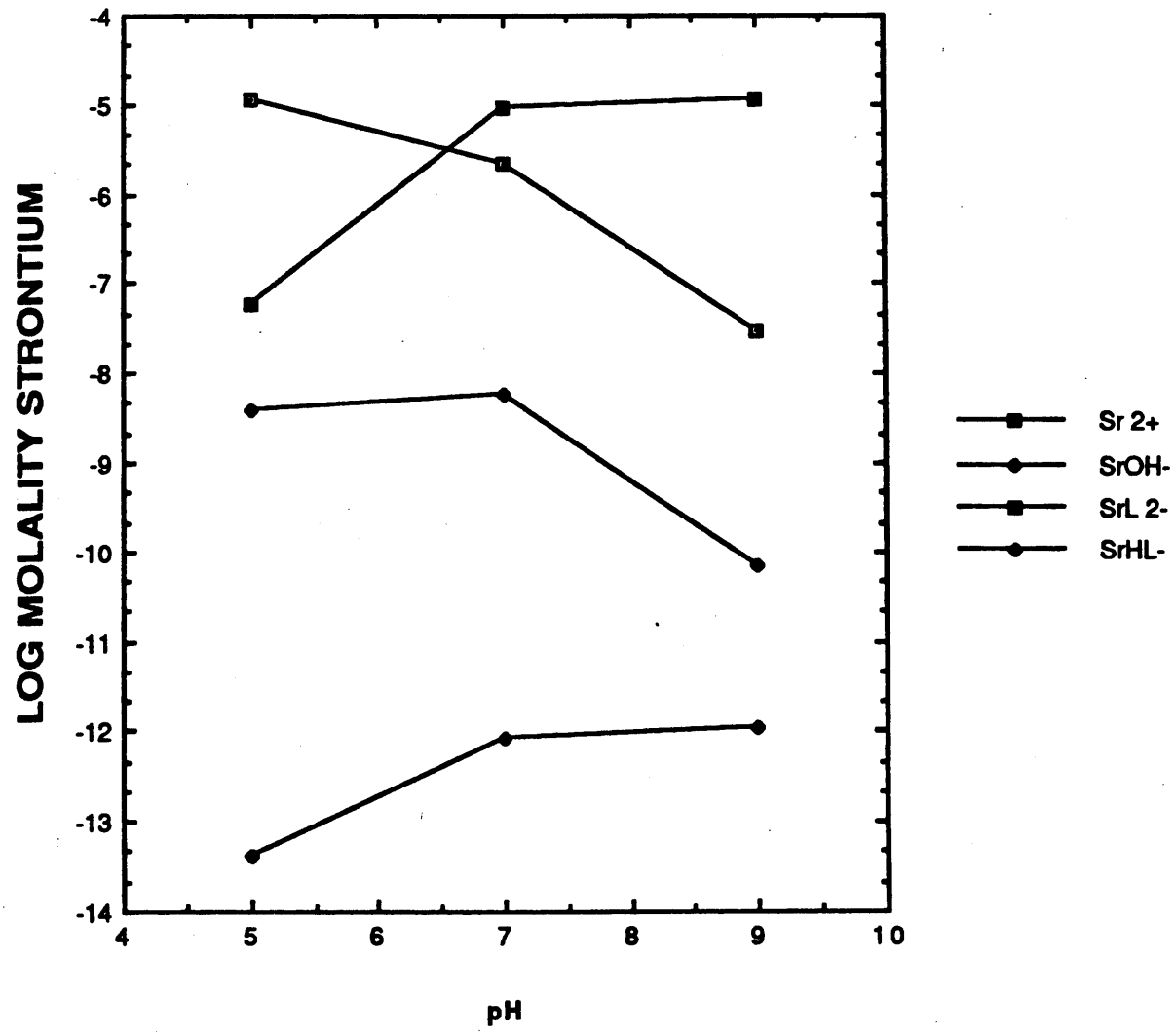
LOG MOLALITIES OF TOTAL STRONTIUM = -4.94 AND TOTAL EDTA (L4-) = -5.46

Figure C-3. This log molality vs pH diagram for Sr ($10^{-4.04}$m, 1 mg/L) and ethylenediaminetetraacetic acid (EDTA) ($10^{-5.46}$m, 1 mg/L) suggests that Sr^{2+} is the dominant species between pH 5 through 9. Above pH 7, the SrL^{2-} complex becomes more dominant. L denotes deprotonated EDTA ligand in which four protons have dissociated. This anion (L) has a maximum charge of -4. A decrease in sorption or cation exchange of Sr may occur under increasing pH conditions, if SrL^{2-} is present. Generally, anion exchange dominants under less alkaline pH conditions. The complexes, $SrOH^{+}$ and $SrHL^{-}$ are predicted to be the less dominant solution species.



LOG MOLALITIES OF TOTAL STRONTIUM = -3.94 AND L 4- (EDTA) = -4.46

Figure C-4. This log molality vs pH diagram for Sr ($10^{-4.94}$m, 1 mg/L) and EDTA ($10^{-4.46}$m, 10 mg/L) suggests that Sr^{2+} is the dominant species between pH 5 through 6.6. Above pH 6.6, the SrL^{2-} complex becomes the dominant species. A decrease in sorption or cation exchange of Sr may occur under increasing pH conditions, if SrL^{2-} is present in the leachate.



LOG MOLALITIES OF TOTAL STRONTIUM = -4.94 AND L 4- (EDTA) = -4.46

Figure C-5. This log molality vs pH diagram for Sr ($10^{-3.94}$m, 1 mg/L) and EDTA ($10^{-4.46}$m, 10 mg/L) suggests that Sr^{2+} is the dominant species between pH 5 through 9. Above pH 7, the SrL^{2-} complex becomes more dominant. A decrease in sorption or cation exchange of Sr may occur under increasing pH conditions, if SrL^{2-} is present in the leachate.

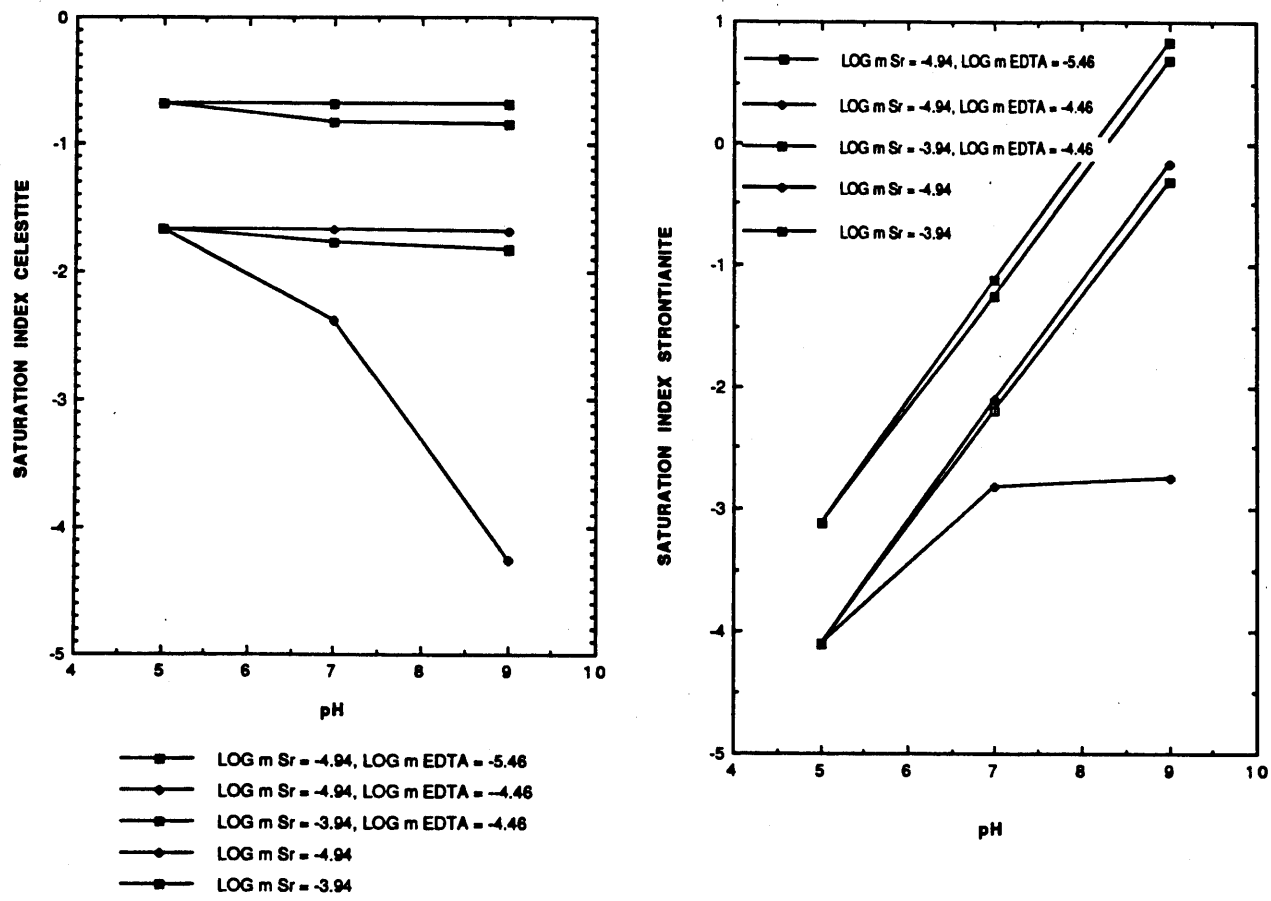


Figure C-6. Saturation indices (SI) for celestite ($SrSO_4$) and strontianite ($SrCO_3$) are defined as $\log_{10}$ activity product/solubility product (Drever 1982, 04-0268). These SI values show that solution is predicted to be undersaturated with respect to strontianite (negative SI value, mineral will dissolve) in presence of EDTA below pH 8.0. Above pH 8.0, strontianite is predicted to precipitate from solution as suggested by positive SI values. The solution remains undersaturated with respect to celestite between pH range of 5 to 9 with and without EDTA present. Sorption processes will dominant when the solution is undersaturated with respect to celestite and stronianite without EDTA present.

REFERENCES

Drever, J. I., 1982. *The Geochemistry of Natural Waters*, Prentice Hall, New York. (Drever 1982, 04-0268)

Brookins, D. G., 1984. *Geochemical Aspects of Radioactive Waste Disposal*, Springer-Verlog, New York. (Brookins 1984, 04-0269)

Environmental Protection Group, December 1990. "Environmental Surveillance at Los Alamos During 1989," Los Alamos National Laboratory Report LA-12000-ENV, Los Alamos, New Mexico. (Environmental Protection Group 1990, 0497)

Parkhurst, D. L., O. C. Thorstenson, and L. N. Plummer, 1980. "PHREEQE—A Computer Program for Geochemical Calculations," US Geological Survey Water Resources Investigations, pp. 80-96. (Parkhurst et al. 1980, 04-0270)

APPENDIX D

OPERABLE UNIT 1129
LIST OF CONTRIBUTORS

for the

LOS ALAMOS NATIONAL LABORATORY
ENVIRONMENTAL RESTORATION PROGRAM

LIST OF CONTRIBUTORS

Name and Affiliation	Education/Expertise	Function
John Absalon (IT Corp.)	18 years of environmental and waste management experience for public, private, and governmental sector clients.	Technical consultant
Jim Bolden (IT Corp.)	B.S. Political Science 12 years of experience in health and safety, includes safety engineer, industrial hygienist, and safety management at fossil, hydroelectric, nuclear, and administrative facilities throughout the US.	Technical consultant
Greg Cole (EES-1)	Ph.D. Geosciences 13 years experience with computerized integration and analysis of field technical data from earth sciences, project management experience.	Facility for Information Management, Analysis, and Display Project Leader
Terry Cooper (IT Corp.)	B.S. Geological Sciences 4 years of experience with the federal government in terrain analyses including hydrology, geohydrology and soil dynamics. 15 months of diversified experience in environmental consulting for federal agencies.	Technical consultant
Jo Cramer (LATA)	36 years experience in records management, document control, and administrative support.	Technical and quality assurance support
Bert Davis (contractor)	Ph.D. Statistics 26 years of experience as an applied statistician; designed and developed test plans to assess chemical and radiological contamination, developed and implemented methodology to assess safety of buildings after remediation from PCB contamination.	Technical consultant
Micheline Devaurs (EM-13)	M.S. Hydrology 8 years experience in evaluation of environmental contamination, hydrologic modeling, and field sampling, including project management.	Operable Unit Project Leader

Richard Dubiskas (IT Corp.)	M.S. Geology 6 years of experience in conducting subsurface investigations with 2 years concentrating on site characterization studies for hazardous waste. Planned and implemented field programs.	Technical consultant
Amy Eilert (Butler)	English major 3 months experience in general technical and editing assistance.	Technical and quality assurance support
Matthew Eilert (Butler)	B.A. Anthropology 6 months experience in general technical and editing assistance.	Technical and quality assurance support
Gabriela Gainer (LATA)	M.S. Geology 5 years experience in geosciences including site characterization, geochemistry, and hydrology. 4 years experience in quality assurance.	Technical and quality assurance support
Jim Griffin (LANL)	22 years of experience in project management, high explosive device engineering, and quality assurance/quality control.	Technical and quality assurance support
Grant Heiken (EES-1)	Ph.D. Geology 23 years experience in volcanology, planteology, and geothermal exploration.	Technical consultant
Dick Herbst (EES-13)	Ph.D. Ceramic Engineering 18 years experience in nuclear waste project management.	Technical consultant
Richard Hutton (SAIC)	B.S. Environmental Geology 15 years of experience in geologic exploration and environmental sciences, including field management, project management, and planning.	Technical consultant
Kimberly Kaal (IT Corp.)	B.S. Geology Over 6 years of experience geology and hydrology, with experience in long-term field programs for CERCLA and RCRA investigations and risk assessment modeling of mixed waste for DOE.	Technical consultant

Andrea Kron (contractor)	B.A. Geology 15 years of experience in cartography, geology, and technical illustration.	Illustrations, flow charts
Kenneth Ladrach (IT Corp.)	M.S. Public Health 5 years of experience in health physics/ radiation protection field including health risk assessments and radiological site characterizations, and with NRC radiation protection regulations.	Technical consultant
Steve Layendecker (IT Corp.)	M.S. Radiation Biology 10 years of professional experience in health physics-related fields.	Technical consultant
Patricia Leyba (IS-5)	B.B.A. (Business Administration) 12 years experience in office/ information management systems.	Document layout and production
Carole Lojek (IT Corp.)	M.S. Geology 7 years of experience includes hydrogeology, environmental assessments, and site characterization in compliance with RCRA and CERCLA.	Technical consultant
Patrick Longmire (INC-4)	Ph.D. Geochemistry 14 years of experience in geochemical aspects of radionuclide, inorganic, and organic solutes.	Operable Unit Project Leader, technical contributor
Amy Longshore (IS-11)	M.S. Technical and Science Communication 4 years of experience writing and editing documents pertaining to technical subjects, scientific research, and environmental, safety, and health issues.	Writer/Editor
Dave McInroy (EM-8)	B.S. Biology 8 years of experience in waste management activities, including project management.	Technical Team Leader, Regulatory Compliance
Earl Morse (IT Corp.)	M.S. Geology Over 7 years of experience in the environmental and energy industries. 4 years of experience in RCRA RFI contamination assessment planning	Technical consultant

	and implementation for groundwater and soil investigations.	
Kelly Peters (IT Corp.)	M.S. Forest Biology 1 year of experience in environmental science, including federal and state regulatory compliance and mixed waste management; 3 years of experience as a laboratory safety manager.	Technical consultant
Matthew Pope (LATA)	M.S. Atmospheric Sciences 12 years experience in air dispersion and dose assessment associated with DOE weapons facilities including environmental assessment, facilities analysis, and environmental restoration.	Technical support and quality assurance support
Al Pratt (EES-13)	B.S. Forestry, B.S. Environmental Science, M.B.A. 10 years experience in resource management; 5 years experience in radioactive waste management program, including project management.	Operable Unit Project Leader
Mike Ray (EM-13)	B.S. Geology 7 years experience in development of waste-related site assessment drilling and sampling plan and data base maintenance for technical baseline design documents.	Records Management Project Leader
Margaret Reneau (IT Corp.)	M.S. Geology 1 year of experience in activities related to RCRA investigations, including permit applications, waivers, RFI work plans, and SWMU evaluations. 2 years of experience in hydrogeological studies.	Technical consultant
Keith Roberson (IT Corp.)	Ph.D. Geology Basic geologic research, with experience in geologic and environmental site characterization, and contamination assessment in RCRA RFIs.	Technical consultant
Carol Simpson (IT Corp.)	Over 15 years experience in document production. 8 years of supervisory, professional, and systems management experience.	Technical consultant

Curtis Thomson (LATA)	B.A. Geology 15 years experience in mineral exploration, mining, mapping and environmental assessment, and project management.	Technical and quality assurance support
Pamela Trexler (LATA)	B.S. Geological and Mining Engineering, MBA 8 years experience in geosciences, site characterization and project scheduling and control.	Technical and quality assurance support
Patricia Trujillo-Oviedo (PA-3)	M.S. Biology-Microbial Ecology M.S. Toxicology / Animal Biology 5 years experience as a Highway Environmentalist and Public Affairs Bureau Chief	Public affairs consultant
Lloyd Ulrey (LANL)	B.S. Mechanical Engineering 42 years experience in design and fabrication engineering of nuclear weapons.	Technical and quality assurance support
Robert Vocke (EM-13)	Ph.D. Water Resources 15 years experience in environmental and hazardous waste site assessment, including waste management, regulatory compliance, and program management.	Program Manager EM-13 Group Leader
Kenneth A.Wohletz (EES-1)	Ph.D. Geology 11 years experience in field, laboratory, and experimental computer simulation research related to hazardous waste isolation, environmental restoration, geothermal systems, petrology, and volcanology; geothermal resource evaluation.	Technical and quality assurance support
Skip Wrightson (IT Corp.)	M.S. Geology 17 years of experience in mineral exploration, engineering geology, oil and gas, includes 8 years experience in environmental geology.	Technical consultant