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RFI Work Plan
for
Operable Unit
1140

Environmental
Restoration
Program

August 1993

A Department of Energy
Environmental Cleanup Program

Los Alamos
NATIONAL LABORATORY

Executive Summary

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EXECUTIVE SUMMARY

Purpose

The Resource Conservation and Recovery Act (RCRA) facility investigation (RFI) for Operable Unit (OU) 1140 is required by the Hazardous and Solid Waste Amendments (HSWA) Module VIII of the RCRA Facility Permit for Los Alamos National Laboratory. The first step in the RFI is preparation of this work plan to propose a methodology for determining the human-health risk of potential RCRA-regulated, hazardous-contaminant releases at OU 1140. Additionally, this work plan includes recommendations for evaluating human-health risks of potential radioactive-contaminant releases. Ecological risk is discussed in Subsection 4.4. This operable unit contains 69 potential release sites (PRSs), all located on Department of Energy (DOE) land at Technical Area (TA) 46.

Two underlying principles guided development of the recommendations for evaluating human-health risks presented in this work plan: 1) that the approach be thorough and appropriate to ensure that human-health risks associated with historic activities at OU 1140 are identified and do not exceed regulatory guidelines and, 2) that the process of identifying the human-health risk levels be fiscally responsible.

Background

The Environmental Protection Agency (EPA) issued the HSWA Module to address potential corrective-action requirements for solid waste management units (SWMUs) at the Laboratory. The Environmental Restoration (ER) Program is responsible for fulfilling part of the regulatory requirements in the Laboratory's RCRA permit. This RFI, together with nine work plans to be submitted to the EPA in 1993 and nine work plans previously submitted, meets the requirement in the HSWA Module to address a cumulative percentage of the Laboratory's SWMUs in RFI work plans by August 27, 1993.

Sites that potentially contain only RCRA materials, or a mixture of RCRA and non-RCRA hazardous materials (e.g., mixed waste), and are RCRA-regulated, are categorized as SWMUs. Sites that are not RCRA regulated, including radioactively-contaminated and one-time-spill sites, are categorized as areas of concern (AOCs). Sites that may contain RCRA materials but are solely regulated by other-than-RCRA authority (i.e., Clean Water Act, Clean Air Act, etc.) are not covered in this work plan (e.g., certain outfalls; see Subsection 5.4.1).

In addition to investigation of SWMUs, the methodology developed in this work plan will be applied to AOCs, which could pose a similar level of risk. In this work plan SWMUs and AOCs are collectively referred to as PRSs. By joint agreement between the DOE, the EPA, and the Laboratory, the ER Program and this work plan include AOCs that may contain radioactive materials and other hazardous substances not subject to RCRA. This commingling of regulated and non-regulated sites is viewed as a cost-effective approach to environmental concerns at the Laboratory. Inclusion of non-regulated sites in this work plan does not confer additional regulatory responsibility or authority for these sites to the regulators and does not bind the Laboratory to proposals contained in the work plan that are outside the scope of the HSWA Module.

The Laboratory's 1988 SWMU Report listed 30 SWMUs at TA-46. Table A in the HSWA Module included 28 of these SWMUs. Table B, a listing of priority SWMUs, included six of the Table A SWMUs.

The Laboratory's 1990 SWMU Report listed 52 SWMUs and AOCs in OU 1140. Seventeen new SWMUs were identified in the preparation of this work plan. This work plan addresses 66 SWMUs and 3 AOCs; recommendations are prescribed for all 69 PRSs.

Installation Work Plan

The HSWA Module requires the Laboratory to prepare an installation work plan to describe the Laboratory-wide approach for implementing the RCRA corrective-action process. This requirement was satisfied by the Installation Work Plan for Environmental Restoration (IWP) submitted to the EPA in November 1990. That document is updated annually, and the most recent revision was published in November 1992. The IWP identifies the Laboratory's PRSs, describes their aggregation into 24 OUs, and presents the Laboratory's overall management plan and technical approach for meeting the requirements of the HSWA Module. When information relevant to this work plan has already been provided in the IWP, the reader is referred to the appropriate version of that document.

OU 1140 Work Plan

Six chapters compose the main text of the RFI Work Plan for OU 1140. Chapters one through three contain introductory and background material. Chapter four describes the technical approach. Chapter five includes PRS descriptions and PRS-specific recommendations for investigation or voluntary corrective action (VCA). Chapter six describes PRSs proposed for no further action (NFA). These chapters are followed by five annexes containing project plans corresponding to portions of the IWP: project management, quality assurance, health and safety, records management, and community relations. All relevant material for the records management and community relations annexes is contained in the IWP and the reader is, therefore, referred directly to the IWP. Following the annexes are eight appendixes presenting work-plan-specific information: cultural and biological resource summaries, list of contributors, field investigation approach and methods, the sample data base, a special study on septic systems, unlocated outfalls, and maps. A glossary follows the appendixes.

The 69 PRSs at OU 1140 include septic systems, dry wells, sewage lagoons, surface disposal/release sites, outfalls, landfills, exhaust stack emissions, and active and inactive waste storage areas. Some of these PRSs are not subject to regulation under the HSWA Module, but receive comparable treatment in this work plan. Eighteen PRSs are proposed for NFA. Forty-four are proposed for investigation. Five are proposed for investigation and partial deferred action or NFA. Detailed sampling plans are proposed for 51 PRSs. Outfalls are a main feature at TA-46. Of 66 outfall points, including both industrial drains and storm runoff, sampling is proposed at 46 locations.

Technical Approach

For the purposes of designing and implementing the sampling and analysis plans described in this work plan, PRSs are grouped into aggregates. However, corrective action recommendations will be made for each PRS. Additionally, because of the complicated drainage patterns at OU 1140, it is possible that corrective action recommendations may be made for outfalls that receive drainage from multiple PRSs. The work plan includes a description and operating history of each PRS or aggregate and an evaluation of any existing data. This information is used to develop a conceptual exposure model for the aggregate. On the basis of this review, no further action is proposed for appropriate PRSs. For currently-active sites, this review is the basis for recommending that investigation and remediation (if required) be deferred until the site is decommissioned. Both types of sites are discussed in Chapter 6. The remaining sites, for which RFI field investigations and/or VCAs are proposed, are discussed in Chapter 5.

Data quality objectives were developed to support the design of the sampling and analysis and VCA plans. This approach ensures that the correct type, amount, and quality of data will be collected. At many sites the selection of samples for laboratory analysis will be based on field surveys and field screening. Laboratory analyses will be performed in mobile and fixed analytical laboratories. Data resulting from the implementation of this work plan will be used as the basis to recommend future actions at this site.

A phased approach to the RFI is used to ensure that results from each step are dealt with in a manner that is cost-effective and in compliance with the HSWA Module. Results from the proposed Phase I sampling effort will be used to make human-health-based recommendations, as will subsequent Phase II sampling results. Environmental risk considerations will be included when programmatic direction is available (see discussion in Subsection 4.4). For most PRSs at OU 1140, there are no existing data and little or no historical evidence that releases have occurred. Therefore, Phase I sampling strategies will focus on determining the presence or absence of hazardous and radioactive contaminants. If analysis of sample data indicates that contamination levels do not exceed conservative screening action levels, the PRS will be recommended for NFA. If contaminants are detected at concentrations at or above these levels, the sampling plans are designed to provide sufficient data to recommend the next step in the corrective-action process. Possible next steps include a baseline risk assessment or remedial alternatives such as VCAs. If the data collected during Phase I are deemed insufficient to support one of these decisions, then additional data will be collected under a Phase II sampling effort and a recommendation will then be made based on the complete data set. The phased approach is designed so that a corrective measures study (CMS) and corrective measures implementation (CMI) would only be undertaken after a Phase II sampling effort. Although not expected, circumstances could arise that would compel a CMS following Phase I sampling. No CMSs are recommended in this work plan.

For all four dry well PRSs and one septic system PRS in OU 1140, strong historical evidence indicates that a release has occurred. A cost-benefit study conducted during preparation of this work plan led to the proposal of VCA removal with confirmatory sampling for these units. The study is described in Appendix F. VCA removals would be conducted in accordance with all applicable or relevant and appropriate regulations, including the National Environmental Policy Act (NEPA). Because of the potential for generating mixed waste, VCA activities at OU 1140 are not planned to start until the Laboratory's mixed waste facility is operational. This facility is not expected to come on line until 1997.

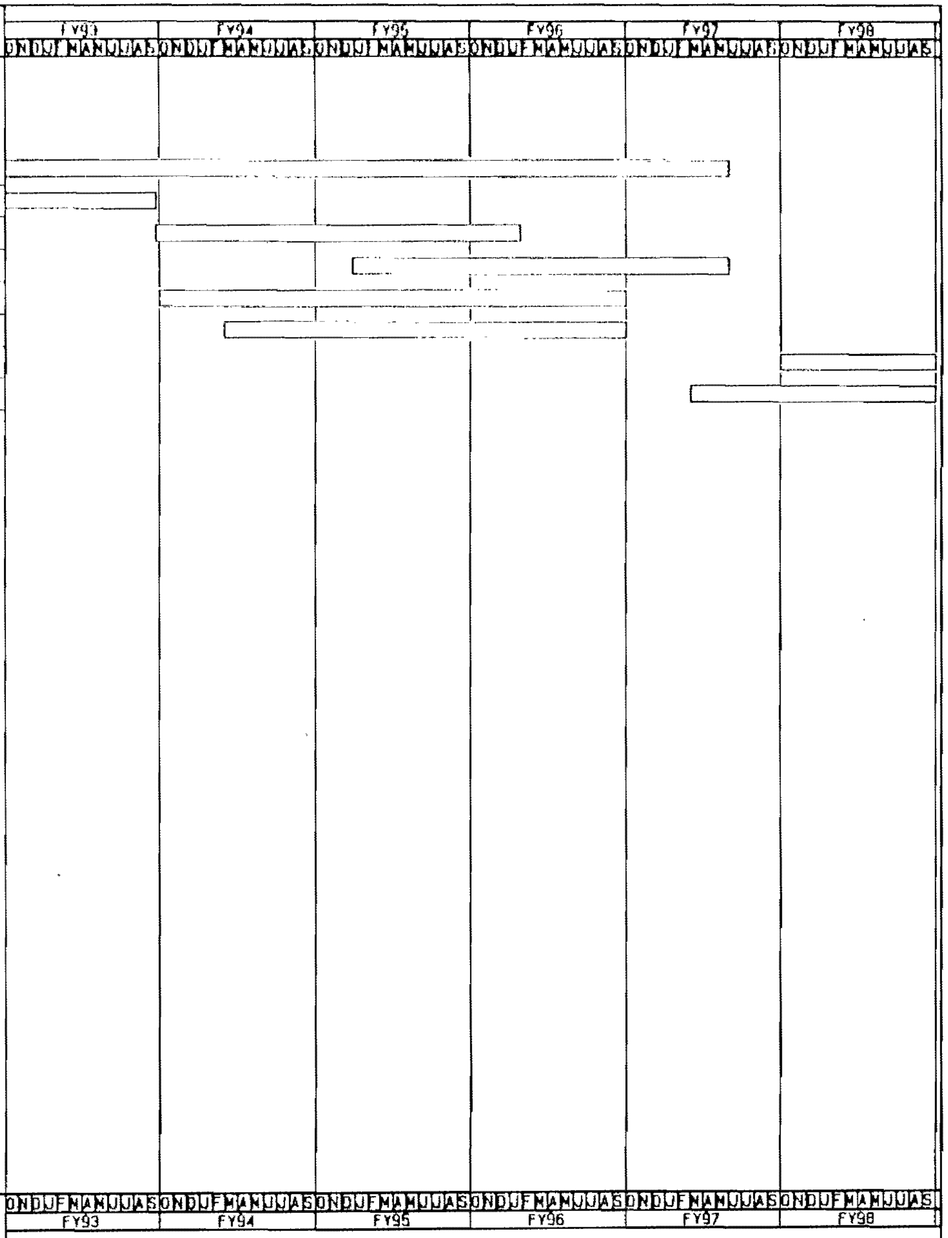
Schedule, Costs, and Reports

The RFI fieldwork described in this document requires approximately 2.5 years to complete (Fig. ES-1). A single phase of fieldwork is expected to be sufficient to complete the RFI for most PRSs. However, if Phase I sampling results are insufficient to make a final recommendation, then Phase II fieldwork will be recommended in an RFI phase report (see below). If Phase II sampling is needed, the fieldwork will take longer than 2.5 years to complete. (The baseline schedule and budget will be modified to reflect the 1997 start of VCA activities. This date is attributable to concern with the possible generation of mixed waste.)

Cost estimates for OU 1140 baseline activities are provided in Table ES-1. The estimated cost for implementing the RFI and reporting is $10.2 million. The total estimated cost for the VCA process at OU 1140 is approximately $4.5 million. The total cost of the corrective action process (assuming no CMS/CMI is required) at OU 1140 is estimated at $14.7 million.

The HSWA Module specifies the submittal of monthly reports and quarterly technical progress reports. In addition, RFI phase reports will be submitted

CODE VALUE	WBS1/WBS2/WBS3/WBS4/WBS5	ORIG DUR	EARLY START	EARLY FINISH
6123011	1140: ADS MANAGEMENT ASSESSMENT	1159	1OCT92	30MAY97
6123012	1140: RFI WORK PLAN	242	1OCT92	21SEP93
6123013	1140: RFI FIELD WORK	581	22SEP93	26JAN96
6123014	1140: RFI REPORT	606	27DEC94	30MAY97
6123016	1140: BENCH/PILOT STUDIES	746	1OCT93	30SEP96
6123018	1140: VOLUNTARY CORRECTIVE ACTION ASSESSMENT	648	1MAR94	30SEP96
6123021	1140: ADS MANAGEMENT REMEDIATION	249	1OCT97	30SEP98
6123028	1140: VOLUNTARY CORRECTIVE ACTION REMEDIATION	299	3MAR97	30SEP98



Plot Date 5MAY93
Data Date 1OCT92
Project Start 1OCT91
Project Finish 30SEP98

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▭	Summary Bar/Early Dates
▬	Critical Designator
▬▭	Progress Bar
◇ / ⚑	Milestone/Flag Activity

Sheet 1 of 1

LOS ALAMOS NATIONAL LABORATORY
ADS 1140: TA-46
FY93 BASELINE MOD: SUMMARY BARCHART

ENVIRONMENTAL RESTORATION

Date	Revision	Checked	Approved

Fig. ES-1. RFI-VCA milestone chart for OU 1140.

TABLE ES-1

ESTIMATED COSTS OF BASELINE ACTIVITIES AT OU 1140

TASK	BUDGET	SCHEDULED START	SCHEDULED FINISH
RFI work plan	$1 560k	1 Oct. 91	21 Sept. 93
RFI	$5 860k	22 Sept. 93	26 Jan. 96
RFI report	$1 960k	27 Dec. 94	30 May 97
Activity data sheet (ADS) management	$830k	1 Oct. 92	30 May 97
Bench/pilot study	$450k	1 Oct. 93	30 Sept. 96
Voluntary corrective action	$4 070k	1 Mar. 94	30 Sept. 98
Report total	$14 730k		
Estimate to completion			
Escalation			
Prior years			
Total at completion			

at the completion of each of the sampling phases. The RFI phase reports will serve to:

- summarize the results of site characterization activities;
- propose modifications to not-yet-completed sampling plans, indicated by the results of in-progress or completed sampling activity;
- recommend additional sampling if Phase I data are deemed insufficient for a final corrective-action decision; and,
- make VCA or NFA recommendations for PRSs shown by the RFI to have acceptable health-based risk levels.

At the conclusion of all RFI activities, a final phase report will be submitted to the EPA.

Public Involvement

Regulations issued pursuant to HSWA and the Laboratory's hazardous waste operating permit mandate public involvement in the corrective action process. In compliance with these regulations, the Laboratory is providing a variety of opportunities for public involvement, including meetings held as needed to disseminate information, to discuss significant milestones, and to solicit informal public review of this and the other draft work plans. The Laboratory also distributes meeting notices and updates the ER Program mailing list; prepares fact sheets summarizing completed and future activities; and provides public access to relevant plans, reports, and other ER Program documents. These materials are available for public review between 9:00 a.m. and 4:00 p.m. on Laboratory business days at the ER Program's public reading room at 1450 Central, Suite 101, in Los Alamos.

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ABBREVIATIONS AND ACRONYMS

ACGIH	American Conference of Governmental Industrial Hygienists
ADS	Activity data sheet
AEA	Atomic Energy Act
AEC	US Atomic Energy Commission
ALARA	As low as reasonably achievable
ANSI	American National Standards Institute
AOC	Area of concern
AP	Administrative procedure
AR	Administrative requirement
BRET	Biological Resource Evaluations Team
CEARP	Comprehensive Environmental Assessment and Response Program
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CGI	Combustible gas indicator
CMI	Corrective measures implementation
CMS	Corrective measures study
COC	Contaminant of concern
cpm	Counts per minute
CRZ	Contamination reduction zone
DA	Deferred action
dB	Decibel
D&D	Decontamination and decommissioning
DOE	US Department of Energy
DOE/AL	US Department of Energy/Albuquerque Operations Office
DOE/HQ	US Department of Energy/Headquarters
DQO	Data quality objective
EM	Environmental Management (Division)
EPA	US Environmental Protection Agency
ER	Environmental Restoration (Program)
ERPG	Emergency Response Planning Guideline
ES&H	Environment, Safety, and Health
FID	Flame ionization detector
FIMAD	Facility for Information Management, Analysis, and Display
FY	Fiscal year
GC	Gas chromatography
HAZWOP	Hazardous Waste Operations Program
HAZWOPER	Hazardous Waste Operations and Emergency Response
H&S	Health and safety, Health and Safety (Division)
HSWA	Hazardous and Solid Waste Amendments
IDLH	Immediately dangerous to life and health
IWP	Installation work plan
kV	Kilovolt
LAAO	Los Alamos Area Office (a branch of the Department of Energy)
LANL	Los Alamos National Laboratory
LASL	Los Alamos Scientific Laboratory (the Laboratory before January 1, 1981)
LLD	Lower limit of detection
LP	Laboratory procedure
MDA	Material disposal area
NEPA	National Environmental Policy Act
NFA	No further action
NIOSH	National Institute of Occupational Safety and Health
NMED	New Mexico Environment Department (prior to April 1991, the NMEID)

NPDES	National Pollutant Discharge Elimination System
OSHA	Occupational Safety and Health Administration
OU	Operable unit
OUPL	Operable unit project leader
PAH	Polycyclic aromatic hydrocarbon
PC	Protective clothing
PCB	Polychlorinated biphenyl
PCOC	Potential contaminant of concern
PID	Photoionization detector
ppb	Parts per billion
PPE	Personal protective equipment
ppm	parts per million
PRS	Potential release site
PVC	Polyvinyl chloride
QA	Quality assurance
QAPjP	Quality assurance project plan
QC	Quality control
QPP	Quality program plan
RCRA	Resource Conservation and Recovery Act
RESRAD	Residual radioactive material
RFA	RCRA facility assessment
RFI	RCRA facility investigation
SAA	Satellite accumulation area
SAL	Screening action level
SARA	Superfund Amendments and Reauthorization Act
SEN	Secretary of Energy notice
SOP	Standard operating procedure
SVOC	Semivolatile organic compound
SWMU	Solid waste management unit
SWSC	Sanitary Waste System Consolidation
TA	Technical area
TAL	Target analyte list
TCL	Target compound list
TCLP	Toxicity characteristic leaching procedure
TD	Total depth
TLV	Threshold limit value
TPH	Total petroleum hydrocarbons
TSCA	Toxic Substances Control Act
TSD	Treatment, storage, disposal
USGS	US Geological Survey
VCA	Voluntary corrective action
VOC	Volatile organic compound
WA	Weapons assembly
WAA	Waste accumulation area
XRF	X-ray fluorescence

GLOSSARY OF TERMS

Activation products Radionuclides resulting from bombardment with neutrons, protons, or other nuclear particles.

Bioaccumulate To increase the concentration of a chemical or chemicals in organisms that reside in environments contaminated with low concentrations of various organic compounds.

Blowdown water A small percentage of the circulating water in a cooling tower that is wasted (e.g., collected and/or discharged to the environment) to limit the concentrations of dissolved solids and other impurities.

Borehole A hole made by boring into the ground to obtain subsurface core samples for contaminant analysis.

Cesium-plasma diode A device used for converting heat directly into electricity.

Confidence limit One of the end points of an interval that has a specified probability of containing a given parameter or characteristic.

Continuous core An unbroken sample of the subsurface profile recovered from a borehole.

Cooling tower A unit in which atmospheric air circulates and cools warm water, generally by direct contact (evaporation).

Dielectric oil An oil that is an electrical insulator or in which an electrical field can be maintained with minimum dissipation in power.

Distal Located away from the point of origin or attachment.

Distribution box A device that equalizes the disposal of septic tank effluent through various lines.

Downgradient The direction of decreasing hydraulic head. In surface water hydrology, this typically corresponds with the direction of decreasing topographic elevation.

Drainage swale A small-scale drainage basin in which surface water collects and from which it is carried by a drainage system.

Entrainment The capture of solid particles, liquid droplets, or mist in a gas stream.

Footprint (of a site) The size and shape of the area on the earth's surface occupied by a site.

Geodetic mapping A survey, suitable for large areas, that allows for the curvature of the earth.

Geomorphologic mapping A survey of the secondary topographic features that are carved by erosion into the primary elements and built up of the erosional debris.

Gross alpha The measurement of all alpha particles radiating from a source.

Gross beta The measurement of all beta particles radiating from a source.

Gross gamma The measurement of all gamma rays radiating from a source.

Ignimbrite A silicic volcanic rock that forms thick, compact, lava-like sheets. Also known as flood tuff.

Isotope enrichment Any process by which the content of a specified isotope in an element is increased.

Lentil (geology) A rock body that is lens-shaped and enclosed in a stratum of unrelated material.

Lithologic Physical characteristic of a rock or rock strata as determined by eye or with a low-power magnifier, and based on color, structures, mineralogic components, and grain size.

Mixed waste Waste containing both radioactive and hazardous components as defined by the Atomic Energy Act and the Resource Conservation and Recovery Act.

mrem (millirem) A unit of ionizing radiation equal to one-thousandth of a rem (0.001 rem).

Organic compounds Chemical compounds based on carbon chains or rings and containing hydrogen with or without oxygen, nitrogen, or other elements.

Palustrine Being, living, or thriving in a marsh.

Polynuclear hydrocarbon A hydrocarbon molecule with two or more closed rings.

Polyaromatic hydrocarbon (PAH) A class of organic compounds consisting of assemblages of cyclic conjugated carbon atoms and characterized by large resonance energies.

Quantitation limits The minimum amount of a chemical that can be detected and measured with a suitable degree of reliability using currently available instrumentation (usually three to five times the instrument detection limit).

Satellite accumulation area (SAA) An area that can store up to 55 gallons of hazardous or mixed wastes or one quart of acutely hazardous waste for an unlimited amount of time.

Stochastic Pertaining to random variables developed in accordance with a probabilistic model.

Swipe A procedure in which a swab is rubbed on a surface and its radioactivity measured to determine if the surface is contaminated with loose radioactive material.

Tracer A foreign substance, usually radioactive, that is mixed with or attached to a given substance so that the distribution or location of the latter can be determined.

Volatilization The conversion of a chemical substance from a liquid or solid state to a gaseous or vaporous state by applying heat, by reducing pressure, or by a combination of these processes. Also known as vaporization.

Welding (geology) Consolidation of sediments by pressure.

Zipper joints (geology) Sets of incised joints that provide drainages off a plateau or from mesa tops into canyon bottoms.

Executive Summary

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Appendixes

Chapter 1

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1.0 INTRODUCTION

1.1 Statutory and Regulatory Background

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

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

The HSWA Module lists solid waste management units (SWMUs) in which a facility has placed solid waste. These wastes may be either hazardous (i.e., RCRA-regulated) or nonhazardous (e.g., construction debris). Table A of the HSWA Module identifies 603 SWMUs at the Laboratory, and Table B lists those SWMUs that must be investigated first. In addition, the Laboratory has identified areas of concern (AOCs), which do not meet the strict regulatory definition of a SWMU. These sites may contain radioactive materials and other hazardous substances (i.e., not RCRA-regulated) listed under CERCLA. As previously stated in the Executive Summary, SWMUs and AOCs are collectively referred to as PRSs.

For the purposes of implementing the cleanup process, the Laboratory has aggregated PRSs that are geographically related in groupings called operable units (OUs). The Laboratory has established 24 OUs, and an RFI work plan is prepared for each. This work plan for OU 1140 addresses PRSs located in one of the Laboratory's technical areas (TAs), TA-46. This plan, together with nine other work plans to be submitted to EPA in 1993 and nine plans submitted in 1991 and 1992, meets the schedule requirements of the HSWA Module, which is to address a cumulative total of 55% of the SWMUs in Table A and a cumulative total of 100% of the 182 priority SWMUs listed in Table B of the HSWA Module.

The HSWA Module outlines five tasks to be addressed in an RFI work plan. Table 1-1 lists these tasks and indicates the Environmental Restoration (ER) Program equivalents. Table 1-2 indicates the location of HSWA Module requirements in ER Program documents.

1.2 Installation Work Plan

The HSWA Module requires that the Laboratory prepare a master plan, called an installation work plan (IWP), to describe the Laboratory-wide system for accomplishing all RFIs and corrective measures studies (CMSs). The IWP has been prepared in accordance with the HSWA Module and is consistent with EPA's interim final RFI guidance (EPA 1989, 0088) and proposed Subpart S of 40 CFR 264 (EPA 1990, 0432), which is designed to implement the cleanup program mandated in Section 3004(u) of RCRA. The IWP was first prepared in 1990 and is updated annually. This work plan follows the requirements specified in Revision 2 of the IWP (LANL 1992, 0768).

The IWP describes the aggregation of the Laboratory's PRSs into 24 OUs (Subsection 3.4.1). It presents a facilities description in Chapter 2 and a description of the structure of the Laboratory's ER Program in Chapter 3. Chapter 4 describes the technical approach to corrective action at the Laboratory. Annexes I-V contain the Program Management Plan, Quality Program Plan, Health and Safety Program Plan, Records Management Program Plan, and the Community Relations Program Plan, respectively. The document also contains a proposal to integrate RCRA closure and corrective action and a strategy for identifying and implementing interim

TABLE 1-1

RCRA FACILITY INVESTIGATION GUIDANCE FROM THE HSWA MODULE

Scope of the RCRA Facility Investigation (RFI)	**ER Program Equivalent**	
The RFI consists of 5 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	**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 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
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, Technical Data Management Plan, Health and Safety Plan, Community Relations Plan B. LANL Task/Site RI/FS Documents and LANL Monthly Management Status Report C. Draft and Final

*RI = Remedial Investigation
FS = Feasibility Study

TABLE 1-2

LOCATION OF HSWA MODULE REQUIREMENTS IN ER PROGRAM DOCUMENTS

HSWA Module Requirements for RFI Work Plans	Installation Work Plan and Other Program Documents	Documents for Operable Unit 1140
Task I: Description of Current Conditions		
A. Facility Background	IWP Section 2.1	RFI Work Plan Chapter 2
B. Nature and Extent of Contamination	IWP Section 2.4 and Appendix F	RFI Work Plan Chapter 5
Task II: RFI Work Plan		
A. Data Collection Quality Assurance Plan	IWP Annex II (Quality Program Plan)*	RFI Work Plan Annex II
B. Data Management Plan	IWP Annex IV (Records Management Program Plan)	RFI Work Plan Annex IV
C. Health and Safety Plan	IWP Annex III (Health and Safety Program Plan)	RFI Work Plan Annex III
D. Community Relations Plan	IWP Annex V (Community Relations Program Plan)	RFI Work Plan Annex V
E. Project Management Plan	IWP Annex I (Program Management Plan)	RFI Work Plan Annex I
Task III: Facility Investigation		
A. Environmental Setting	IWP Chapter 2	RFI Work Plan Chapter 3
B. Source Characterization	IWP Appendix F	RFI Work Plan Chapter 5
C. Contamination Characterization	IWP Appendix F	RFI Work Plan Chapters 4 and 5
D. Potential Receptor Identification	IWP Section 4.2	RFI Work Plan Chapters 4 and 5
Task IV: Investigative Analysis		
A. Data Analysis	IWP Section 4.2	Phase reports and RFI report
B. Protection Standards	IWP Section 4.2	RFI report
Task V: Reports		
A. Preliminary and Work Plan	IWP, Rev. 0	Work plan
B. Progress	Monthly reports, quarterly reports, and annual revisions of IWP	Phase reports
C. Draft and Final		Draft and final RFI report

* Annex II of the IWP addresses these requirements by reference to controlled documents: the Generic Quality Assurance Project Plan (LANL 1991, 0553) and the ER Program's standard operating procedures (LANL 1993, 0875).

remedial measures. When information relevant to this workplan has already been provided in the IWP, the reader is referred to the appropriate revision of the IWP.

1.3 Description of OU 1140

OU 1140 is located in Los Alamos County in north-central New Mexico (Fig. 1-1), and consists of TA-46 (Fig. 1-2). The 69 PRSs include: septic systems, dry wells, sewage lagoons, surface disposal/release sites, outfalls, landfills, stack emissions, and active and inactive waste storage areas. All PRSs are shown on Map H-1 in Appendix H.

The OU covers approximately 270 acres of mesa and canyon terrain; the developed area, which contains the PRSs, is roughly 50 acres in extent (a PRS location map is included in Appendix H). The PRSs have been grouped into six aggregates based on similar risk-assessment conceptual models and similar sampling approaches. The aggregates and their work plan subsections are as follows: 5.1, Septic Systems and Dry Wells; 5.2, Lagoon Systems; 5.3, Surface Releases; 5.4, Outfalls; 5.5, Landfills; and 5.6, Stack Emissions. Some PRSs have components that fall into multiple (two or three) aggregates; they have multiple applicable risk-assessment conceptual models, and require several sampling approaches for a complete investigation. All PRSs, or parts thereof, proposed for no further action (NFA) or deferred action (DA) have been included in Chapter 6, irrespective of the above aggregations.

Outfalls are an important feature at TA-46. A total of 66 outfall locations have been identified and field marked with alphabetic characters, and 44 of these are proposed for sampling. The outfalls include industrial drains and surface runoff locations. Surface runoff outfalls that do not receive flow from a PRS are generally not sampled. The outfall sampling approach is unique in that the key identifier is the alphabetic designator rather than the PRS identifier. The outfalls do not necessarily correlate with a particular PRS; an outfall may receive flows from multiple PRSs, or a PRS may flow to multiple outfalls. Data collected from most outfall samples will support the characterization of multiple PRSs. The relationship between outfalls and PRSs is discussed in detail in Subsection 5.4.

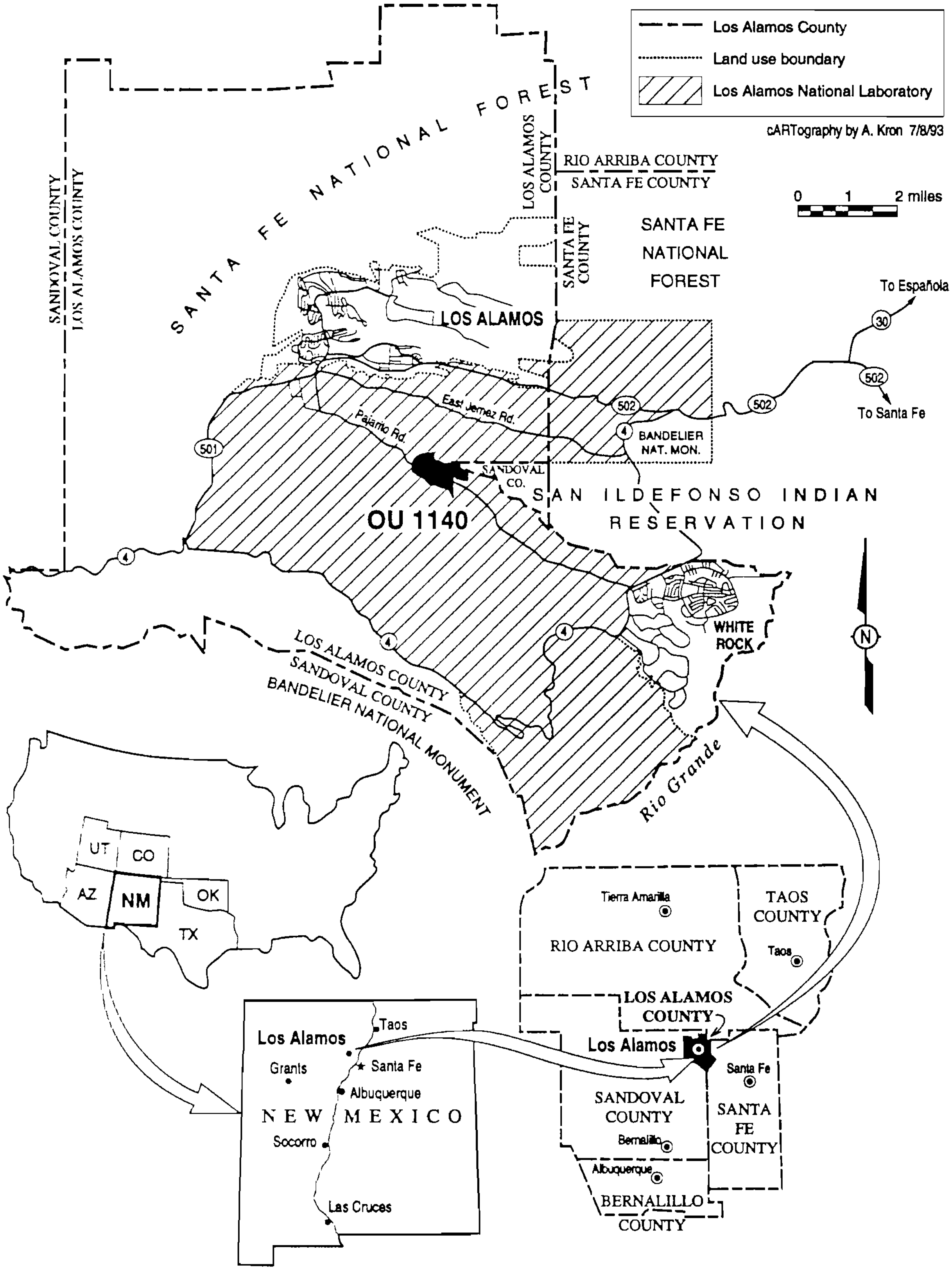

Fig. 1-1. Location of Operable Unit 1140.

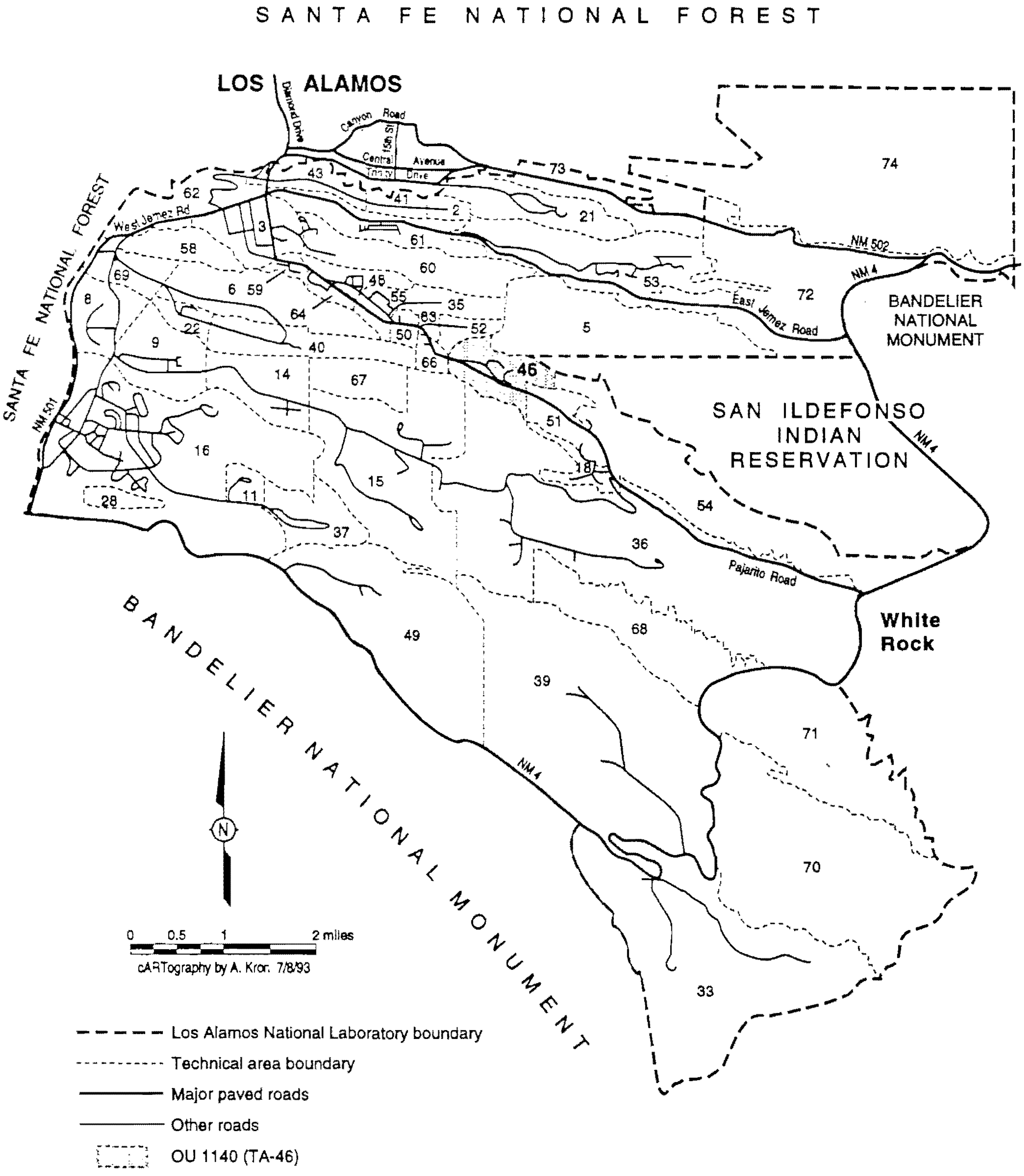

Fig. 1-2. **Location of Operable Unit 1140 with respect to Laboratory technical areas and surrounding landholdings.**

The PRSs in OU 1140 are located on property owned by the DOE. Photochemical, laser, and hydrogen fuel-cell research are the primary activities at the site. There are also smaller efforts in heat pipe research and electronics design and fabrication. These operations do not generate large amounts of wastes. Hazardous wastes are collected at satellite accumulation areas and shipped off site.

Production operations are not, and have never been, conducted at TA-46. Hazardous and radioactive wastes that may be in the PRSs would be the result of incidental releases and disposal from research operations. Therefore, potential contaminant quantities are expected to be small. Most potential hazardous-waste (i.e., RCRA-regulated) release sites are the legacy of the Rover Nuclear-rocket Program. The Rover Program left behind potential radioactive waste release sites as well, but the Jumper Program also contributed to the radioactive waste potential problems. A more complete discussion of the history of TA-46 is in Chapter 2.

Table 1-3 includes all PRSs at OU 1140; HSWA Module Table A SWMUs are included. For PRSs that are shown to be in more than one work plan subsection (aggregate), the subsection listed first contains the history and description of the PRS. Those PRSs that are proposed for NFA are identified as being in Chapter 6. Unless exceptions are made, EPA approval of this work plan has the effect of delisting from the Laboratory permit all SWMUs proposed for NFA in Chapter 6.

1.4 Work Plan Organization

This work plan follows the generic outline provided in Table 3-3 of the IWP (LANL 1992, 0768). Following this introductory chapter, Chapter 2 provides background information on OU 1140, which includes a description and history of the OU, a description of past waste management practices, and current conditions at technical areas in the OU. Chapter 3 describes the environmental setting, and Chapter 4 presents the technical approach to the field investigation.

Chapter 5 includes a description and history of each PRS, a conceptual exposure model, data needs and data quality objectives, and recommendations for investigation or removal, and a sampling plan.

TABLE 1-3

PRSs IN OU 1140

1988 SWMU NUMBER	TABLE A SWMU NUMBER	1990 PRS NUMBER	CURRENT OR PROPOSED PRS NUMBER	CHAPTER OR SUB-SECTION	TYPE OF PRS
46-001		46-001	46-001	6	Inactive storage
46-002	46-002	46-002	46-002	5.2, 5.4, 6	Sanitary lagoon, outfall
46-003(a)	46-003(a)	46-003(a)	46-003(a)	5.1, 5.4, 6	Septic system, outfall
46-003(b)	46-003(b)	46-003(b)	46-003(b)	5.1	Septic system
46-003(c)	46-003(c)	46-003(c)	46-003(c)	5.1	Septic system
46-003(d)	46-003(d)	46-003(d)	46-003(d)	5.1	Septic system
46-003(e)	46-003(e)	46-003(e)	46-003(e)	5.1	Septic system
46-003(f)	46-003(f)	46-003(f)	46-003(f)	5.1, 5.3, 5.4	Septic system, outfall, surface release
46-003(g)	46-003(g)	46-003(g)	46-003(g)	5.1, 5.4	Septic system, outfall
		46-003(h)	46-003(h)	5.3	Outfall
46-004(a)	46-004(a)	46-004(a)	46-004(a)	6	Drain line
46-004(b)	46-004(b)	46-004(b)	46-004(b)	6	Surface release
46-004(c)	46-004(c)	46-004(c)	46-004(c)	5.1	Dry well
46-004(d)	46-004(d)	46-004(d)	46-004(d)	5.1	Dry well
46-004(d)	46-004(d)	46-004(d)	46-004(e)	5.1	Dry well
46-004(f)	46-004(f)	46-004(f)	46-004(f)	5.4	Outfall
46-004(g)	46-004(g)	46-004(g)	46-004(g)	5.4, 5.6, 6	Outfall, exhaust stack emissions, drain line
46-004(h)	46-004(h)	46-004(h)	46-004(h)	5.4, 5.6, 6	Outfall, exhaust stack emissions, drain line
		46-004(i)	46-004(i)	6	Outfall
		46-004(j)	46-004(j)	6	Outfall
		46-004(k)	46-004(k)	6	Outfall
		46-004(l)	46-004(l)	6	Outfall
		46-004(m)	46-004(m)	5.4	Outfall
		46-004(n)	46-004(n)	6	Outfall
		46-004(o)	46-004(o)	6	Outfall
			46-004(p)	5.1	
			46-004(q)	5.4	Outfall
			46-004(r)	5.4	Outfall
			46-004(s)	5.4	Outfall

TABLE 1-3 (continued)

PRSs IN OU 1140

1988 SWMU NUMBER	TABLE A SWMU NUMBER	1990 PRS NUMBER	CURRENT OR PROPOSED PRS NUMBER	CHAPTER OR SUB-SECTION	TYPE OF PRS
			46-004(t)	5.4	Outfall
			46-004(u)	5.4	Outfall
			46-004(v)	5.4	Outfall
			46-004(w)	5.4	Outfall
			46-004(x)	5.4	Outfall
			46-004(y)	5.4	Outfall
			46-004(z)	5.4	Outfall
			46-004(a2)	5.4	Outfall
			46-004(b2)	5.4	Outfall
			46-004(c2)	5.4	Outfall
			46-004(d2)	5.6, 5.4	Exhaust stack emissions
46-005	46-005	46-005	46-005	5.2, 5.4	Sanitary lagoon, outfall
46-006(a)	46-006(a)	46-006(a)	46-006(a)	5.3, 5.4	Surface release, outfall
46-006(b)	46-006(b)	46-006(b)	46-006(b)	5.3, 5.4	Surface release, outfall
46-006(c)	46-006(c)	46-006(c)	46-006(c)	5.3, 5.4	Surface release, outfall
46-006(d)	46-006(d)	46-006(d)	46-006(d)	5.3	Surface release
46-006(e)	46-006(e)	46-006(e)	46-006(e)	6	Surface release
			46-006(f)	5.3	Surface release
			46-006(g)	5.3	Surface release
46-007	46-007	46-007	46-007	5.3, 5.4	Surface release, outfall
		46-008 (misc.)	46-008 (misc.)	6	Inactive storage
46-008(a)	46-008(a)	46-008(a)	46-008(a)	5.3	Inactive storage
46-008(b)	46-008(b)	46-008(b)	46-008(b)	5.3	Inactive storage
46-008(c)	46-008(c)	46-008(c)	46-008(c)	6	Inactive storage
46-008(d)	46-008(d)	46-008(d)	46-008(d)	5.3	Inactive storage
46-008(e)	46-008(e)	46-008(e)	46-008(e)	5.3	Inactive storage
46-008(f)	46-008(f)	46-008(f)	46-008(f)	5.3	Inactive storage
		46-008(g)	46-008(g)	5.3	Inactive storage
46-009		46-009(a)	46-009(a)	5.5	Landfill
		46-009(b)	46-009(b)	5.5	Landfill

TABLE 1-3 (continued)

PRSs IN OU 1140

1988 SWMU NUMBER	TABLE A SWMU NUMBER	1990 PRS NUMBER	CURRENT OR PROPOSED PRS NUMBER	CHAPTER OR SUB-SECTION	TYPE OF PRS
		46-010 (misc.)	46-010 (misc.)	6	Active storage
		46-010(a)	46-010(a)	6	Active storage
		46-010(b)	46-010(b)	6	Active storage
		46-010(c)	46-010(c)	6	Active storage
		46-010(d)	46-010(d)	5.3	Active storage
		46-010(e)	46-010(e)	6	Active storage
		46-010(f)	46-010(f)	6	Active storage
		C-46-001	C-46-001	5.3, 5.4	Surface release, outfall
		C-46-002	C-46-002	5.6, 5.4	Exhaust stack emissions, outfall
		C-46-003	C-46-003	5.6, 5.4	Exhaust stack emissions, outfall

Chapter 6 of this work plan provides a description of each PRS proposed for NFA or DA and the basis for that recommendation.

The main body of the work plan is followed by five annexes containing project plans corresponding to portions of the IWP: project management, quality assurance, health and safety, records management, and community relations. All relevant material for the records management and community relations annexes is contained in the IWP and the reader is, therefore, referred directly to the IWP. Following the annexes are eight appendixes presenting work-plan-specific information. Appendixes A and B describe the Cultural and Biological Resources within OU 1140, respectively. They prescribe mitigative practices in compliance with New Mexico and Federal regulations. Appendix C is a list of contributors to this work plan. Appendix D summarizes details of the field-investigation approach and methods. Appendix E is the sampling plan data base. Appendix F discussed how ecological risk will be included in Phase I of the RFI. Appendix G is a summary of unlocated outfalls. Appendix H contains a map showing the locations of all PRSs and outfalls in OU 1140 and a map that also shows all proposed Phase I sample locations. A list of acronyms precedes Chapter 1.

A glossary of unfamiliar terms is provided at the beginning of this work plan, in addition to the glossary in the IWP (LANL 1992, 0768).

The units of measurement used in this document are expressed in both English and metric units, depending on which unit is commonly used in the field being discussed (Table 1-4). When information is derived from some other published report, the units are consistent with those used in that report.

TABLE 1-4

APPROXIMATE CONVERSION FACTORS FOR SELECTED SI (METRIC) UNITS

MULTIPLY SI (METRIC) UNIT	BY	TO OBTAIN US CUSTOMARY UNIT
Cubic meters (m^3)	35	Cubic feet (ft^3)
Centimeters (cm)	0.39	Inches (in.) meters
Meters (m)	3.3	Feet (ft)
Kilometers (km)	0.62	Miles (mi)
Square kilometers (km^2)	0.39	Square miles (mi^2)
Hectares (ha)	2.5	Acres
Liters (L)	0.26	Gallons (gal.)
Grams (g)	0.035	Ounces (oz)
Kilograms (kg)	2.2	Pounds (lb)
Micrograms per gram (mg/g)	1	Parts per million (ppm)
Milligrams per liter (mg/L)	1	Parts per million (ppm)
Celsius (°C)	9/5 + 32	Fahrenheit (°F)

REFERENCES

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EPA (US Environmental Protection Agency), April 10, 1990. RCRA Permit No. NM0890010515, EPA Region VI, issued to Los Alamos National Laboratory, Los Alamos, New Mexico, effective May 23, 1990, EPA Region 6, 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)**

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- History
- Past Waste Management Practices
- Current Conditions

2.0 BACKGROUND INFORMATION

2.1 Description

Operable Unit 1140 covers approximately 270 acres spread across the head of Cañada del Buey and extending south across Mesita del Buey into Pajarito Canyon. Piñon-juniper-grassland vegetation covers the mesa, with ponderosa forest on canyon walls and floors. Laboratory operations have been conducted only in the developed complex at Technical Area (TA) 46 where laboratories, office buildings, warehouses, and storage facilities are clustered in an area of approximately 50 acres atop Mesita del Buey. The site is level; most of the complex is paved and surrounded by 8-ft chain link fences. The core of the site is enclosed by a chain link security fence.

TA-46 is bounded on the north by Cañada del Buey, a 60-ft-deep, steep-walled canyon. A sewage lagoon and filter beds are located on the point at the eastern end of the site. A small tributary, locally known as SWSC Canyon, originates near the southern end of the site and drains northeast to Cañada del Buey. The main Laboratory sanitary waste treatment plant, the Sanitary Waste System Consolidation (SWSC) facility, is located in this canyon. South of SWSC Canyon is a detached cluster of buildings and two sewage ponds. Pajarito Road extends along the southern boundary of TA-46 (see Fig. 2-1).

2.2 History

TA-46 was established in 1954 as a weapons assembly (WA) site; TA-46-1, a three-story laboratory building, was built for that purpose. The building was never used for assembling weapons. Instead, TA-46 housed the Nuclear Rocket (N) Division's Rover Program to develop nuclear reactors for propulsion of space rockets. Other laboratory buildings were added in the mid-1950s. Experiments included coolant-flow and structural testing of fuel elements made of uranium-loaded graphite, which were sometimes tested until they failed. Hazardous materials used for the program included beryllium, beryllium oxide, cadmium nitrate, uranium-235 and -238, thorium, nickel carbonyl (in a closed system), and organic compounds. Mercury was used in equipment such as vacuum pumps. The Rover Program terminated in 1973.

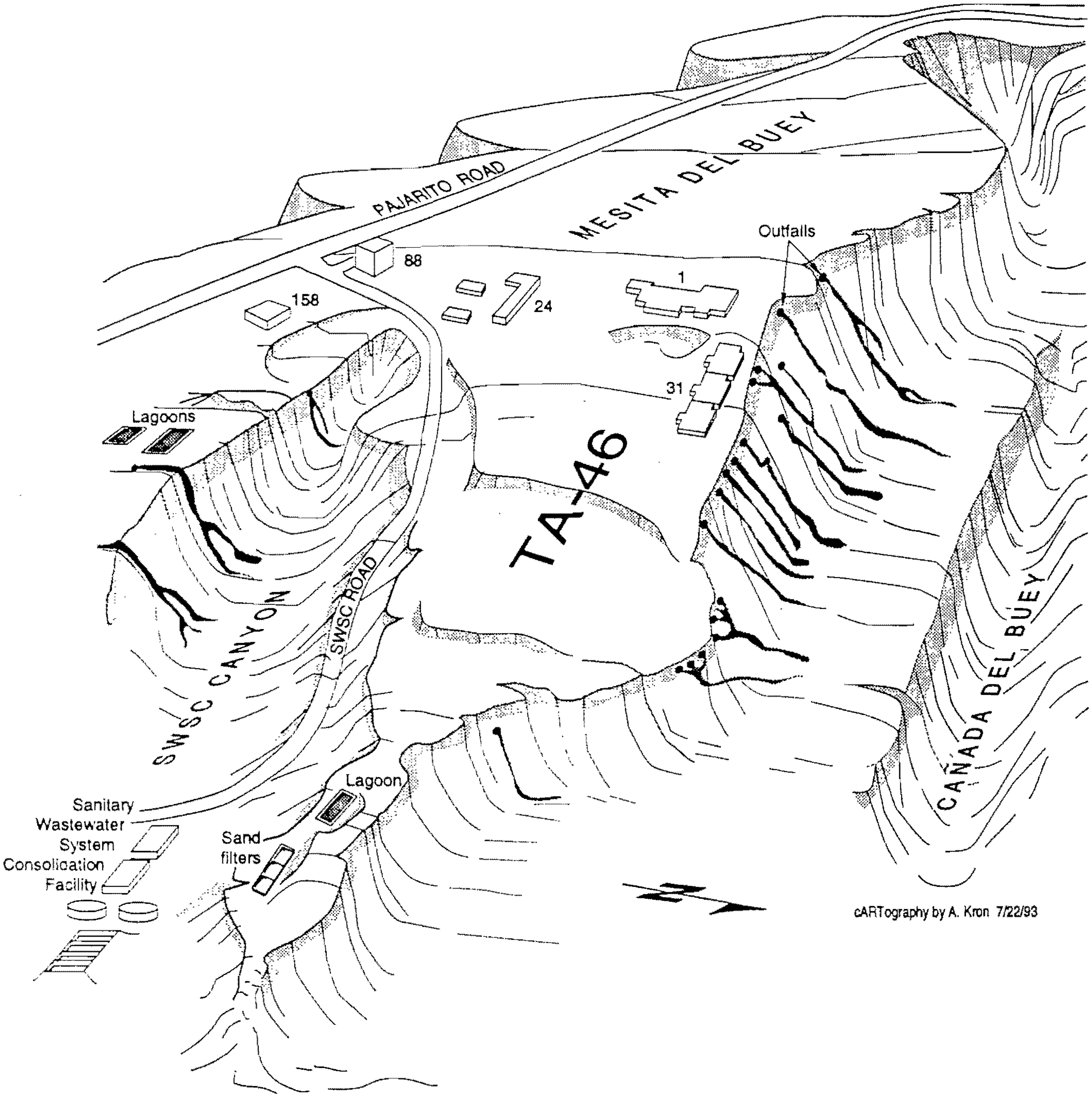

Fig. 2-1. Overview of TA-46.

By 1976, Applied Photochemistry (AP) Division research groups at TA-46 established the Jumper Program to develop uranium isotope separation methods. This program used lasers to excite uranium hexafluoride gas of various enrichments. Uranium-237 (6.75-day half-life) served as a tracer. In 1978 the Laser Isotope Enrichment Building, TA-46-154, was built. The Jumper Program terminated in the early 1980s. Laser research remains a principal activity at TA-46.

Also in the 1970s, groups in the Energy (Q) Division conducted programs in support of solar energy, constructing experimental solar buildings and solar ponds east of TA-46-158. When the solar programs ended in the late 1980s, the ponds were converted to sanitary waste lagoons. Other activities conducted at TA-46 included free-electron laser research, heat pipe research, accelerator technology, electronics development, and production of nonradioactive isotopes of oxygen, carbon, and nitrogen. These activities generated little waste other than cleaning solvents such as trichloroethylene, 1,1,1-trichloroethane, and acetone.

2.3 Past Waste Management Practices

Waste disposal practices at TA-46 followed procedures acceptable at the time. Management of hazardous material focused on worker safety, with controlled management of waste a secondary consideration. At various times waste streams contained uranium compounds, organic solvents and cleaning agents, oils, hazardous metals, and sanitary waste. Waste was released to the environment via liquid disposal through sanitary systems and directly via outfalls, leakage of drums and other containers, gaseous plumes, and direct disposal of solids.

Significant amounts of liquid wastes were discharged over the years. Chemical and industrial effluent discarded down sinks and floor drains flowed to septic tanks and later to the sewage lagoons. According to various engineering drawings, some floor drains connected directly to outfalls (McCulla 1992, 11-203). Both untreated cooling water and treated blow-down from cooling towers went into floor drains or had separate outfalls directly to the environment. Untreated effluent from a sink in TA-46-77 flowed to the ground outside the building where it soaked into the soil. Machinists used water to cool polishing equipment; analyses indicated high levels of uranium in effluent resulting from metallurgical polishing in TA-46-1 (Runyan 1965, 11-049). A water-filled, open, concrete tank, TA-46-81, was constructed to clean alkali metals from equipment and glassware (Ehrenkranz 1963, 11-038). Dry wells at buildings TA-46-31 and TA-46-58 functioned by allowing effluent to soak into soil and tuff.

Spills and disposal practices also involved dusts and other solid materials. When fuel elements were sawed open, particles fell into floor drains or lodged in air ducts of the buildings (Welty 1958, 11-006). Hazardous materials, such as cadmium nitrate, were used in large quantities (Schulte 1958, 11-009). Experimenters used caustic compounds and metals extensively, discarding natural (nonradioactive) cesium metal and other material in a ditch at the south side of TA-46-1 (Teatum 1961, 11-018) and into a dry well on the west side of the building. Mercury spills occurred both inside and outside of buildings (Hyatt 1957, 11-003).

Materials delivered and stored in drums included oils, solvents, and organic cleaning agents such as acetone, trichloroethylene, and 1,1,1-trichloroethane. Barrels and drums stored in many areas of TA-46 were monitored infrequently and often rusted and leaked on docks, pavement, and soils. Spillage flowed to nearby storm drains (DOE 1987, 0264).

Gases used for flushing equipment during the Rover Program were vented through stacks (Ettinger 1962, 11-021), so there was potential for carrying contaminants through the ductwork. Since experimenters performed operations in numerous unfiltered hoods, exhaust systems were installed around machining equipment for worker safety (Ettinger 1963, 11-023).

Over the years, disposal practices became more regulated at the Laboratory. Most septic tanks at TA-46 were abandoned in 1973 when the sewage lagoon was completed. Beginning in 1978, cooling-water outfalls were licensed under US Environmental Protection Agency national pollutant discharge elimination system (NPDES) permits. Beginning in 1987, groups established satellite accumulation areas for the management of hazardous wastes. Beginning in 1988, the Laboratory established institutional controls for the disposal of hazardous wastes. In the 1990s, there was a Laboratory-wide cleanup campaign to send discarded material to regulated accumulation and disposal areas.

2.4 Current Conditions at Operable Unit 1140

All buildings at TA-46 are occupied and active. Since no experiments involving radionuclides are currently conducted at TA-46, no mixed waste is generated. Photochemical research, such as the free electron laser experiments and hydrogen fuel cell research, are the primary activities at the site. Other active programs in heat pipe research, electronics design and fabrication, and accelerator research do not generate large amounts of wastes. Hazardous wastes are collected at regulated accumulation areas to be shipped off site.

Efforts to clean and refurbish TA-46 to current environmental standards include locating sources of numerous outfalls and interconnections of waste lines, identifying old structural features such as septic tank connections, and rerouting waste streams away from outfalls that discharge directly to the environment. Strict Laboratory procedures govern all waste disposal methods. NPDES outfalls are monitored on a regular schedule. Supervisors are charged with enforcing waste disposal regulations and taking corrective actions for spills and accidents.

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- Cultural and Biological Resources
- Geology
- Hydrology
- Conceptual Geologic/ Hydrologic Model

3.0 ENVIRONMENTAL SETTING

3.1 Physical Description

Operable Unit (OU) 1140, Technical Area (TA) 46, is located near the center of the Laboratory, atop Mesita del Buey (Fig. 3-1). The nearest adjacent Laboratory facilities include TA-51 to the east and TA-52 to the west, while adjoining Laboratory land includes portions of TA-51 and 54 (OU 1148), TA-65 (OU 1093), TA-36 (OU 1130), TA-15 (OU 1086), and TA-5, TA-52, and TA-66 (OU 1129). San Ildefonso Pueblo land adjoins a small segment of the TA-46 northeast boundary.

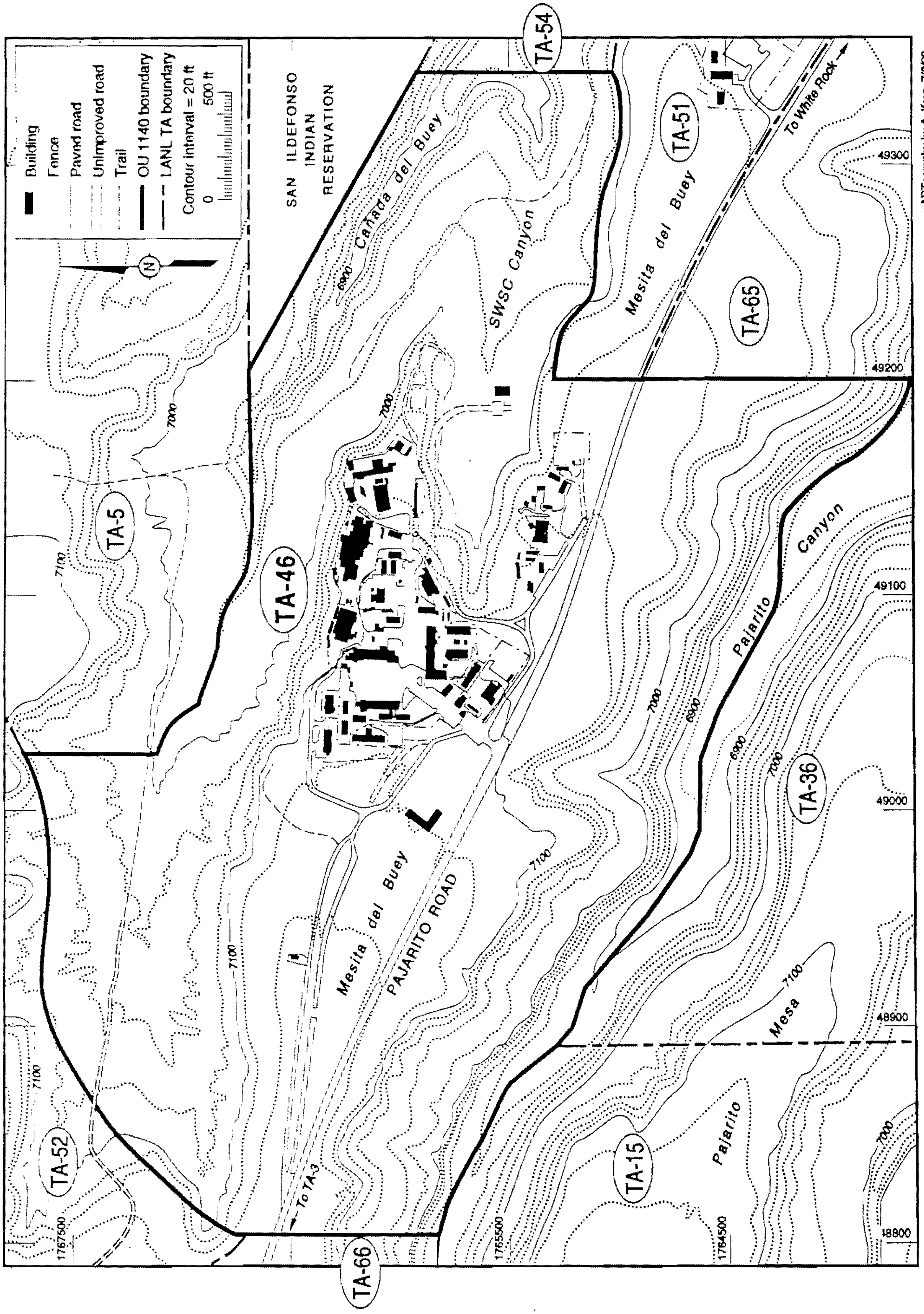
TA-46 is bounded by Cañada del Buey to the north and Pajarito Canyon to the south. All of the Laboratory development lies north of Pajarito Road and the drainage divide between the two canyons. Pajarito Canyon is thus not expected to be affected by activities at TA-46, and will not be considered further in this work plan. Both Pajarito Canyon and Cañada del Buey will be included in the work plan for OU 1049 (Canyons).

Elevations at TA-46 range from approximately 7 150 ft on the mesa top near TA-66 to 6 850 ft at the floor of Pajarito Canyon. All structures in TA-46 are on the mesa top at an elevation near 7 100 ft with the exception of the Sanitary Wastewater Systems Consolidation (SWSC) Project treatment plant located in SWSC Canyon, a small tributary of Cañada del Buey that enters from the south.

3.2 Climate

The work of Bowen (1990, 0033) on Los Alamos climate conditions is summarized in Subsection 2.5.3 of the Installation Work Plan (IWP) (LANL 1992, 0768). No site-specific climatological data are available for TA-46, but it can be safely assumed that conditions at TA-46 are intermediate between those at the TA-59 meteorological station, 2.5 miles northwest of TA-46, and those at the Area G meteorological station, located at TA-54, approximately 3 miles to the southeast. The following brief summary is from Bowen (1990, 0033).

Los Alamos has a semiarid, temperate mountain climate, with average normal temperatures ranging from 29°F in January to 68°F in July. Mean annual precipitation is 18 in. at TA-59, 40% of which falls in July and August



cARTography by A. Kron 7/8/93

Fig. 3-1. Location of OU 1140 with respect to surrounding landholdings.

during the summer monsoons. Most of the rest falls as winter snowfall, which averages 51 in. Surface winds are quite light, averaging 7 mph, and are strongest from March through June and weakest in December and January.

The predominant daytime wind direction is from the south, while southwesterly and westerly winds predominate at night.

3.3 Cultural and Biological Resources

Appendix A of this work plan contains the results of a cultural resource survey conducted at OU 1140. Nineteen archaeological sites were located during the survey, fourteen of which are eligible for inclusion on The National Register of Historic Places. The significant attributes of these sites will not be affected by the Environmental Restoration (ER) Program sampling activities described in this work plan. The monitoring and avoidance recommendations contained in Appendix A will be followed by all ER sampling personnel.

A summary of a biological assessment conducted for OU 1140 is presented in Appendix B of this work plan. This summary indicates that if reasonable precautions are followed, the RFI sampling program described in this work plan can be conducted without significant impact to the biological resources of OU 1140. The Laboratory's Biological Resource Evaluations Team (BRET) will be available for consultations as required during the RFI process.

3.4 Geology

The geology of the Laboratory and the Pajarito Plateau is discussed in great detail in Subsection 2.6.1 of the IWP (LANL 1992, 0768). Unlike some technical areas at the Laboratory (notably TA-54 and TA-49), very little site-specific geologic research has been conducted at TA-46. The geologic discussion presented in the IWP may, therefore, be considered a useful introduction to geologic conditions at TA-46. Site-specific information, as available, is presented in the following subsections.

3.4.1 Bedrock Stratigraphy

The surface bedrock throughout the entire vicinity of TA-46 is the Tshirege Member of the Bandelier Tuff, an ash flow tuff (ignimbrite) that erupted from the Valles Caldera west of the Laboratory approximately 1.13 million years ago. The Tshirege Member has been subdivided into a sequence of mappable cooling units that are distinguishable in the field on the basis of color, degree of welding, degree of alteration, and erosional characteristics (Figs. 3-2, 3-3) (Vaniman and Wohletz 1990, 0541; Vaniman 1991, 11-223).

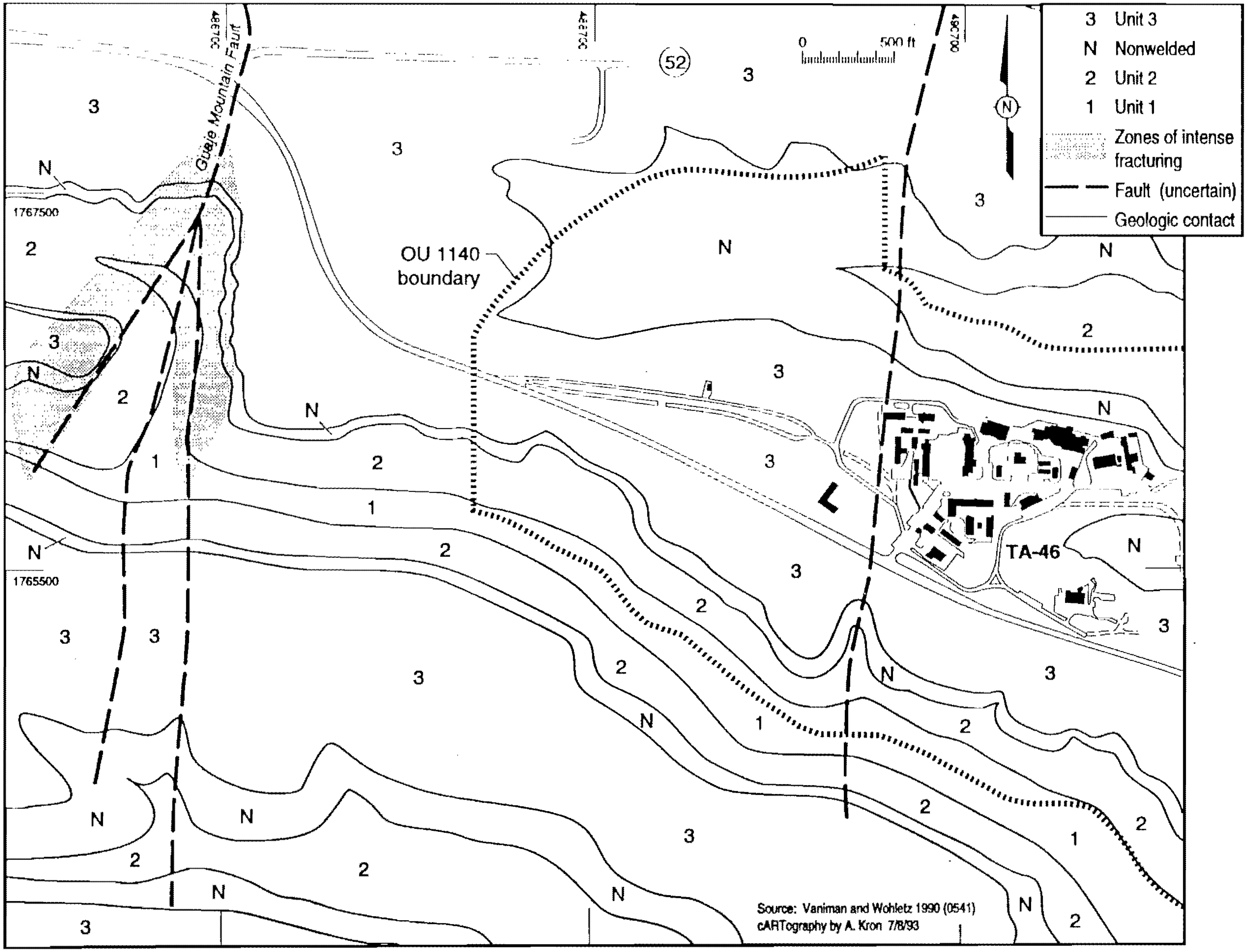
The mesa top at TA-46 consists of Vaniman and Wohletz's Unit 3, a resistant, brown, poorly welded cliff-forming tuff (1990, 0541). Two deeper units of the Tshirege, a weak, white, nonwelded slope-former unit and a resistant, moderately-to densely-welded cliff-former (Unit 2), crop out in Cañada del Buey, north of TA-46.

The Bandelier Tuff is laced with numerous fractures. These include cooling fractures, typically limited to a single cooling unit, and tectonic fractures, associated with subsurface faults and/or in situ stress. These tectonic fractures may cut through different cooling units and may, therefore, provide more continuous and deeper flow paths for liquid or vapor-phase migration than cooling fractures.

Subsurface geology in the vicinity of TA-46 is shown on Fig. 3-4, lithologic logs for two 3 000-ft-deep water supply wells near TA-46 (PM-4 and PM-5) and a 750-ft-deep test hole drilled beneath Building TA-46-88 for the ICON facility.

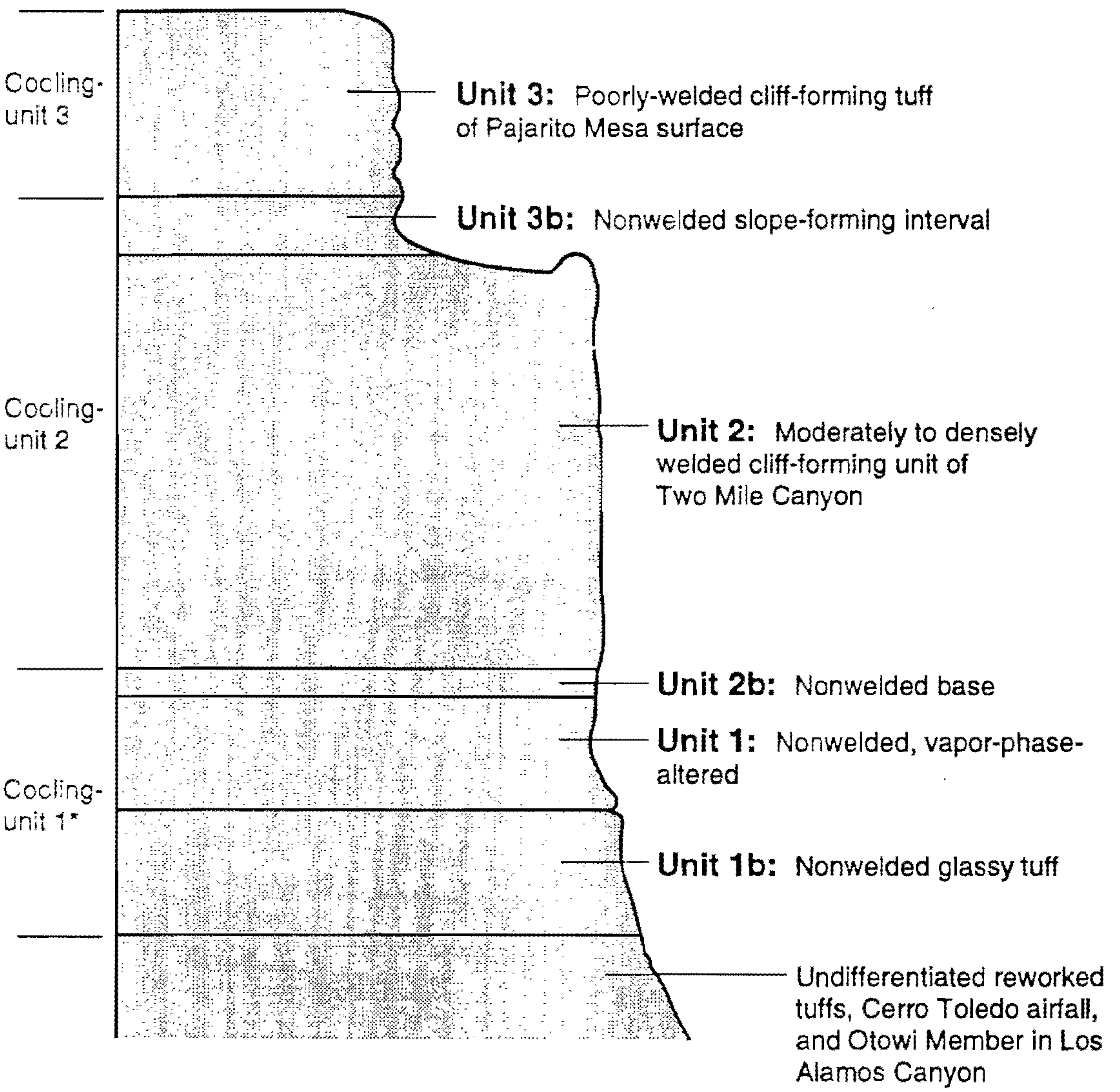
The lithologic logs show that the base of the Tshirege Member is at an elevation of between 6 600 and 6 750 ft. The underlying Otowi Member of the Bandelier Tuff is between 320 and 375 ft thick, and the Guaje Pumice Bed is about 30 ft thick. The base of the Bandelier Tuff is therefore at an elevation of about 6 300 to 6 400 ft, 700 to 800 ft below the mesa top at TA-46, and at least 400 to 500 ft below the adjacent canyon floors.

The pre-Bandelier stratigraphy in the vicinity of TA-46 is shown in Fig. 3-4, and the individual units are described in the IWP.



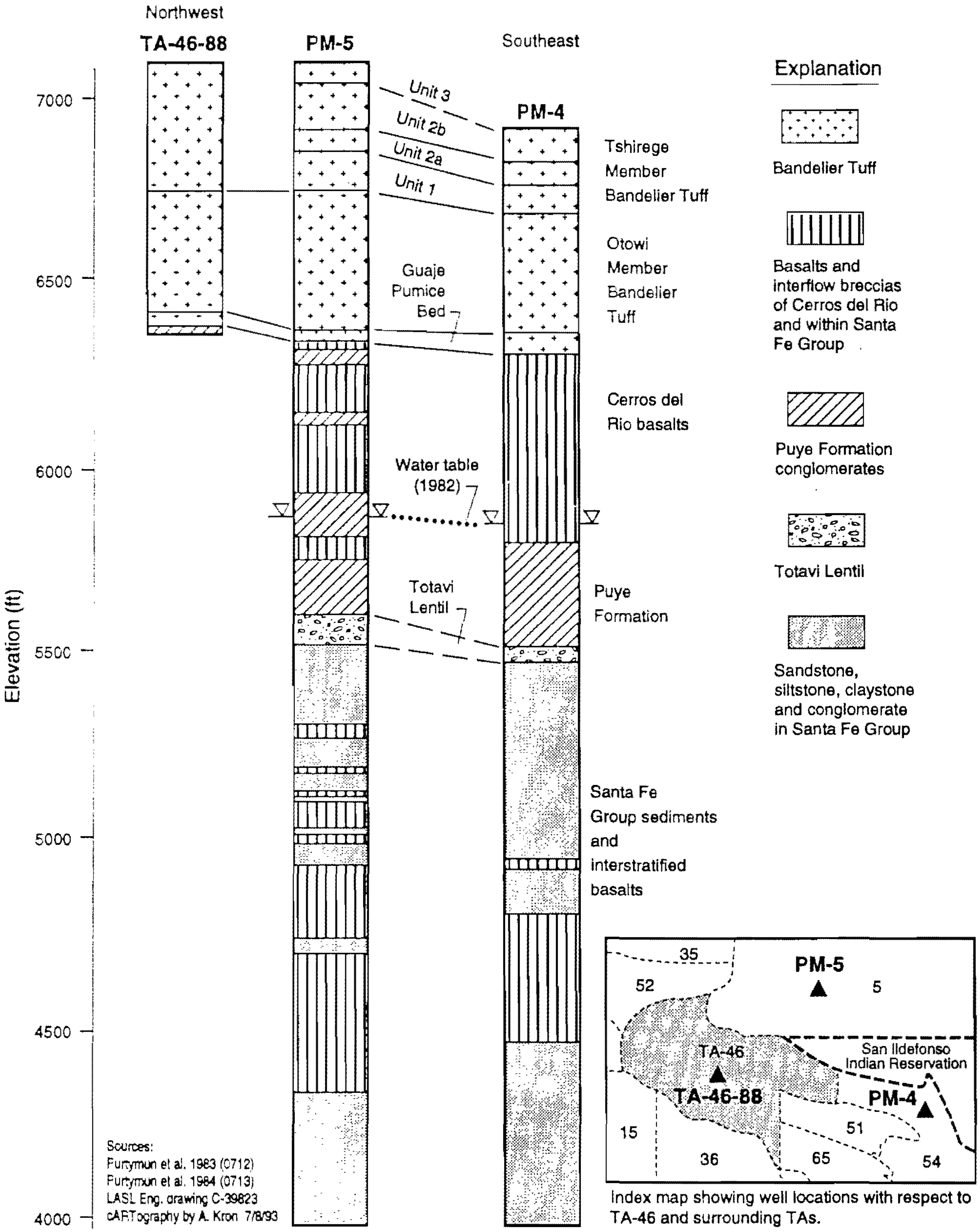
Source: Vaniman and Wohletz 1990 (0541)
cARTography by A. Kron 7/8/93

Fig. 3-2. **Geologic map of OU 1140 and surroundings.**



*Cooling units of Crowe et al. 1978, LA-7225-MS

Fig. 3-3. Schematic stratigraphy of the Tshirege Member, Bandelier Tuff, in the vicinity of TA-46. (Modified from Vaniman 1991, 11-223)



Sources:
Purtymun et al. 1983 (0712)
Purtymun et al. 1984 (0713)
LASL Eng. drawing C-39823
cARTography by A. Kron 7/8/93

Index map showing well locations with respect to TA-46 and surrounding TAs.

Fig. 3-4. Lithologic logs for borings near TA-46.

3.4.2 Structure

Vaniman and Wohletz prepared a detailed geological and structural map for a 5.6 square mile area surrounding TA-55, including most of TA-46 (1990, 0541). Faults mapped include the Rendija Canyon Fault and the Guaje Mountain Fault, 1.3 and .75 miles west of TA-46, respectively. Locations of zipper joints and local drainage patterns led Vaniman and Wohletz to suspect the existence of an additional subsurface fault running north-south across TA-46 (Fig. 3-2).

Other subsurface faults in the area have been shown to be associated with increased surface fracturing of the Bandelier Tuff (Vaniman and Wohletz 1990, 0541). If the suspected fault through TA-46 is real, associated surface fractures may increase the potential for downward contaminant transport.

3.4.3 Surficial Deposits

3.4.3.1 Soils

Soils in the vicinity of TA-46 have been mapped by Nyhan et al. and are shown in Fig. 3-5 (1978, 0161).

The mesa top soil is Hackroy sandy loam, a shallow, well-drained soil formed in weathered tuff. This soil is typically only about a foot thick, with a 4-in. brown sandy loam surface layer overlying an 8-in. reddish-brown clay-rich subsoil. This natural mesa top soil is probably rare near areas of interest at TA-46 because much of the mesa top has been affected by human activities including excavation, paving, scraping, building, and landfilling.

The slopes and walls of Cañada de Buey consist of rock outcrops with only sparse and shallow poorly-developed colluvial soils (Nyhan et al. 1978, 0161). Soil development is more widespread on north-facing than on south-facing slopes.

Test holes drilled in Cañada del Buey east of TA-46 revealed alluvial deposits up to 50 ft thick consisting of silt, sand, and gravel (Devaurs and Purtymun 1985, 0049; Gallaher 1993, 11-224), while no alluvium is present immediately north of TA-46.

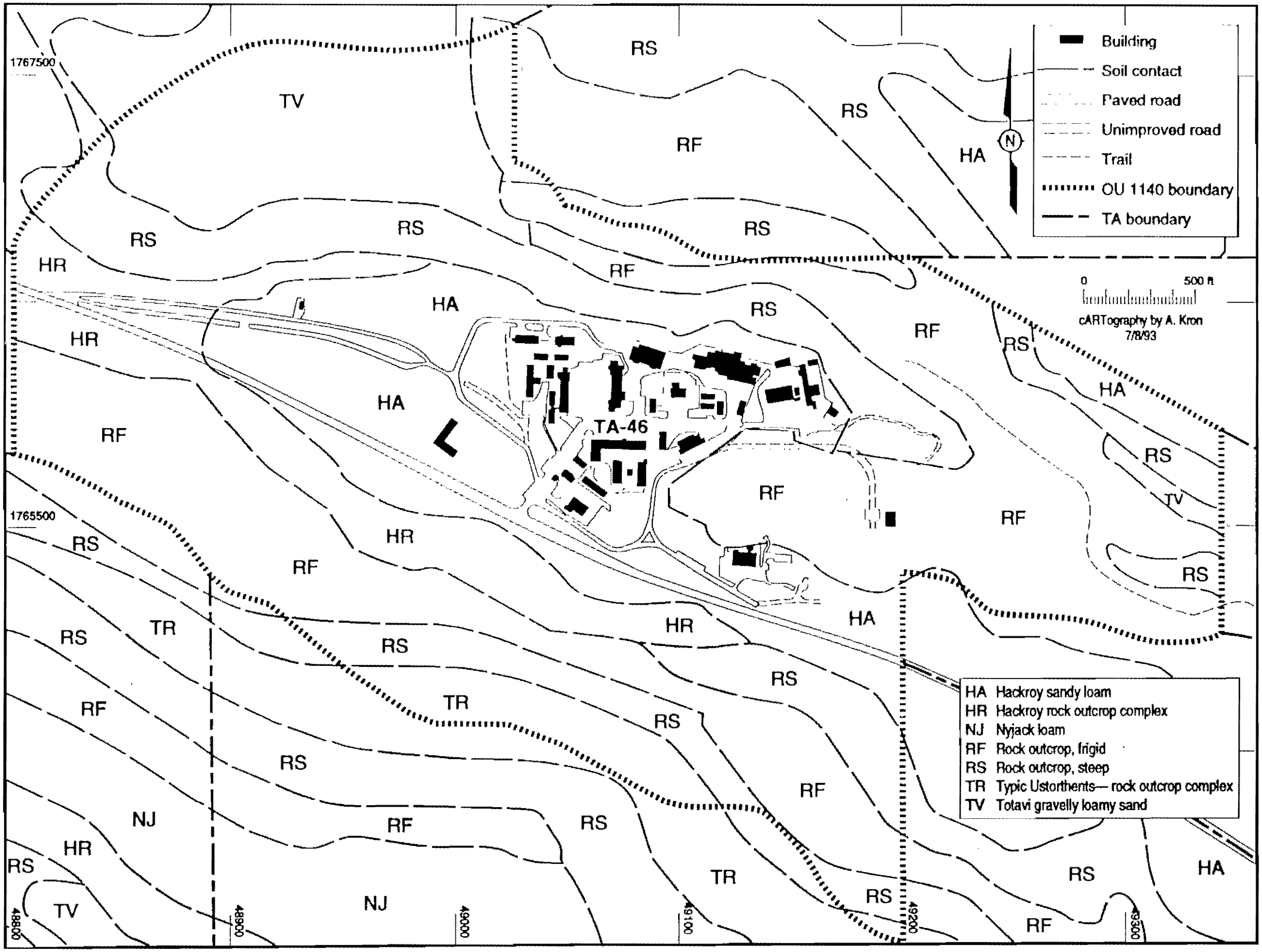


Fig. 3-5. Soil map of OU 1140 (adapted from Nyhan et al. 1978, 0161)

3.4.3.2 Geomorphic Processes

The primary geomorphic processes active at TA-46, as on much of the Pajarito Plateau, consist of 1) erosion of mesa top soils by runoff; 2) retreat of canyon walls by rock fall and landslides; 3) colluvial transport on sloping portions of canyon walls; and, 4) erosion and deposition of sediments by streams in the canyon bottoms. These processes are discussed in Subsection 2.6.1.6 of the IWP; no additional site-specific information for TA-46 is available (LANL 1992, 0768).

3.5 Conceptual Hydrologic Model

3.5.1 Surface Water Hydrology

Runoff and infiltration of surface water are significant aspects of surface water hydrology at Los Alamos, providing mechanisms by which contaminants can be potentially mobilized and transported through the environment. Runoff may carry contaminants into drainage channels and then transport and deposit contaminants downstream. Infiltration of surface water is the source of subsurface moisture that can potentially transport contaminants underground.

Surface runoff occurs on the mesa tops and in small drainages off the mesa for brief periods during intense summer thunderstorms and during spring snowmelt periods. Runoff from summer storms on the Pajarito Plateau reaches a maximum discharge in less than two hours and has a duration of generally less than 24 hours (Purtymun et al. 1990, 0215). High discharge rates can transport large masses of suspended and bed sediments for long distances down the canyons. Spring snowmelt runoff occurs over a period of several weeks to several months at a low discharge rate. Although the long duration of snowmelt runoff results in the movement of significant masses of suspended and bed sediments, the mass transported seems to be less than that carried by summer runoff events (Purtymun et al. 1990, 0215).

At the present time, stream flow is intermittent in Cañada del Buey north of TA-46, occurring primarily during snowmelt and the summer thunderstorm season (Purtymun and Kennedy 1971, 0200; Devaurs and Purtymun 1985, 0049). If and when the Sanitary Wastewater Systems Consolidation Project treatment plant (located at the eastern end of TA-46) begins discharging to SWSC Canyon, effluent discharge will maintain permanent flow in Cañada del Buey for some distance downstream. Any contaminants from TA-46 that reach the confluence of Cañada del Buey and SWSC Canyon may be transported farther downstream by this permanent flow. A surface water sample was collected in 1990 from Cañada del Buey north of TA-46 and analyzed for major ions, radiochemicals, and a full suite of volatile and semivolatile organic compounds. Analytic results revealed no evidence of contamination from Laboratory operations (Environmental Protection Group 1992, 0740).

3.5.2 Hydrogeology

3.5.2.1 Vadose Zone

The vadose zone, or unsaturated zone, consists of that part of the subsurface above the water table where pore spaces and fractures are not saturated with water. The hydrology of the vadose zone of the Pajarito Plateau is discussed in IWP Subsection 2.6.2, Hydrology. It includes discussions of the hydrogeologic properties of the tuff and the movement of fluids through the tuff, and describes related studies that have been conducted at the Laboratory. The summary of the studies provides strong support for the concept that under natural unsaturated conditions, the vadose zone of the Bandelier Tuff provides substantial impedance to the movement of liquid in the subsurface.

Under saturated conditions, on the other hand, more substantial downward flow and transport may be possible, especially along fractures through the tuff. These saturated conditions may occur under areas of continuous or long-term ponding, such as the canyon floor of Cañada del Buey (especially downstream of the future SWSC Canyon plant outfall), at cooling tower outfalls receiving continuous discharge, beneath leaking lagoons or septic systems, or in dry wells excavated into the tuff for the disposal of liquid wastes.

No site-specific vadose-zone studies have been conducted at TA-46.

3.5.2.2 Alluvial Aquifers

IWP Subsection 2.6.4, Geohydrology of Canyon Surface Waters and Alluvial Aquifers, discusses alluvial aquifers in the canyons of the Pajarito Plateau on a canyon-by-canyon basis (LANL 1992, 0768). These aquifers in alluvial fills of the canyon bottoms are created and maintained by recharge from surface channels. Water moves downward through the alluvium until it is impeded by the less permeable tuff. Depletion by evapotranspiration and movement into the underlying rock limits the size of the alluvial aquifers. These aquifers are of interest because of the following issues:

- Contaminated surface water recharging an alluvial aquifer may be stored in the canyon system and be available for uptake by biota.
- Water from the alluvial aquifers can percolate into the underlying tuff and potentially move toward the much deeper main aquifer.

An alluvial aquifer of localized extent within the alluvium of Cañada del Buey was discovered during the drilling of monitoring wells in summer 1992 (Gallaher 1993, 11-224), although no alluvial aquifer was found in four test holes drilled in spring 1985 (Devaurs and Purtymun 1985, 0049). The monitoring well that encountered the alluvial aquifer is east of TA-46, downstream of the confluence of Cañada del Buey and SWSC Canyon. In the immediate vicinity of TA-46, Cañada del Buey is cut into exposed tuff bedrock, which implies the absence of any significant alluvial aquifer. If significant contamination associated with OU 1140 is detected near the inner canyon of Cañada del Buey, further research into the existence, number, and extent of alluvial aquifers will be conducted, in cooperation with the OU 1049 (canyons) project team.

Investigation of the alluvial aquifers will be performed as part of the RFI process for OU 1049 (canyons)

3.5.2.3 Perched Aquifers

If significant water from alluvial aquifers infiltrates into the underlying rock units, it may produce perched aquifers within the Cerros del Rio basalts or within the Puye Formation. Such perched aquifers exist to the north in lower

Los Alamos and Pueblo Canyons, as described in the IWP Subsection 2.6.5, Perched Water (LANL 1992, 0768). Perched aquifers in the bedrock are not evident in water-supply wells PM-4 and PM-5 near TA-46, where over 400 ft of tuff occur between the bottoms of canyons and the Cerros del Rio basalts.

3.5.2.4 Main Aquifer

The main aquifer beneath TA-46 is found in conglomerates of the Puye Formation and the Cerros del Rio basalts. The water table elevation beneath TA-46 is approximately 5 900 ft, 1 200 ft below the mesa top (Purtymun and Stoker 1988, 0205). The hydraulic gradient in the area is about .01 ft/ft to the east, toward the Rio Grande. This gradient, combined with estimated aquifer hydraulic properties, suggests an average groundwater velocity of 95 ft/year (3 in./day) to the east (Purtymun and Stoker 1988, 0205).

Although many recent papers indicate that recharge to the main aquifer is limited to the Valles Caldera (e.g., Purtymun and Johansen 1974, 0199; Abeele et al. 1981, 0009; Purtymun 1984, 0196; Purtymun and Stoker 1988, 0205), some earlier work suggested that the primary source of recharge to the aquifer was small streams on the eastern flank of the Sierra de los Valles and the western part of the Pajarito Plateau (Griggs and Hem 1964, 0313; Cushman 1965, 0042). Some recent chemical and isotope studies also support recharge areas outside the Valles Caldera (Goff 1991, 11-222; Kearl et al. 1991, 0652). Recharge to the main aquifer from alluvial aquifers in canyons in the vicinity of the Laboratory thus remains a possibility. In contrast, because of the great thickness of unsaturated tuff underlying the mesas, recharge to the main aquifer from infiltration from the mesa tops seems unlikely.

3.6 Conceptual Three-Dimensional Geologic/Hydrologic Model of Operable Unit 1140

A conceptual model of OU 1140 geologic and hydrologic conditions is shown in Fig. 3-6. Major features of this model include the following:

- Most rainfall and discharge water at the site is subject to evapotranspiration, perhaps after a brief residency in the soil, rather than deep infiltration.

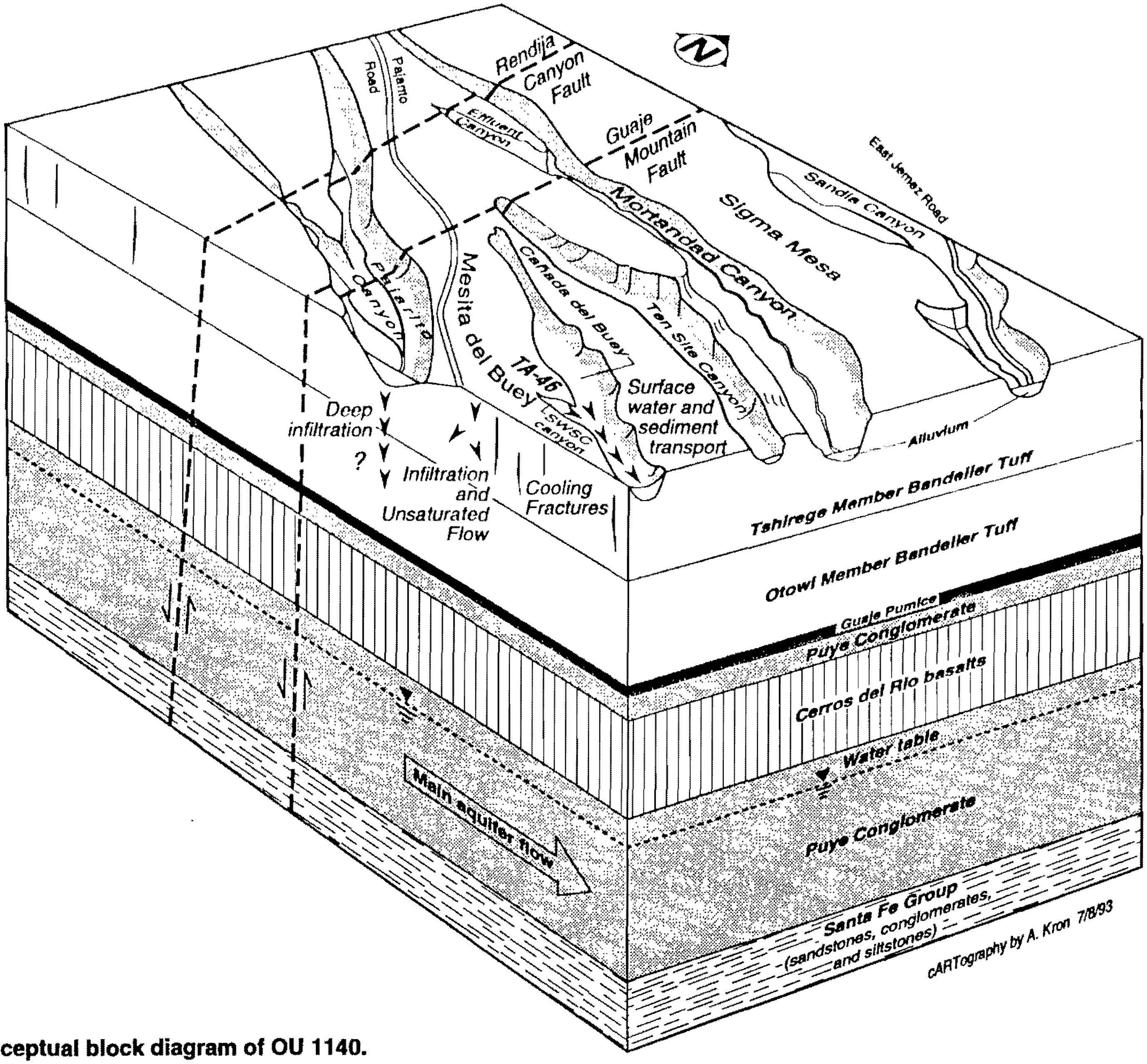


Fig. 3-6. Conceptual block diagram of OU 1140.

- Potentially contaminated materials from TA-46 may reach Cañada del Buey via surface flow during periods of heavy runoff, including summer thunderstorms and snowmelt. Discharge from SWSC Canyon may then carry these materials downstream.

- Opportunities for deep infiltration of contaminants are primarily limited to saturated areas, such as canyon-bottom alluvium, process outfall locations, leaking lagoons and septic systems, and dry wells. Infiltration at these sites may be facilitated by tectonic fractures within the tuff.

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Chapter 4

- Aggregation of PRSs
- Site Characterization Decision Model
- Conceptual Model
- Ecological Risk Assessment
- Sampling and Analytical Strategies
- Potential Response Actions

4.0 TECHNICAL APPROACH

This chapter presents the technical approach to evaluation of potential release sites (PRSs). The technical approach described herein is applied to all PRSs in Chapter 5.

4.1 Aggregation of Potential Release Sites

In Chapter 5, PRSs at TA-46 are grouped into six aggregates as indicated in Table 4-1.

TABLE 4-1

AGGREGATES AT TA-46

SUBSECTION	DESCRIPTION
5.1	Septic systems and dry wells
5.2	Lagoon systems
5.3	Surface releases
5.4	Outfalls
5.5	Landfills
5.6	Stack emissions

PRSs are assigned to an appropriate aggregate based on similarities in sampling strategies and conceptual exposure models. Additional factors that differentiate aggregates include: topography surface, subsurface, or both; origin and function; potential contaminants; and, contaminant transport mechanisms.

Some PRSs appear in more than one aggregate. For instance, many PRSs include associated outfalls. which are further discussed in Subsection 5.4.

4.2 Site Characterization Decision Model

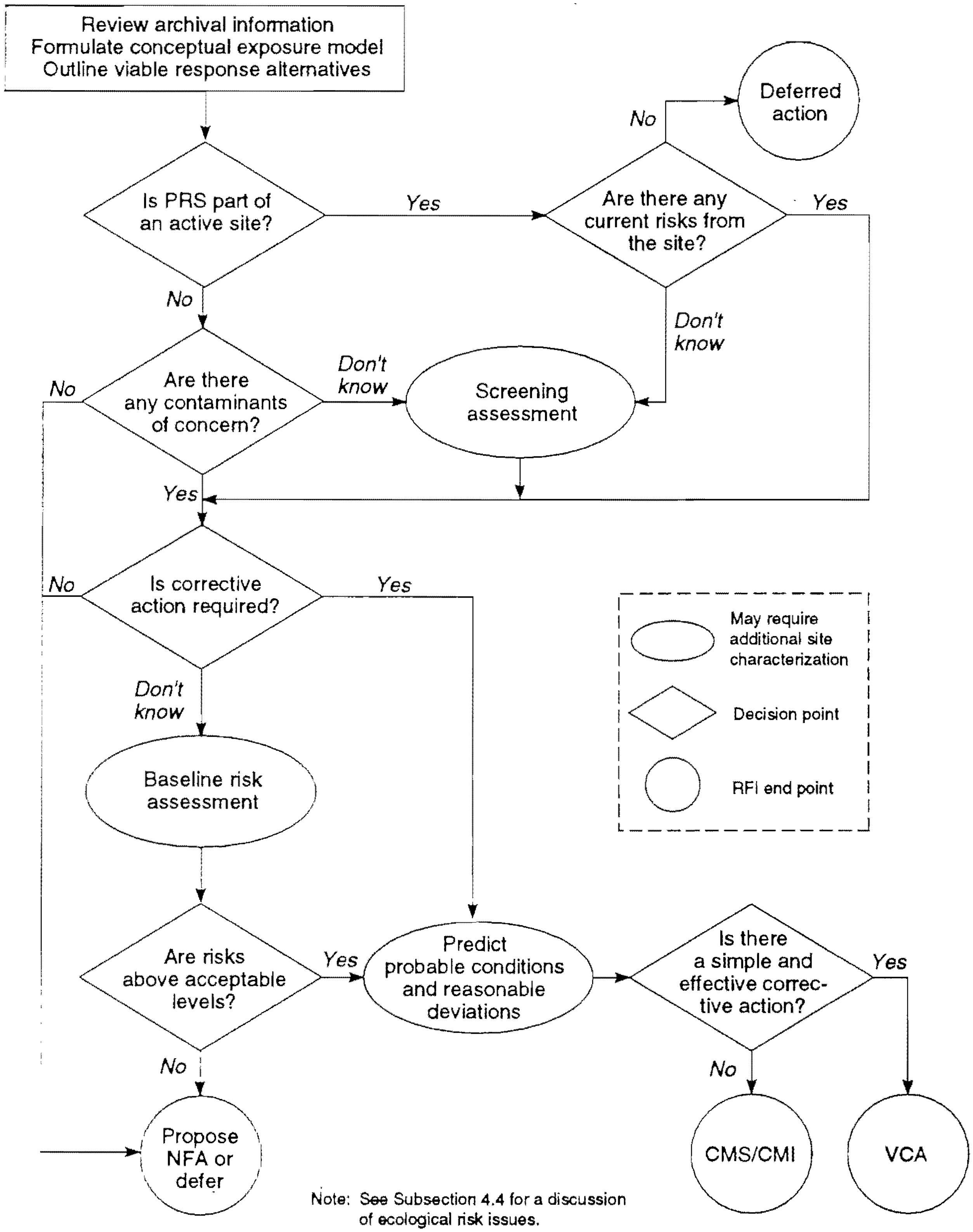
This work plan adheres to the Laboratory Environmental Restoration (ER) Program technical approach for data collection and evaluation as documented in Chapter 4 of the Installation Work Plan (IWP) (LANL 1992, 0768). This technical approach adopts the philosophy of the observational approach in Appendix G of the IWP, which bases decisions for action [e.g., collecting additional data as opposed to proceeding to the corrective measures study

(CMS) phase] on definitions for acceptable uncertainties that depend on the current phase of the investigation (LANL 1992, 0768). Investigations are phased so that decisions remain closely tied to the ultimate goal of selecting an appropriate corrective action and so that they are formulated in consideration of what is already known about the site. The Laboratory's ER Program has adopted a risk-based approach to making corrective action decisions during the Resource Conservation and Recovery Act (RCRA) facility investigation/corrective measures study (RFI/CMS) process. In this work plan, the Data Quality Objectives (DQO) process (Chapter 4 and Appendix I of the IWP) is used to identify site-specific risk-based decisions or risk-related questions; to identify and in some cases quantify risk-based decision errors; and, to specify sampling designs to support the risk-based decisions or risk-related questions (LANL 1992, 0768). The approach for evaluating ecological risks is currently under development; to the extent possible, ecological risk will be assessed as part of the Phase I investigation. Subsection 4.4 presents the status of the ecological assessment.

A goal of this RFI is to confirm the presence or absence of contaminants of concern (COCs). COCs are defined as hazardous constituents or radionuclides whose levels are above screening action levels (SALs) or other risk-based limits. SALs are media-specific concentration levels for constituents derived using conservative criteria; they are discussed in Subsection 4.2.1.

The first step in the RFI is to evaluate archival information and make field reconnaissance visits to formulate a conceptual model for the site (Fig. 4-1). These data help develop a list of potential contaminants of concern (PCOCs).

As shown in Fig. 4-1, no further action (NFA) or deferred action (DA) may be recommended after the first step of the RFI. Criteria for NFA based on archival information are discussed in Subsections 4.2.2 and 4.6.1 of this work plan, and the details are described in Appendix I, Subsection 4.1, of the IWP (LANL 1992, 0768). An NFA recommendation based on the absence of a human health risk does not imply that ecological risks do not exist. The PRSs recommended for NFA or DA based on archival information are presented in Chapter 6 of this work plan.



Note: See Subsection 4.4 for a discussion of ecological risk issues.

Fig. 4-1. Human health-based risk decision flow during the RCRA facility investigation.

For several aggregates, archival information includes data from the November 1989 Laboratory Sampling and Analysis Data Document (LANL 1989, 0425). The concentration data from this study were never officially released due to questions concerning data quality. Consequently, the environmental problem data in this study are used merely to provide a historical perspective, and not as a basis for decision-making.

In some cases, however, existing site information is adequate to identify the need for a corrective action. If there is an obvious, feasible, and effective remedy, then a voluntary corrective action (VCA) will be implemented. Further information about VCAs is found in Subsection 4.2.2.

For many PRSs in Operable Unit (OU) 1140, archival information indicates a high probability that there are no COCs at the site, but there are no existing confirmatory sampling data, and the archival information is not sufficient to recommend NFA. For these sites and sites where virtually no information exists, a Phase I screening assessment will be conducted to determine the presence or absence of COCs. The generic logic flow for screening assessments is shown in Fig. 4-2. Descriptions of sampling strategies for screening assessments are given in Subsection 4.5. While there are various approaches for collecting data in support of a screening assessment, the primary strategy employed at OU 1140 is reconnaissance sampling. The purpose of reconnaissance sampling is to determine if there are any COCs at a PRS for which little or no historical information exists. As Fig. 4-2 depicts, the process for identifying COCs incorporates a test of whether observed concentrations can be distinguished from known background values; if the answer to this question is yes, then the observed value (adjusted for background if necessary) is compared to SALs or other risk-based limits. Aggregate-specific logic flows are found in Chapter 5.

The primary goal of Phase I screening assessments is to identify those PRSs that pose no hazard to human health or the environment so that they can be recommended for NFA. Eliminating PRSs that are not problems in Phase I screening allocates resources efficiently and effectively, and provides timely corrective actions for those PRSs that present the greatest hazard.

The range of actions that can result based on Phase I screening assessments is described in Subsection 4.2.2. In some cases, these actions will need to

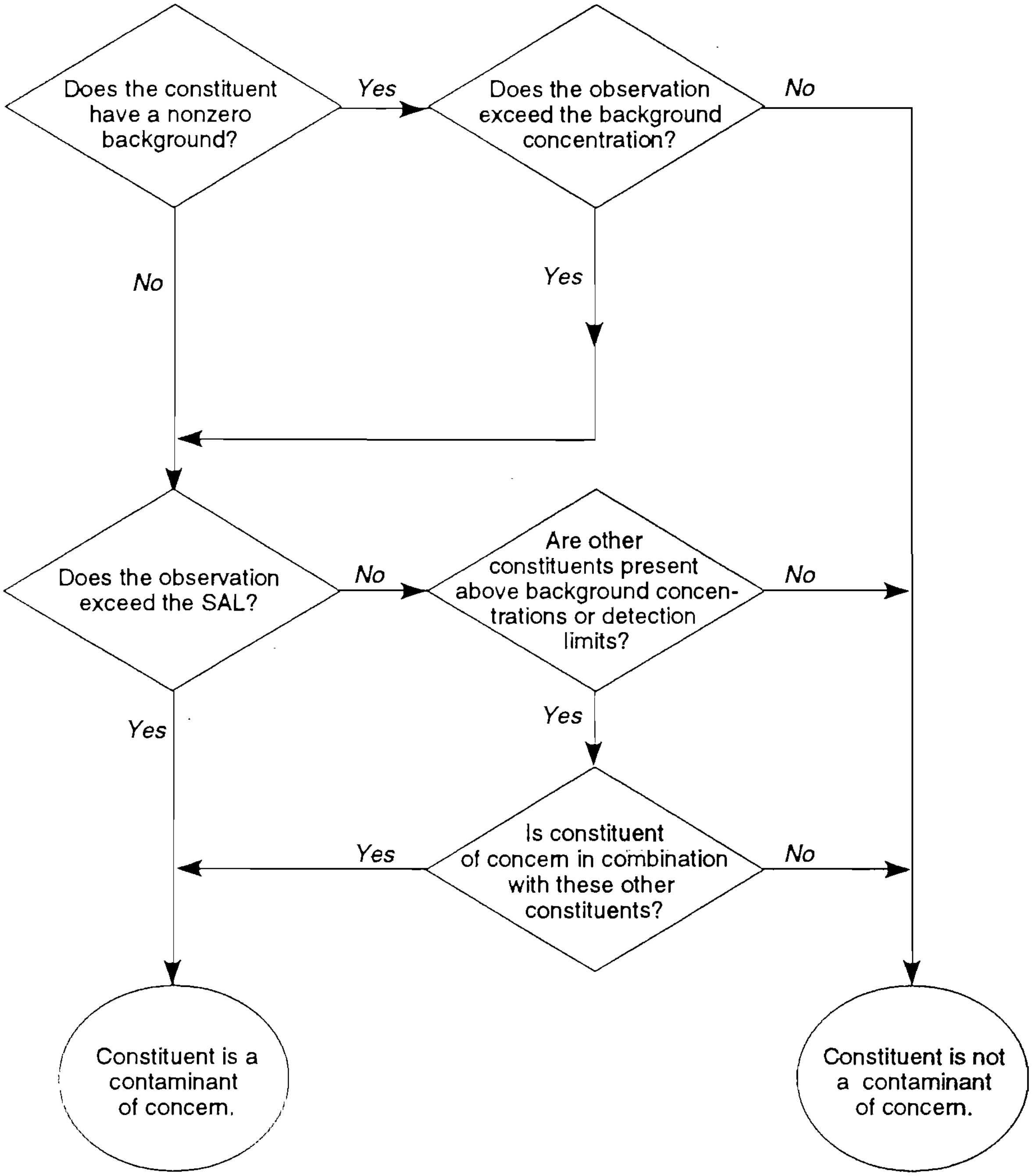


Fig. 4-2. Decision logic for screening assessment.

be preceded or supplemented by additional data collection activities (Phase II sampling). Phase II sampling can have a variety of goals: e.g., supporting a baseline risk assessment, establishing the nature and extent of contamination, monitoring a VCA. Whenever Phase II sampling is required, it will be proposed in future, amended versions of this work plan.

PRS or PRS aggregate-specific decision processes are described in the remediation decisions and investigation objectives subsections of Chapter 5.

4.2.1 Screening Action Levels (SALs)

SALs are media-specific concentration levels for constituents derived using conservative criteria. In most cases, SALs for nonradiological constituents are based on the methodology in proposed RCRA Subpart S for calculation of action levels (EPA 1990, 0432). Radiological SALs are based on a 10 mrem per year dose using a conservative residential-use exposure scenario. SALs for radionuclides can be derived using the residual radioactive (RESRAD) code (Gilbert et al. 1989, 0754), which has been developed for the Department of Energy (DOE) to calculate residual radioactive material guidelines. However, if a regulatory standard exists and is lower than the value derived by these methods, the lower value will define the SAL. The derivation of SALs is discussed in Chapter 4 of the IWP, and the values are given in Appendix J (LANL 1992, 0768).

The motivation for developing SALs is to have a conservative tool for identifying sites that clearly pose no human health risk. SALs are not cleanup levels; cleanup levels will be based on site-specific risk evaluations and "as low as reasonably achievable" (ALARA) criteria. Because the dose-response model assumes some risk of stochastic effects even at low doses, radiation protection philosophy has for some time included not only limits, but also the ALARA concept. DOE has incorporated this concept in its orders as a process which has the objective of keeping dose levels as far below applicable limits as social, technical, economic, practical, and public policy considerations permit.

SALs are generally lower than cleanup levels. For example, if a site will never be used for residential purposes, the site-specific land use scenario (e.g., recreational use) could lead to cleanup levels higher than the SALs derived from a conservative residential use scenario.

SALs for the primary PCOCs at OU 1140 (based on archival data) are provided in Table 4-2.

4.2.2 Future Action Alternatives

Review of archival information and/or the results of Phase I sampling will lead to a PRS-specific or (when multiple PRSs have releases through a shared outfall) an outfall-specific decision about future action at the site. Action will consist of one of the following alternatives.

4.2.2.1 No Further Action

A PRS may be proposed for NFA if no COCs are known or found to be present based on historical data or Phase I sampling, if releases of COCs are judged not to have taken place in the past and are unlikely to take place in the future, or if some other regulatory program takes precedence. NFA designations are possible at any point in the remedial process.

Sites designated for NFA based on archival information are discussed in Chapter 6.

4.2.2.2 Deferred Action

Some PRSs in OU 1140 include an active drain line component. This work plan proposes to defer investigation of these drain lines until decommissioning. However, if Phase I data from related components that are investigated indicate contamination above SALs, these drain lines will be included in a Phase II investigation of the PRS.

A copy of this work plan is being sent to the decontamination and decommissioning (D&D) organization at the Laboratory as a first step to facilitate communication and coordination between the ER and D&D Programs. No facilities at OU 1140 are presently scheduled for D&D. If facilities are scheduled for D&D during the course of ER activities, then the two programs will be coordinated. The D&D Program will remain on distribution for documents pertaining to ER activities at OU 1140.

TABLE 4-2

BACKGROUND AND SCREENING ACTION LEVELS FOR POTENTIAL CONTAMINANTS OF CONCERN AT OU 1140

CONTAMINANT	LOCAL SOIL BACKGROUND (mg/kg)	SOIL SALs (mg/kg)	CRQL[a] (mg/kg)
Metals			
Barium	120 - 810[b]	5 600[c]	40
Beryllium	1.1 - 3.3[b]	0.16[c]	1[d]
Cadmium	0.03 - 0.52[b]	80[c]	1
Chromium	4.2 - 136[b]	400 (VI)[c]	2
Copper	2 - 18[b]	3 000[c]	5
Lead	8 - 98[b]	500[e]	0.6
Mercury	.007 - .029[b]	24[c]	0.04
Nickel	1.6 - 19[b]	1 600[c]	8
Silver	<1.6[f]	400[c]	2
Uranium (total)	1.5 - 6.7[f]	240[c,g]	
Zinc	38 - 71[b]	24 000[c]	4
Organic Compounds-VOCs			
Acetone	0	8 000[c]	0.01
2-Butanone (MEK)	0	2 100[c]	0.01
Methyl chloride	0	6.4[c]	0.01
Tetrachloroethylene (PCE)	0	5.9[c]	0.01
Toluene	0	890[c]	0.01
1,1,1-Trichloroethane (TCA)	0	1 000[c]	0.01
Trichloroethylene (TCE)	0	3.2[c]	0.01
Organic Compounds-SVOCs			
Acenaphthene	0	4 800[c]	0.33
Benzo(a)anthracene	0		0.33
Benzo(a)pyrene	0	0.1[c]	0.33[d]
Benzo(b)fluoranthene	0		0.33
Benzo(g,h,i)perylene	0		0.33
Benzo(k)fluoranthene	0		0.33
Benzoic acid	0	320 000[h]	
Bis(2-chloroethoxy)methane	0		0.33
Chrysene	0		0.33
Dibenzo(a,h)anthracene	0		0.33
Dibenzofuran	0		0.33

TABLE 4-2 (continued)

BACKGROUND AND SCREENING ACTION LEVELS FOR POTENTIAL CONTAMINANTS OF CONCERN AT OU 1140

CONTAMINANT	LOCAL SOIL BACKGROUND (mg/kg)	SOIL SALs (mg/kg)	CRQL[a] (mg/kg)
Organic Compounds-SVOCs (continued)			
Fluoranthene	0	3 200[c]	0.33
Indeno(1,2,3-cd)pyrene	0		0.33
Phenanthrene	0		0.33
Pyrene	0	2 400[c]	0.33
Organic Compounds-PCBs			
Aroclors (PCB)	0	0.09[i]	
Alpha-BHC	0	0.1[i]	
Beta-BHC	0	4[h]	
Chlordane	0	0.5[i]	
DDD	0	3[i]	
DDT	0	2[i]	
Endosulfan	0	4[i]	
Radionuclides	**(pCi/g)**	**(pCi/g)**	
Cesium-137	nd[j] - 1.4[k]	4[e]	
Thorium-230		10[l]	
Thorium-232		0.88[e]	
Uranium-234		86[l]	
Uranium-235		18[e]	
Uranium-238		59[e]	
Plutonium-238	nd - 0.01[k]	27[e]	
Plutonium-239, -240	nd - 0.052[k]	24[e]	
Americium-241		22[e]	
Miscellaneous			
Chrysotile (asbestos)			

[a] Contract-required quantification limits for soil (Appendix J of the IWP, LANL 1992, 0768).
[b] Ferenbaugh et al. 1990, 0099.
[c] Appendix J of the IWP (LANL 1992, 0768).
[d] The SAL is less than the CRQL; therefore, special analytical services may be required.
[e] Dorries 1993, 11-237.
[f] Duffy and Longmire 1993, 11-239.
[g] SAL for chemical toxicity only. Radiological SALs presented in radionuclide section.
[h] SAL calculated using method described in IWP Appendix J (LANL 1992, 0768).
[i] EPA 1990, 0432.
[j] nd - not detected.
[k] Purtymun et al. 1987, 0211.
[l] Radionuclide SALs calculated using RESRAD assuming a 10 mrem/yr exposure limit.

The PRSs in this category are discussed in Subsections 5.2 and 5.4 and Chapter 6 of this work plan.

4.2.2.3 Voluntary Corrective Action

Subsection 5.1 addresses septic systems and dry wells. A recent study has indicated that there are certain circumstances under which a VCA removal of these units is economically justified (ICF Kaiser Engineers 1993, 11-241). Specifically, a VCA will be recommended when existing data or site operational information suggests that a unit is sufficiently contaminated to warrant corrective action, yet transport of the contaminants is believed to be limited to a finite and easily estimated area. In these cases, Phase I investigations will not be conducted. See Subsection 5.1 for further discussion.

In certain circumstances, a partial VCA will be combined with a Phase I investigation. For instance, lagoon liners will be removed prior to collection of soil samples underneath the lagoon. See Subsection 5.2 for further discussion.

For waste generated during VCAs, potential disposal alternatives include land disposal and incineration. Land disposal has been used throughout the work plan for cost estimates prepared in support of cost-effectiveness decisions, but other alternatives will be considered when final disposal decisions are made. Although not specifically discussed in this work plan, waste treatment may be required prior to final disposal.

4.2.2.4 Baseline Risk Assessment

PRSs in which contamination has been confirmed by Phase I screening, but which are not suitable candidates for VCA, may require a baseline risk assessment and (if indicated by the risk assessment) a CMS. In certain cases, performance of the risk assessment may require Phase II sampling. The baseline risk assessments for OU 1140 will be performed using the risk scenarios described in Subsection 4.3. Because of the circumstances at OU 1140 (i.e., many small, adjacent, or overlapping PRSs), it is anticipated that Phase I sampling will generate sufficient data to support a baseline risk assessment if one is needed.

Refer to Subsection 4.6 for a discussion of potential response actions.

4.3 Conceptual Exposure Model for OU 1140

A conceptual exposure model was developed to identify potential contaminant migration pathways and any potential human receptors. This model determines the location and magnitude of sampling needed to accurately characterize the site. A conceptual model includes four elements: 1) identification of PCOCs; 2) characterization of the release of PCOCs; 3) determination of migratory pathways; and, 4) identification of human receptors. Subsection 4.3.1 presents an overview of the selection of PCOCs at OU 1140. Subsection 4.3.2, Potential Environmental Pathways, discusses the potential chemical release mechanisms and migration pathways. Subsection 4.3.3, Potential Human Receptors, presents the conceptual exposure models that describe current and future receptors that may have potential exposure to site-related contaminants.

4.3.1 Potential Contaminants of Concern

The objectives of the Phase I environmental data collection activity are to accomplish the following:

1. Confirm the presence or absence of anticipated PCOCs from known past site activities,
2. Use broad spectrum analytical methods that will allow for a reasonable determination that important additional PCOCs are not present (e.g., the evaluation of tentatively identified compounds from mass spectral scans),
3. Select analytical methods primarily on the basis of sensitivity for anticipated PCOCs at their SALs and secondarily for broad-band-spectrum capability, and,
4. Estimate if the concentration of each PCOC is greater than some method threshold.

These data will be used to determine if any site PCOC exceeds some specified, unacceptable concentration that would be considered a problem. If a site problem is determined, then these data will provide information needed to conduct a baseline risk assessment and (if necessary) to design a Phase II data collection survey that would further define the extent of the unacceptable area or volume of media contaminated.

Table 4-2 lists the PCOCs that have been identified through archival information for OU 1140. Chemicals that are essential human nutrients when present at low concentrations and toxic at very high levels (e.g., potassium, magnesium) will not be quantified in a baseline risk assessment (EPA 1989, 0305).

The main classes of potentially hazardous chemicals located at OU 1140 are volatile organic compounds, semivolatile organic compounds, metals, and radionuclides. Types of volatile organic compounds found at OU 1140 include solvents (e.g., acetone) and chemicals used in laboratory projects (e.g., 2-butanone). Semivolatile organic compounds include a variety of chemical groups and some used at OU 1140 include polychlorinated biphenyls (PCBs) used in transformers and polycyclic aromatic hydrocarbons (PAHs) found in waste oils. Metals and radionuclides may be found in all of the aggregates at OU 1140. Pesticides and asbestos are found in a few specific locations. These substances are each analyzed for specifically, and are thus considered their own classes.

No greater degree of PCOC specificity is possible with available information. However, the broad spectrum of analytical methods that will be used will be able to confirm or deny the presence of very specific PCOCs (refer to Section 7.0 of Appendix D).

4.3.2 Potential Environmental Pathways

Chemical or radionuclide PCOCs at TA-46 may have been released into the environment intentionally via drains, outfalls, dry wells, landfills, and stack releases; or inadvertently as spills, leaks, or spattering to surface soil or transport through asphalt from drum storage areas, septic tanks, and surface impoundments.

After chemicals have been released from OU 1140 into the environment, they can potentially migrate via: 1) liquid infiltration into near-surface or subsurface soils that may potentially reach groundwater or result in seepage to the surface; 2) organic volatilization into ambient air; 3) wind entrainment of contaminated dust and deposition onto surface soils and plant surfaces;

4) surface water overflow and then runoff resulting in the contamination of sediments in drainage channels; 5) soil erosion and excavation exposing subsurface contamination; and, 6) uptake by plants.

Pathways that may be complete, but are considered less significant, include dermal contact with surface water, incidental ingestion of surface water, ingestion of fish, and uptake by animals (i.e., cows and elk). Surface water at TA-46 consists of ephemeral runoff down the canyon walls. Therefore, no source of surface water is large enough to support fish, to serve as a source of drinking water (i.e., campers), or as a potential area for swimming. The stream in the bottom of Cañada del Buey will be investigated as part of OU 1049 (canyons) and will not be considered in this RFI.

The major migration pathways and relevant environmental media through which human exposure to residual contaminants could occur are summarized in Table 4-3.

TABLE 4-3

SUMMARY OF MAJOR MIGRATION PATHWAYS, CONTACT MEDIA, AND RESULTING POTENTIAL HUMAN EXPOSURE ROUTES

MIGRATION PATHWAYS	CONTACT MEDIA	RESULTING POTENTIAL HUMAN EXPOSURE ROUTES
A. Liquid infiltration into near-surface or subsurface soils	1. Chemicals in near-surface or subsurface soils	1. See D
B. Wind entrainment and dispersal of surface soil and atmospheric dispersion of volatiles	1. Chemicals deposited on surface soils and edible plant surfaces 2. Chemicals in air (particulate matter and volatile compounds)	1. Ingestion of soil, dermal contact with soil, and ingestion of plants 2. Inhalation of suspended dust or volatile compounds
C. Surface water runoff carrying soil/sediment in suspension and in solution	1. Chemicals deposited in drainage sediments 2. Contaminated surface water infiltrating uncontaminated surface and subsurface soils	1. Ingestion of sediments and dermal contact with sediments 2. Ingestion of soil and dermal contact with soil
D. Soil erosion and excavation, exposing subsurface contaminated soil to the surface	1. Feeds wind dispersal (B) and surface water runoff (C)	1. See B and C
E. Root uptake by plants (from contaminated soils)	1. Edible portions of plants	1. Ingestion of plants

The thickness of the unsaturated zone beneath TA-46 suggests that migration of contaminants from the surface to the main aquifer is unlikely (see Subsection 3.5). Groundwater transport to the main aquifer will therefore not be considered a viable transport pathway in this stage of the RFI. If contamination is discovered in deep soils, then the potential existence of a pathway to groundwater will be reevaluated.

There is no evidence that a perched aquifer exists beneath the mesa at OU 1140. There is an alluvial aquifer within Cañada del Buey (see Subsection 3.5.2.2) which falls under OU 1049 (canyons).

4.3.3 Potential Human Receptors

This subsection discusses how people could potentially be exposed to site-related contaminants at TA-46 in the absence of site remediation and presents the conceptual site model. Currently, the land is used for Laboratory operations; therefore, workers at TA-46 represent the only potentially exposed population on site. Canyons are used for recreational activities (i.e., jogging and hiking). The nearest permanent residents are in a trailer park located approximately 1.5 miles northwest of TA-46 and in the towns of Los Alamos and White Rock, approximately 3 and 5 miles from OU 1140, respectively. Future land use at OU 1140 will be evaluated in a baseline risk assessment and could encompass continued Laboratory operations and recreational uses. Residential use is not considered a potential future land use scenario; therefore, this scenario will not be evaluated in a baseline risk assessment.

4.3.3.1 Conceptual Site Model

On-site conceptual models identify historical sources of contamination, historical migration and conversion, potential current sources of contamination, release mechanisms, contact media, and exposure routes for each PRS. Elements of the conceptual models are presented in Table 4-4. PRS-specific conceptual models are presented in Chapter 5 for each of the six aggregates.

The conceptual models for OU 1140 are formulated based on available PRS information only. Further refinement of conceptual models or development

TABLE 4-4

SUMMARY OF CONCEPTUAL MODEL ELEMENTS

PATHWAYS/MECHANISM	CONCEPT/HYPOTHESES
HISTORICAL SOURCES	• Operations/processes that contributed to the creation of the PRS (i.e., storage area, etc.)
PRS RELEASE MECHANISM	• Any spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, leaching, dumping, or disposing into the environment
MIGRATION PATHWAY/ CONVERSION MECHANISM	
Atmospheric dispersion	
Particulate dispersion	• Entrainment is limited to contaminants in surface soils • Entrainment and deposition are controlled by soil properties, surface roughness, vegetative cover and terrain, as well as atmospheric conditions
Volatilization	• Volatilization is limited to volatile organic compounds in surface soils
Surface water runoff	
Surface water	• Surface runoff is directed by natural topographic features or manmade diversions and flows toward the canyons. A topographic low can cause the water to pond on the mesa top, but in most cases the water will flow into the canyon. • Contaminant transport by surface runoff can occur in solution, sorbed to suspended sediments, or as mass movement of heavier bed sediments • Surface runoff may carry chemicals beyond the OU boundary • Contaminated surface runoff may infiltrate the canyon-bottom alluvium
Sediments	• Surface soil erosion and sediment transport is a function of runoff intensity and soil properties • Contaminants dispersed on the soil surface can be collected by surface water runoff and concentrated in sedimentation areas in drainages • Erosion of drainage channels can extend the area of contaminant dispersal in the drainage
Alluvial aquifers	• Surface runoff discharged to the canyons may infiltrate into sediments of channel alluvium
Infiltration	• Infiltration into surface soils depends on the rate of precipitation or snowmelt, antecedent soil water status, depth of soil, and soil hydraulic properties • Infiltration into the tuff depends on the unsaturated flow properties of the tuff • Joints and fractures in the tuff may provide additional pathways for infiltration to enter the subsurface regime
POTENTIAL RELEASE MECHANISM	
Leaching	• Storm water/snowmelt can dissolve contaminants from soil or other solid media, making them available for contact • Water solubility of contaminants and their relative affinity for soil or other solid media affects the ability of leaching to cause a release • Leaching and subsequent resorption can extend the area of contamination

TABLE 4-4 (continued)

SUMMARY OF CONCEPTUAL MODEL ELEMENTS

PATHWAYS/MECHANISM	CONCEPT/HYPOTHESES
Soil erosion	• The erosion of surface soils is dependent on soil properties, vegetative cover, slope and aspect, exposure to the force of the wind, and precipitation intensity and frequency • Depositional areas as well as erosional areas exist, and erosive loss of soil may not occur in all locations • Storm water runoff can mobilize soils/sediments, making them available for contact • Storm intensity/frequency, physical properties of soils, topography, and ground cover determine the effectiveness of erosion as a release mechanism • Erosion may also enlarge the contaminated area
Mass wasting	• The loss of rock from the canyon walls is a discontinuous, observable process • The rate of the process is extremely slow
Resuspension (wind suspension)	• Wind suspension of contaminated soil/sediment as dust makes contaminants available for contact via inhalation/ingestion • Physical properties of soil (e.g., silt content, moisture content), wind speed, and size of exposed ground surface determine effectiveness of wind suspension as a release mechanism • Wind suspension can enlarge the area of contamination and create additional exposure pathways, such as deposition on plants followed by plant consumption by humans/animals
Excavation	• Manual or mechanical movement of contaminated soil during construction, remediation, or other activities makes contaminated soil available for dermal contact, ingestion, and inhalation as dust • The method of excavation (i.e., type of equipment), physical properties of soil, weather conditions, and magnitude of excavation activity (i.e., depth and total area of excavation) influence the effectiveness of excavation as a release mechanism • Excavation can increase or decrease the size of the contaminated area, depending on how the excavated material is handled
EXPOSURE ROUTE	
Inhalation	• Vapors, aerosols, and particulates (including dust) can be inhaled and absorbed by the lungs and mucous membranes • Physical and chemical properties of airborne contaminants influence the degree of retention in the body after being inhaled
Ingestion	• Ingestion of soil, water, food, and dust can lead to contaminant intake via absorption in the gastrointestinal tract
Direct contact	• Some hazardous chemical constituents will absorb through the skin when in contact with contaminated surfaces of soil, tuff, or rubble • Physical and chemical properties of contaminants influence the degree of dermal absorption • Factors such as skin moisture and temperature affect the degree of dermal absorption
External penetrating radiation	• External, or whole body radiation, can occur through exposure to gamma-ray-emitting radionuclides that may be present in soil either directly through the soil or re-entrained dusts • Exposure to penetrating radiation can also occur through inhalation or ingestion when radionuclide-contaminated soil or tuff surfaces erode and/or dusts become re-entrained

of separate models may be necessary based on data gathered through the RFI.

Site-specific information on PRS aggregates, such as potential contaminants of concern and migration pathways, is presented in Chapter 5.

4.3.3.2 Potential Human Exposure

To identify the presence of COCs, sampling plans proposed for OU 1140 involve comparing analytical data from samples to SALs. As mentioned in Subsection 4.2.1, SALs are based on a conservative, residential exposure scenario. If measured concentrations exceed SALs or if there are several PCOCs present and an additive potential exists, then further investigation will be conducted. If contaminated media are found in Phase I or Phase II, the human exposure potential to these contaminants will be quantified in a baseline risk assessment. Human exposure is estimated through a model of the reasonable maximum exposed individual who is defined through assumptions of current and future land use (EPA 1989, 0305; EPA 1991, 0746; EPA 1992, 11-246). Two land use scenarios will be evaluated in baseline risk assessments for OU 1140: continued Laboratory operations (current and future) and recreational (current and future). Continued Laboratory operations is a scenario that encompasses two theoretical populations of potentially exposed individuals: on-site workers and construction workers. Future residential use is unlikely because OU 1140 is located in a remote area.

Currently, there are no commercial dairy or cattle operations in the vicinity of OU 1140. If the land reverts to the National Forest Service in the future, then limited cattle grazing is a possibility. The number of cows that this area would be able to sustain is small because of the semiarid climate, thus reducing the probability of significant uptake of contaminants from a single PRS. Similarly, game animals such as deer and elk also have a large foraging area and, like cattle, would not be expected to have significant uptake of contaminants from any single PRS. Therefore, these exposure scenarios will not be evaluated in a baseline human-health risk assessment because they are expected to be less conservative than scenarios already being evaluated.

Refer to Subsection 4.3 of the 1992 IWP for ER programmatic guidance on probable land use scenarios (LANL 1992, 0768). Depending on site-specific parameters (e.g., types of contaminants present or migration potential), the worst-case exposure scenario (i.e., the reasonable maximum exposed individual) may vary. For those PRSs where two scenarios may be applicable, both scenarios will be evaluated in a baseline risk assessment. For any baseline risk assessment, the 95% upper confidence limit on the arithmetic average concentration of COCs in exposure areas, either surface or subsurface soils, is sufficient to determine receptor exposures. Data are averaged over an exposure unit, the definition of which is determined by the land use scenario. When exposure units have been established, they will be incorporated in risk assessment calculations.

Although programmatic guidance on conducting baseline risk assessments will be available in the next IWP, site-specific information will be used to construct appropriate exposure scenarios and assumptions. Assumptions made for the continued Laboratory operations and recreational scenarios are developed below.

4.3.3.2.1 Continued Laboratory Operations

In the foreseeable future, land use is likely to continue to be similar to current Laboratory operations. Populations of on-site workers (individuals who work on or near the site) and construction workers (individuals who would be exposed to near-surface and subsurface soils through various activities including excavation) are estimated to be the most likely reasonable maximum exposed individuals and are therefore the exposure scenarios that will be evaluated under the land use scenario of continued Laboratory operations.

On-site workers (i.e., maintenance and office workers) are expected to be exposed routinely to contaminated media; therefore, this scenario is considered the most conservative exposure scenario for those PRSs in OU 1140 that consist of potential surface contamination on the mesa top. Surface contamination (0 to 6 in.) above SALs will be evaluated for both current and future risks in a baseline risk assessment using the on-site worker scenario. PRS aggregates that include potential surface contamination on the mesa top are: surface releases (Subsection 5.3), outfalls (Subsection 5.4), landfills (Subsection 5.5), and stack emissions (Subsection 5.6).

The construction worker is expected to be exposed to subsurface contamination during excavation activities. Once subsurface soil is excavated and brought to the surface, on-site workers could also be exposed. Therefore, for PRSs in OU 1140 that consist of subsurface contamination above SALs, a baseline risk assessment using the construction worker and on-site worker scenarios will be evaluated. PRS aggregates with potential subsurface contamination include septic systems and dry wells (Subsection 5.1), lagoons (Subsection 5.2), some outfalls (Subsection 5.4), and landfills (Subsection 5.5).

Exposure pathways relevant to continued Laboratory operations include: 1) inhalation of fugitive dust or volatile compounds; 2) incidental ingestion of contaminated soils; 3) direct dermal contact with contaminated soils; and, 4) external radiation (see Table 4-5).

TABLE 4-5

SUMMARY OF EXPOSURE ROUTES IN THE CONTINUED LABORATORY OPERATIONS SCENARIO

EXPOSURE ROUTE	ASSUMPTIONS
1. Inhalation of ambient air (fugitive dust)	• Fugitive dust is generated by the soil disturbances (i.e., bulldozers, trucks and other earth-moving equipment, and during construction activities) • Construction activities may expose subsurface chemicals to the surface (i.e., excavation) • There may be volatile organic compounds in near-surface and subsurface soils that would contribute to the inhalation exposure • For dust transport indoors, it can be assumed that indoor concentrations are less than those outdoors • For vapor transport indoors, concentrations indoors and outdoors can be assumed to be equivalent, except at sites where subsurface soil gases are entering indoors; in this case, vapor concentrations inside could exceed those outdoors
2. Incidental ingestion of soil	• Incidental soil ingestion of surface or subsurface soils may occur as a result of construction activities • Office workers would be expected to contact much less soil and dust than construction workers
3. Dermal contact with soil	• Skin surface area available for contact with soil includes arms, hands, face, and head
4. External radiation	• Irradiation from radionuclides on the ground surface may occur

4.3.3.2.2 Recreational Users

The recreational scenario is the most probable future scenario for PRSs consisting of surface and/or subsurface contamination on the canyon wall and/or the canyon bottom. Workers are not expected to come into direct contact with contaminated media on walls or on canyon bottoms because of limited development in these areas. The recreational scenario may include short-term camping, day-hiking, hunting, and possibly limited construction.

PRSs in OU 1140 that consist of surface and/or subsurface contamination above SALs on canyon walls and/or canyon benches will be evaluated in a baseline risk assessment using the recreational scenario. (Potential contamination of canyon bottoms will be investigated as part of OU 1049.) Those PRSs include: outfalls (Subsection 5.4), stack emissions (Subsection 5.6), and surface water runoff into drainage channels from areas on the mesa top that have potential surface contamination (landfills, Subsection 5.5; lagoons, Subsection 5.2; and surface emissions, Subsection 5.3).

Recreational users of the area could potentially come into contact with contaminants through ambient air, soils, and sediments in drainages.

Exposure pathways for the recreational scenario include: 1) inhalation of ambient air (fugitive dust); 2) incidental soil ingestion; 3) dermal contact with soil; 4) external radiation; and, 5) ingestion of edible plants (piñon nuts, berries, etc.). Table 4-6 presents the exposure routes and assumptions used to define the recreational scenario.

See Table 4-7 for a summary of the exposure mechanisms and receptors for each aggregate in OU 1140.

4.4 Ecological Risk Assessment

Ecological risk-assessment methodology is currently under development. Guidance on the measurement end points and spatial scales for determining significant ecological effects will be included in the 1993 IWP. NFA proposals for PRSs will be based on RFI data compared to human health risk-based SALs and used for risk assessment calculations. Ecological risk-assessment decisions will be made after the ecological risk guidance is issued. To the extent possible, Phase I sampling will include assessment of ecological risk

TABLE 4-6

SUMMARY OF EXPOSURE ROUTES IN THE RECREATIONAL SCENARIO

EXPOSURE ROUTE	ASSUMPTIONS
1. Inhalation of ambient air (fugitive dust)	• Fugitive dust is generated by the wind and during recreational activities (e.g., dirt biking)
2. Incidental ingestion of soil	• Incidental ingestion of soils or sediments may occur as a result of recreational activities
3. Dermal contact with soil	• Skin surface area available for contact with soil may include arms, hands, face, upper body, legs, and head
4. External radiation	• Irradiation from radionuclides on the ground surface may occur
5. Ingestion of edible plants	• Root uptake of chemicals by plants may result in human exposure via ingestion

as an objective. If necessary, subsequent data collection focusing specifically on ecological risk will also be pursued. See Appendix F (Ecological Risk Assessment) for further discussion. If potentially unacceptable ecological effects are identified, then the NFA decisions will be revisited. A remediation or mitigation strategy considering the cumulative contribution of all PRSs, including those recommended for NFA or remediation, will be proposed.

Certain environmental evaluations [for National Environmental Policy Act (NEPA), endangered species, wetlands, cultural resources, etc.] will be completed before sampling or any other significant activity at OU 1140. The purpose of these evaluations will be to recommend a mitigative strategy to limit the impact of RFI activities on environmental features protected by specific regulations. These environmental features (see Appendix B) will be important during the ecological risk assessments and include:

- State or Federal sensitive, threatened, or endangered plant or animal species that potentially occur in the OU,
- sensitive areas (for example, flood plains or wetlands), and,
- plant and wildlife data that represent habitat types in the OU.

TABLE 4-7

EXPOSURE MECHANISMS AND RECEPTORS FOR THE PRS AGGREGATES IN OU 1140

POTENTIAL AREA OF CONTAMINATION	RELEASE MECHANISMS	CURRENT POTENTIAL RECEPTORS	FUTURE POTENTIAL RECEPTORS
Aggregate 1, Septic Systems/Dry Wells			
Subsurface soil	Excavation or erosion resulting in wind dispersion, surface water runoff, and infiltration	None	Construction workers, on-site workers
Structures	Excavation or erosion exposing structures	None	Construction workers, on-site workers
Sludge inside tanks	Leaching to surrounding subsurface soils	None	Construction workers, on-site workers
Aggregate 2, Lagoons			
Surface soil and sludge in lagoons and siphon box	Erosion, resulting in wind dispersion; surface water runoff and infiltration; volatilization; external irradiation	On-site workers and construction workers	Recreational users, construction workers, on-site workers
Sediments in drainage channels	Wind dispersion, runoff	On-site workers and construction workers	Recreational users and construction workers
Subsurface soil	Excavation or erosion, resulting in surface release mechanisms	None	Recreational users, construction workers, on-site workers
Structures and sand in filters	Surface water runoff, external irradiation	On-site workers and construction workers	Recreational users, construction workers, on-site workers
Aggregate 3, Surface Releases			
Surface soil	Erosion, resulting in wind dispersion; surface water runoff and infiltration; volatilization; external irradiation	On-site workers and construction workers	On-site workers and construction workers
Aggregate 4, Outfalls			
Surface soil	Erosion, resulting in wind dispersion; surface water runoff and infiltration; volatilization; external irradiation	On-site workers, recreational users, and construction workers	On-site workers, recreational users, and construction workers
Sediments	Wind dispersion, runoff	On-site workers, recreational users, and construction workers	On-site workers, recreational users, and construction workers
Subsurface soil	Excavation or erosion, resulting in surface release mechanisms	None	Recreational users, on-site workers, and construction workers

TABLE 4-7 (continued)

EXPOSURE MECHANISMS AND RECEPTORS FOR THE PRS AGGREGATES IN OU 1140

POTENTIAL AREA OF CONTAMINATION	RELEASE MECHANISMS	CURRENT POTENTIAL RECEPTORS	FUTURE POTENTIAL RECEPTORS
Aggregate 5, Landfills			
Surface soil	Erosion, resulting in wind dispersion; surface water runoff and infiltration; volatilization; external irradiation	On-site workers and construction workers	Recreational users, construction workers, on-site workers
Subsurface soil	Excavation or erosion, resulting in surface release mechanisms	None	Recreational users, construction workers, on-site workers
Debris	Erosion, resulting in wind dispersion; surface water runoff and infiltration; volatilization; external irradiation	On-site workers and construction workers	Recreational users, construction workers, on-site workers
Sediments in drainage channel	Wind dispersion, runoff	On-site workers and construction workers	Recreational users and construction workers
Aggregate 6, Stack Emissions			
Surface soil	Erosion, resulting in wind dispersion; surface water runoff and infiltration; volatilization; external irradiation	On-site workers and construction workers	On-site workers, recreational users, and construction workers
Sediments	Wind dispersion, runoff	On-site workers, construction workers, and recreational users	On-site workers, construction workers, and recreational users

4.5 Sampling and Analytical Strategies

The following subsection provides an overview of sampling and analytical issues relevant to OU 1140. See Appendix D for further details.

4.5.1 Sampling Strategies

Reconnaissance sampling is the main sampling strategy for the Phase I screening assessment survey. This approach will provide the type and quality of data needed to distinguish PRSs that merit further investigation from PRSs that are appropriate candidates for NFA.

An exception to the reconnaissance sampling approach can be found in Subsection 5.1. Septic systems or dry wells that are determined suitable candidates for VCA will not be the subject of reconnaissance sampling. For those PRSs, sufficient data will be collected during the VCA to determine whether contaminant levels at the excavation site are below an acceptable risk-based limit. In this case, average values rather than maxima will drive the decision. Derivation of the specific risk-based limit will be accomplished based on Laboratory policy to be issued prior to the initiation of VCAs.

Other sampling approaches, for instance those aimed at establishing the nature and extent of contamination, will not be applied during Phase I, but may be more appropriate for Phase II data collection efforts in support of a corrective measures study.

The goal of reconnaissance sampling in PRSs is to detect the presence of PCOCs above SALs. Whenever possible, data will be biased to achieve this goal by selecting sample locations expected to represent maximum PCOC concentrations, based either on knowledge of the physical processes responsible for PCOC distribution, or on the results of preliminary field screening.

During reconnaissance sampling, the portion of the field sample that is submitted for fixed-based laboratory analysis will be biased by mobile laboratory analytical results. Thus, reconnaissance sampling may have two levels of biasing to increase the chance of sampling the maximum potential contaminant concentration in a PRS.

Reconnaissance sampling data will be compared to SALs in the screening assessment (Fig. 4-2) to determine the presence or absence of COCs. If individual PCOCs do not exceed SALs, but data indicate that there are several PCOCs present, the potential for additive effects will be considered. If an additive potential exists, then the combined PCOCs will be the subject of further investigation. Samples taken in adjacent or overlapping PRSs can be aggregated in the baseline risk assessment. All PRSs will have at least three full laboratory analyses, which in most cases will be the minimum number required for a baseline risk assessment.

For some reconnaissance surveys, the number of samples is based on quantitative statements of error tolerances. These are stated as the desired probability of detecting potential contamination when a certain per cent of the site is expected to be contaminated above SALs. For example, the decision maker may state that he/she wants a sampling program with a 90% probability of detecting contamination above SALs, if 25% of the site is contaminated.

For OU 1140, 90% was selected as the desired probability for most aggregates. The septic systems and dry wells aggregate is a special case, employing a 95% probability for detection of contamination at the proximal end of drain lines; the stack emissions aggregate is another special case which does not incorporate a statistical approach. The 90% value represents a reasonable and conservative level of probability for an OU where archival information does not suggest that severe contamination problems are likely. The choice of a per cent of site contaminated was determined on an aggregate-specific basis for OU 1140. This choice depends on a series of considerations including the following:

(a) the nature and toxicity of suspected contaminants;

(b) assumptions about how receptors might integrate their exposure (i.e., over how large an area they are likely to range);

(c) available data or assumptions about the distribution of likely contamination at the site (homogeneity vs heterogeneity); and,

(d) site size, topography, and related characteristics.

A table or nomogram (Table 4-8) supplies the number of independent analyses of the PRS that must be taken to meet this performance goal. For the above example, nine independent analyses are required to meet the decision-maker's uncertainty tolerances. The derivation of this approach is given in Appendix H of the IWP (LANL 1992, 0768).

As noted above, the reconnaissance sampling approach uses biasing techniques to assure that the samples sent for analytical laboratory analysis are likely to detect contamination if it is present at a PRS. This biasing provides a probability statement that is conservative (i.e., the probability of detecting contamination is actually greater than the stated value). Although the nomogram approach does not consider uncertainty related to laboratory analytical methods, this is more than compensated for by the biasing

TABLE 4-8

SAMPLE SIZES FOR RECONNAISSANCE SAMPLING

DETECTION PROBABILITY	FRACTION OF SITE AFFECTED									
	0.50	**0.45**	**0.40**	**0.35**	**0.30**	**0.25**	**0.20**	**0.15**	**0.10**	**0.05**
0.51	2	2	2	2	2	3	4	5	7	14
0.54	2	2	2	2	3	3	4	5	8	16
0.57	2	2	2	2	3	3	4	6	9	17
0.60	2	2	2	3	3	4	5	6	9	18
0.63	2	2	2	3	3	4	5	7	10	20
0.66	2	2	3	3	4	4	5	7	11	22
0.69	2	2	3	3	4	5	6	8	12	23
0.72	2	3	3	3	4	5	6	8	13	25
0.75	2	3	3	4	4	5	7	9	14	28
0.78	3	3	3	4	5	6	7	10	15	30
0.81	3	3	4	4	5	6	8	11	16	33
0.84	3	4	4	5	6	7	9	12	18	36
0.87	3	4	4	5	6	8	10	13	20	40
0.90	4	4	5	6	7	9	11	15	22	45
0.93	4	5	6	7	8	10	12	17	26	52
0.96	5	6	7	8	10	12	15	20	31	63
0.99	7	8	10	11	13	17	21	29	44	90

techniques described above. Laboratory precision and accuracy are expected to be high for the full laboratory methods used to characterize PCOCs.

False negative errors (i.e., failing to detect contamination) are controlled in reconnaissance surveys by choice of sample size. False positive errors (i.e., incorrectly concluding that a site is contaminated) can be controlled only by controlling measurement error through appropriate quality assurance (QA) procedures. However, the consequences of a false negative decision are more serious (propose NFA for a contaminated PRS) than are the consequences of a false positive error (continue the remedial investigation).

Table 4-9 reflects the DQO specifications for each aggregate in OU 1140.

TABLE 4-9

COMPARISON OF DQO STEPS ACROSS OU 1140 AGGREGATES

DQO STEP	AGGREGATE 1 SEPTIC SYSTEMS/ DRY WELLS	AGGREGATE 2 LAGOONS	AGGREGATE 3 SURFACE RELEASES	AGGREGATE 4 OUTFALLS	AGGREGATE 5 LANDFILLS	AGGREGATE 6 STACK EMISSIONS
Problem Statement	(I) Pursue VCA if contamination likely (II) Otherwise, establish presence/ absence of PCOCs	Establish presence/absence of PCOCs	Establish presence/absence of PCOCs	Establish presence/absence of PCOCs	Establish presence/absence of PCOCs	Establish presence/absence of PCOCs
Decision Process	(I) Confirm cleanup adequacy (II) Reconnaissance screening (compare to SALs)	Reconnaissance screening (compare to SALs)	Reconnaissance screening (compare to SALs)	Reconnaissance screening (compare to SALs)	Reconnaissance screening (compare to SALs)	Reconnaissance screening (compare to SALs)
Inputs	Concentration of VOCs, SVOCs, metals, PCBS, radionuclides in structures and surrounding soil	Concentration of VOCs, SVOCs, metals, PCBS, radionuclides in soils, tuff, and sludge	Concentration of VOCs, SVOCs, metals, PCBS, radionuclides on pavement and in surface/ near-surface/ subsurface soil	Concentration of VOCs, SVOCs, metals, PCBS, radionuclides in surface/ subsurface soil	Concentration of VOCs, SVOCs, metals, PCBS, radionuclides, asbestos in surface/ subsurface soil	Concentration of uranium/ thorium/ beryllium in surface soil
Boundaries	(I) Excavated structures; 1 ft border following excavation (II) Septic system/ dry well structures; subsurface soil and bedrock (up to 15 ft depth including 5 ft of bedrock)	Soils and tuff underneath and sludge in the lagoons, sand in the filters, and soil around the filters	Paved areas and surface/ near-surface soil adjacent to surface releases for 2 PRSs; subsurface soil also (to bedrock)	For industrial outfalls: release points, drainages, collection points. For storm outfalls: collection points only (boundaries extend to bedrock in both cases)	Landfill surface/ subsurface soils [to bedrock or hand auger capacity on PRS 46-009(b) slope], downstream channels (also to bedrock)	Top 6 in. of soil in selected mesa tops, storm drains, other unpaved points not covered by other aggregates

TABLE 4-9 (continued)

COMPARISON OF DQO STEPS ACROSS OU 1140 AGGREGATES

DQO STEP	AGGREGATE 1 SEPTIC SYSTEMS/ DRY WELLS	AGGREGATE 2 LAGOONS	AGGREGATE 3 SURFACE RELEASES	AGGREGATE 4 OUTFALLS	AGGREGATE 5 LANDFILLS	AGGREGATE 6 STACK EMISSIONS
Decision Logic	(I) Excavate structure, confirm if PCOCs are less than risk-based limit (II) Compare maximum value to SAL; if any SAL is exceeded, continue investigation (baseline RA); separate decision for each PRS	Compare maximum value to SAL; if any SAL is exceeded, continue investigation (baseline RA), and include drain lines; separate decision for each PRS	Compare maximum value to SAL; also consider outfalls data; if any SAL is exceeded, continue investigation (baseline RA); separate decision for each PRS	Compare maximum value to SAL; if any SAL is exceeded, continue investigation (baseline RA), and include drain lines; separate decision for each outfall; data also support decisions on PRSs in other aggregates	Compare maximum value to SAL; if any SAL is exceeded, continue investigation (baseline RA); separate decision for each PRS	Compare maximum value to SAL; also consider data gathered for outfalls aggregate; if any SAL is exceeded, continue investigation (baseline RA); separate decision for beryllium contamination
Design Criteria	(I) 8 surface soil sampling locations for septic systems, 3 for dry wells (II) 8-10 boreholes for septic systems, 3 for dry wells	90% probability of detecting contaminants covering 10% of area – enhanced by judgmental sampling (= 22 sampling locations)	90% probability of detecting contaminants covering 50% of area – enhanced by judgmental sampling (= 4 sampling locations)	Drainages: 90% probability of detecting contaminants covering 30% of area (= 7 sampling locations). Collection points: 90% probability of detecting contaminants covering 50% of area (= 4 sampling locations). Both criteria enhanced by judgmental sampling	90% probability of detecting contaminants in 20% of 46-009(a) and 30% of 46-009(b) enhanced by judgmental sampling [= 11 sampling locations for 46-009(a), = 7 sampling locations for 46-009(b)]	Judgmental sampling based on wind and other factors (7 samples to be collected exclusively for this aggregate)

4.5.2 Sampling Methods and Field Surveys

Field investigations during RFI Phase I have many common elements. While not all Phase I field surveys include all components, most surveys include the following elements: health and safety, location, and geophysics. The SOPs for these methods are summarized in Table D-3, Appendix D of this work plan.

Most samples taken at OU 1140 will be taken with hand augers. Other samples will include surface soil samples collected by a range of techniques, as well as vertical and angled boreholes drilled through soil into the underlying tuff bedrock.

Field sample handling procedures will include collection of material for volatile and semivolatile organic compounds, metals, radionuclides, semivolatiles, and asbestos. Information on recordkeeping and field log maintenance can be found in Appendix D.

Samples will be collected from defined sampling points, specified in Chapter 5 for each aggregate. All sample points for all aggregates are illustrated in Map H-2 in Appendix H. If field screening instruments indicate that contamination exists at locations not previously selected, then additional samples will be taken.

Much of the surface of TA-46 is paved. Sub-pavement contamination will not be investigated unless COCs are discovered in outfalls or visible evidence indicates possible contamination. See Subsection 5.3 for more information.

Many of the sampling points described in Chapter 5 are designed to detect the downstream flow of contaminants through outfalls or drainage channels. However, the sampling conducted for this OU will not lead to conclusions about contamination further downstream from the sampling points (i.e., in canyon bottoms); but may provide useful information for the OU 1049 (canyons) RFI.

Please refer to Appendixes D (Field Investigation Approach and Methods), E (Sample Data Base), and H (Maps) for detailed OU 1140 field sampling information.

4.5.3 Analytical Methods

Although SW-846 methods are not expressly required by Module VIII of the Laboratory's hazardous waste permit, it is intended that SW-846 methods will be the basis for final recommendations (NFA) for PRSs unless prior agreements have been made with EPA Region 6. If alternative methods are proposed to analyze data that would be the basis for a final PRS recommendation, negotiations will be conducted prior to sampling to ensure that EPA Region 6 will accept the data. SW-846 methods will also be used to characterize waste generated during VCAs for compliance with land disposal restrictions.

In scenarios where the data will not be utilized for a final recommendation on the disposition of a PRS, SW-846 methods and alternate methods will be considered. Such scenarios include: mobile field laboratory results used to decide which samples will be sent to a fixed-base laboratory for analysis; and data to verify the need for, and to be used in the design of, a Phase II sampling effort.

Field screening methods include volatile organic methods, metals, and radiation methods. For instruments based on counting technology, increasing counting time reduces the detection limit. Field screening methods are discussed in Section 5.0 of Appendix D.

Refer to Section 6.0 of Appendix D for a discussion of all field laboratory methods that are currently available for use at OU 1140. Selected field laboratory analyses (both positive and negative) will receive off-site laboratory confirmation.

See Section 7.0 of Appendix D for a detailed listing of analytical methods. In general, the analytical methods described in Chapter 5 refer to analytes in broad categories (e.g., metals). However, the OU 1140 work team recognizes the need to be as specific as possible when identifying analytes and analytical methods. Ongoing efforts will produce a more focused PRS-specific list in advance of the time that fieldwork commences for OU 1140.

Both positive and negative Phase I findings will be subjected to formal data validation procedures. See the Quality Assurance Project Plan (Annex II) for additional information.

4.6 Potential Response Actions

Remediation alternatives must achieve acceptable risk levels; however, choosing between alternatives that meet human health risk requirements will be based on factors such as ecological impact, cost, regulatory concerns (in addition to risk), public/community input, and impact on Laboratory operations (see IWP, Appendix I) (LANL 1992, 0768). The evaluation of alternatives and all selection factors will be detailed in documents that comply with the HSWA Module and NEPA.

4.6.1 Criteria for Recommending No Further Action

Chapter 6 presents the PRSs recommended for NFA or DA based on archival information and field visits. Figure 4-1 depicts the decision logic for these recommendations. Appendix I, Subsection 4.1 of the IWP presents a detailed discussion of the rationale for NFA or DA based on archival information (LANL 1992, 0768).

NFA recommendations based on screening assessments (Fig. 4-2) will include an evaluation of combined effects from multiple contaminants and ALARA criteria for radioactive contaminants.

NFA recommendations after baseline risk assessments will be based on acceptable risks (in the range of 10^{-6} to 10^{-4}) for carcinogens, and a hazard index less than one for noncarcinogens. These NFA recommendations will also consider ALARA criteria for radioactive contaminants.

4.6.2 Excavation and Removal Options

Disposal and treatment options for OU 1140 include: excavation and removal to an off-site RCRA-permitted treatment, storage, and disposal facility in some cases, or to the DOE Los Alamos landfill; excavation and removal to the Laboratory mixed waste facility; excavation and incineration; decontamination (burning or other treatment); and recycling. These options may be carried out either as a VCA or as the result of a CMS.

4.6.3 Conditional Remedies

Conditional remedies for OU 1140 include capping and monitoring of surface soil or installation, maintenance, and monitoring of sediment catchments. Conditional remedies are most appropriate for active sites that will be the focus of additional remediation in the future.

4.6.4 Access Restrictions

All OU 1140 PRSs are behind security fences or no trespassing signs. Access restrictions to these PRSs will continue for the foreseeable future.

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Chapter 5

- Septic Systems and Dry Wells
- Lagoon Systems
- Surface Releases
- Outfalls
- Landfills
- Stack Emissions

5.0 EVALUATION OF POTENTIAL RELEASE SITE AGGREGATES

Technical Area (TA) 46 is an active Laboratory technical area currently used for chemical and laser research. It contains 69 potential release sites (PRSs). Past activities that may have contributed potential contaminants of concern (PCOCs) include the Rover Program (Phoebus reactor rocket engine), which was reactor research for a nuclear rocket engine; a solar research effort; and, the Jumper Program, a project to develop uranium isotope enrichment methods. For a more detailed history of TA-46, see Subsection 2.2.

The PRSs and outfalls associated with TA-46 are listed in Table 5-0-1 (with the exception of no further action (NFA) PRSs, or portions thereof, which are found in Chapter 6) and shown in Map H-1. These SWMUs have been organized into 6 PRS aggregate groups: septic systems and dry wells, lagoon systems, surface releases, outfalls, landfills, and stack emissions. These groupings are also indicated in Table 5-0-1.

It should be noted that data from the November, 1989 Laboratory Sampling and Analysis Data Document (Environmental Problems) are presented throughout this chapter (LANL 1989, 0425). The concentration data from this study was never officially released as a result of questions concerning data quality. All data in the tables except those specifically noted for some radionuclides, were generated in fixed laboratories. However, quality control data indicated some instances of possible inaccuracies due to blank contamination, high background interference, or poor recovery of known standard analytes (LANL 1989, 0425). The program was terminated before these problems were resolved. In this chapter, the Environmental Problem data are used as qualitative data to help identify PCOCs. These data are never used as a basis for recommendation of NFA for any PRS.

TABLE 5-0-1

TA-46 POTENTIAL RELEASE SITES (PRSs)

PRS	PRS TYPE	SUBSECTION
46-002	Lagoon system, outfall	5.2, 5.4
46-003(a)	Septic system, outfall	5.1, 5.4
46-003(b)	Septic system	5.1
46-003(c)	Septic system	5.1
46-003(d)	Septic system	5.1
46-003(e)	Septic system	5.1
46-003(f)	Septic system, surface release, outfall	5.1, 5.3, 5.4
46-003(g)	Septic system, outfall	5.1, 5.4
46-003(h)	Surface release (outfall)	5.3
46-004(c)	Dry well	5.1
46-004(d)	Dry well	5.1
46-004(e)	Dry well	5.1
46-004(f)	Outfall	5.4
46-004(g)	Outfall, stack emission	5.4, 5.6
46-004(h)	Outfall, stack emission	5.4, 5.6
46-004(m)	Outfall	5.4
46-004(p)	Dry well	5.1
46-004(q)	Outfall	5.4
46-004(r)	Outfall	5.4
46-004(s)	Outfall	5.4
46-004(t)	Outfall	5.4
46-004(u)	Outfall	5.4
46-004(v)	Outfall	5.4
46-004(w)	Outfall	5.4
46-004(x)	Outfall	5.4
46-004(y)	Outfall	5.4
46-004(z)	Outfall	5.4
46-004(a2)	Outfall	5.4
46-004(b2)	Outfall	5.4
46-004(c2)	Outfall	5.4
46-004(d2)	Stack emission, outfall	5.6, (5.4)*
46-005	Lagoon system, outfall	5.2, 5.4

Table 5-0-1 (continued)

TA-46 POTENTIAL RELEASE SITES (PRSs)

PRS	PRS TYPE	SUBSECTION
46-006(a)	Surface release, outfall	5.3, (5.4)*
46-006(b)	Surface release, outfall	5.3, (5.4)*
46-006(c)	Surface release, outfall	5.3, (5.4)*
46-006(d)	Surface release	5.3
46-006(f)	Surface release	5.3
46-006(g)	Surface release	5.3
46-007	Surface release, outfall	5.3, (5.4)*
46-008(a)	Surface release	5.3
46-008(b)	Surface release	5.3
46-008(d)	Surface release	5.3
46-008(e)	Surface release	5.3
46-008(f)	Surface release	5.3
46-008(g)	Surface release	5.3
46-009(a)	Landfill	5.5
46-009(b)	Landfill	5.5
46-0010(d)	Surface release	5.3
C-46-001	Surface release (sampled at outfall only)	5.4
C-46-002	Stack emission, outfall	5.6, (5.4)*
C-46-003	Stack emission, outfall	5.6, (5.4)*

*(5.4) indicates that outfall data will be used to support a decision for this PRS.

5.1 Septic Systems and Dry Wells

5.1.1 Background

Figure 5-1-1 shows the PRSs associated with the septic systems and dry wells aggregate. This aggregate consists of 11 solid waste management units (SWMUs) composed of 7 septic systems and 4 dry wells (Table 5-1-1). Of these SWMUs, three are currently active [dry wells 46-004(c), 46-004(d), and 46-004(e)]; one septic tank is possibly active [septic tank 46-003(g)]; and one dry well (46-004(p)] is not currently in use and has not been decommissioned. Note on Fig. 5-1-1 that not all buildings were served by septic systems and dry wells. Newer buildings have always been connected to the existing sanitary system.

Investigation and any needed corrective action associated with active systems will be deferred until these systems are decommissioned. Operable Unit (OU) 1140 personnel are cooperating with the Laboratory's Facilities Engineering Division to reroute waste streams into sanitary sewers. These projects are expected to be completed by 1995. No voluntary corrective action (VCA) will be initiated on inactive systems until the Laboratory's proposed mixed waste facility is operational. The decision to defer VCAs in this aggregate is discussed in depth in Subsection 5.1.2.

The septic systems and dry wells are aggregated because they have similar conceptual models. Drain fields are included because of their functional relationship to the septic tanks (the source terms are identical) and because their characterization and remediation are closely related to the septic system VCAs and screening action alternatives.

Septic tanks, their associated structures (distribution boxes, manholes, siphon tanks), septic system drain lines, and drain fields are addressed in this PRS aggregate. Any associated outfalls (Table 5-1-1) are discussed in the outfalls aggregate (see Subsection 5.4.1.1.2).

Because at least one documented case exists [see SWMU 46-003(c)] in which an acid drain line was accidentally connected into a TA-46 septic system, none of the SWMUs in this PRS aggregate are being considered for NFA at this time. Drain lines formerly connected to a septic system SWMU and currently active are addressed in Subsection 5.2, Lagoon Systems.

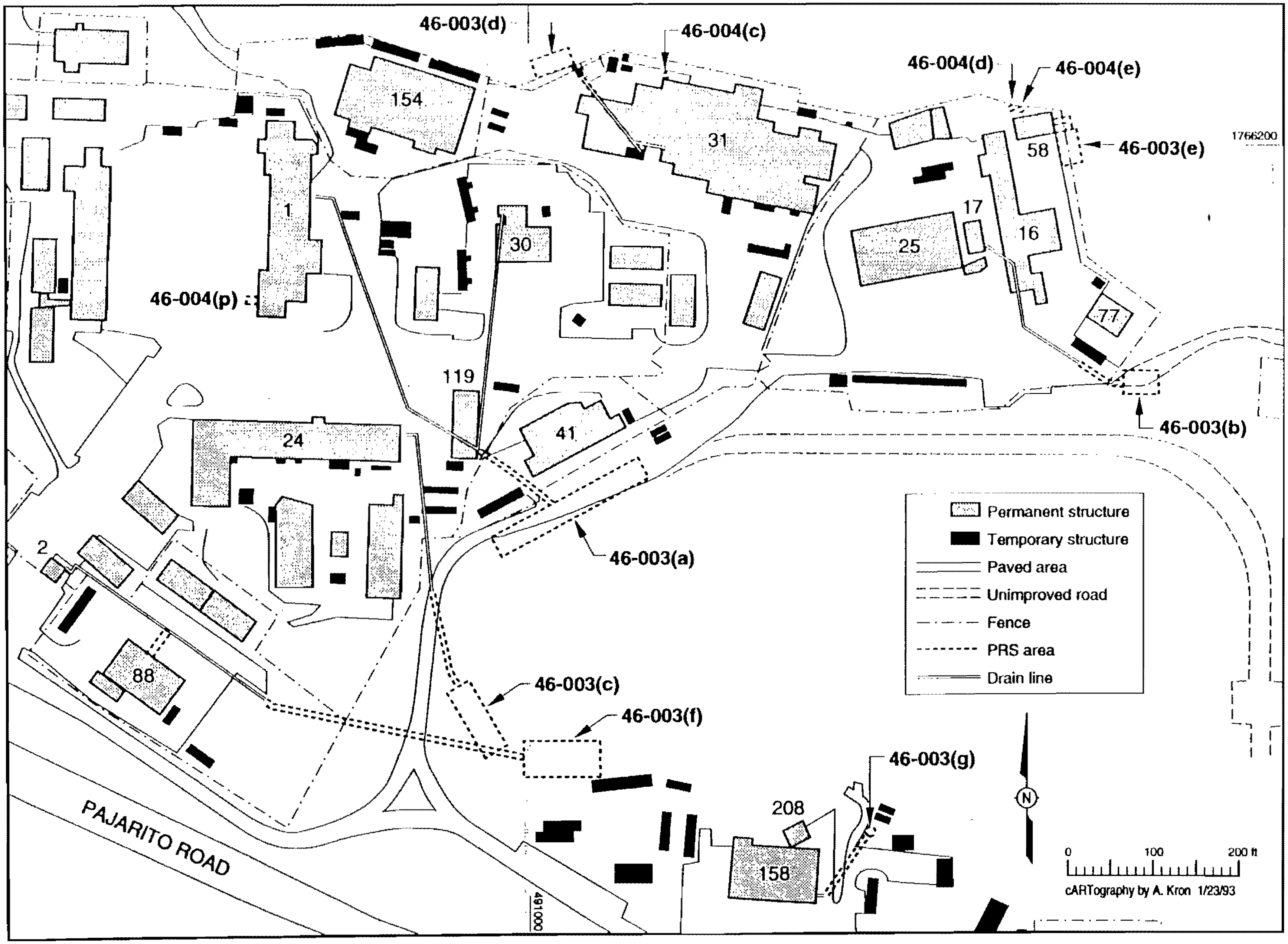


Fig. 5-1-1. Location of PRSs in the septic system/dry well aggregate at OU 1140 (TA-46).

TABLE 5-1-1

SEPTIC SYSTEM AND DRY WELL PRS AGGREGATE

SWMU	DESCRIPTION	STATUS	POTENTIAL CONTAMINANTS OF CONCERN (PCOCs)
46-003(a)	Septic system southwest of TA-46-41. Received waste from TA-46-1, TA-46-30, and a guard station.	Inactive	Volatiles; semivolatiles; PCBs; metals; mercury; uranium-235, -238
46-003(b)	Septic system southeast of TA-46-77. Received waste from TA-46-17.	Inactive	Volatiles; semivolatiles
46-003(c)	Septic system east of TA-46-76. Received waste from TA-46-24.	Inactive	Volatiles;semivolatiles; metals; PCBs; mercury; uranium-235, -238
46-003(d)	Septic system northwest of TA-46-31. Received waste from TA-46-31.	Inactive	Volatiles; semivolatiles; metals; PCBs; thorium; asbestos; plutonium-238, -239/240; uranium-235, -238
46-003(e)	Septic system east of TA-46-58. Received waste from TA-46-58.	Inactive	Volatiles; semivolatiles; metals; plutonium-238, -239/240; uranium-235, -238
46-003(f)	Septic system southeast of TA-46-76. Received waste from TA-46-88 and from septic system SWMUs 46-003(a,c).	Inactive	Volatiles; semivolatiles; metals, PCBs; mercury; uranium-235, -238
46-003(g)	Septic system east of TA-46-158. Received waste from TA-46-158 and later from office buildings. System is known to have overflowed.	Active	Volatiles; semivolatiles; metals; PCBs; activation products
46-004(c)	Dry well north of TA-46-31. Receives waste from SWMU 46-004(a).	Active	Volatiles; semivolatiles; metals; thorium; PCBs; asbestos; uranium-235, -238
46-004(d)	Dry well north of TA-46-58. Received overflow waste from SWMU 46-004(c).	Active	Volatiles; semivolatiles; metals; mercury; PCBs; uranium-235, -238; plutonium-238, -239, -240; thorium-230
46-004(e)	Dry well north of TA-46-58. Received industrial waste from sinks in TA-46-58.	Active	Volatiles; semivolatiles; metals; mercury; PCBs; uranium-235, -238; plutonium-238, -239, -240; thorium-230
46-004(p)	Dry well southwest of TA-46-1. No drain lines. Received manually disposed waste only.	Active	Volatiles; semivolatiles; metals; asbestos

5.1.1.1 Description and History

Inlet and historical drain lines (Fig. 5-1-2) of all the systems described below will not be addressed until it is determined if a Phase II RCRA Facility Investigation (RFI) is necessary. All septic systems except SWMU 46-003(g) were abandoned in the early 1970s when the sanitary lagoon, SWMU 46-002, was built to receive the waste streams that had been flowing into the septic systems. Anecdotal reports suggest that the septic tanks may have been backfilled at the time of abandonment.

Figures showing the locations of septic system components are included in Subsection 5.1.4, Phase I Sampling and Analysis Plan.

SWMU 46-003(a): TA-46-6,-8, -9, -10. SWMU 46-003(a) is a sanitary system consisting of a septic tank (TA-46-8), a manhole (TA-46-6), two distribution boxes (TA-46-9 and TA-46-10), and an associated drain field. SWMU 46-003(a) lies beneath paved roads, parking lots, and buildings in the immediate vicinity of Building TA-46-41; however, the precise locations of septic tank TA-46-8 and its associated drain field have not been determined. Engineering drawing ENG-R 1521 indicates that septic tank TA-46-8 is located approximately 50 ft west of the southwest corner of TA-46-41.

The sanitary system was installed in 1954 to serve the bathroom facilities of the first buildings at TA-46 (TA-46-1 and TA-46-2). A janitorial sink in the basement of TA-46-1 also drained into this septic system. TA-46-1 housed offices, two assembly bays, a staff machine shop, a few laboratories for electrical assembly and checkout, general laboratories, and a uranium polishing area (Roberts and Griggs 1992, 11-180; Roberts and Reading 1992, 11-181). All of these functions were connected with the Rover Program. At TA-46, reactor components were assembled for fit check only and then transported to the Nevada Test Site, where nuclear components were installed (Roberts and Griggs 1992, 11-183). Building TA-46-2 was a guard station.

In 1959, this sanitary system was connected to the bathroom facility and a sink along the north wall of Building TA-46-30. TA-46-30 contained a high-bay area with a crane, an actuator (a critical rotating assembly component of the reactor) test area, and a small machine shop dedicated to actuator

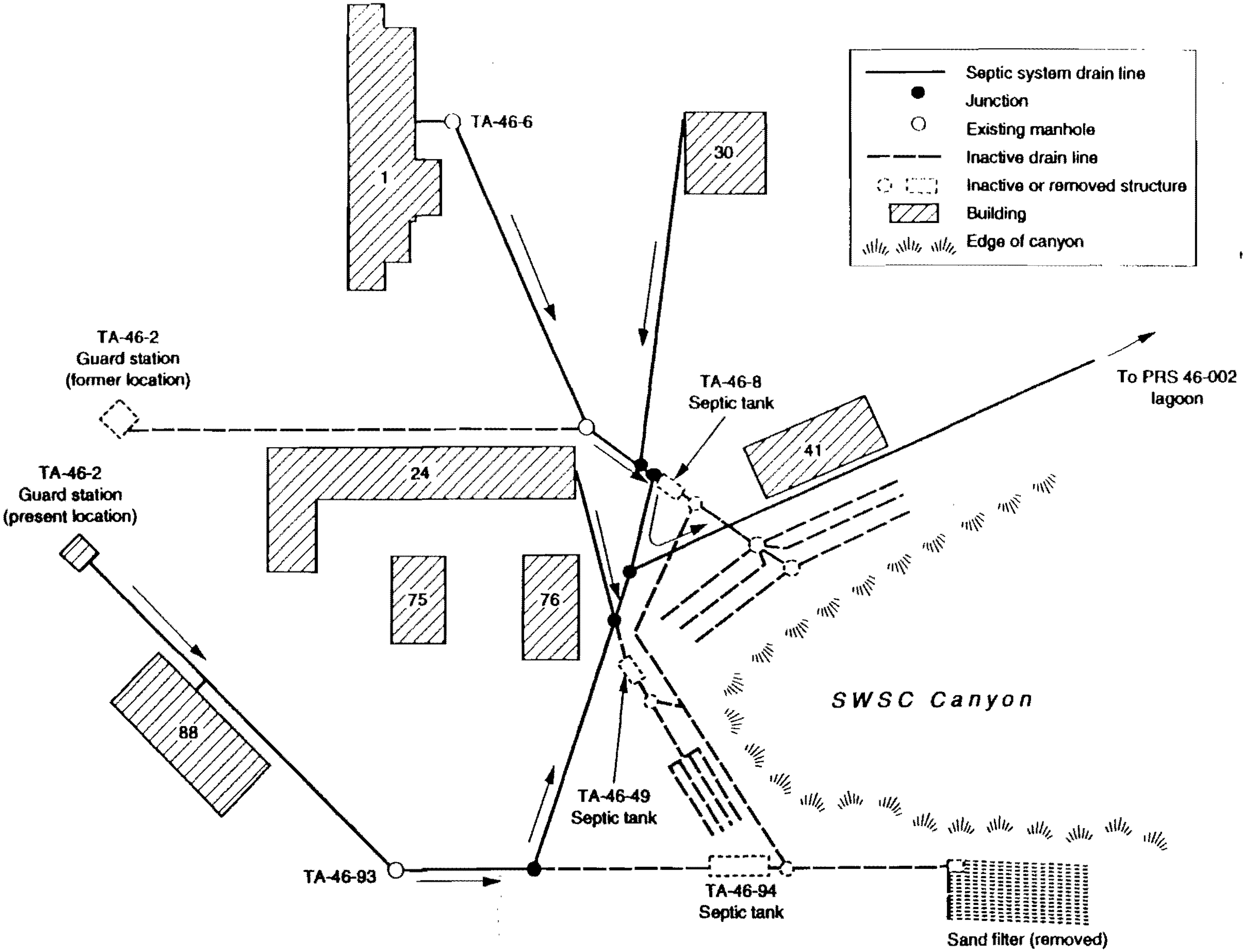


Fig. 5-1-2. Schematic diagram showing the interconnections of septic systems at TA-46.

development. All reactor components in this facility were handled for test operations only and were nonradioactive.

A 1968 Engineering drawing, ENG-C 34339, indicates that septic tank TA-46-8 was connected to a sand filter of SWMU 46-003(f). This drawing also indicates the drain field associated with SWMU 46-003(a) was abandoned. Septic tank TA-46-8 was abandoned in 1972-73 (Gonzales 1981, 11-088) when the buildings it previously served were connected to a sanitary lagoon (SWMU 46-002). However, manhole TA-46-6 (see Fig. 5-1-2), which served the septic system drain line and now serves the drain line to the lagoon, is still active and is, therefore, considered to be part of an active sanitary waste water system not subject to the Resource Conservation and Recovery Act (RCRA). In the event that contaminants are found elsewhere in this septic system, samples will be taken from the area surrounding and below the manhole in Phase II.

Because general laboratory operations were conducted in these facilities, PCOCs include organics and metals (including mercury). Residual uranium from uranium polishing activities is an additional PCOC. Any contamination would have been the result of accidental spills, improper disposal of laboratory materials, or undocumented cross-connection of industrial waste lines with septic lines.

SWMU 46-003(b): TA-46-22, -29. SWMU 46-003(b) is a sanitary system composed of septic tank TA-46-22, a distribution box (TA-46-29), drain lines, and a drain field. The precise locations of septic tank TA-46-22 and its associated drain field are unknown. Engineering drawing ENG-R 1521 indicates that this septic tank is located beneath an asphalt road 40 to 50 ft south of TA-47-17. Septic tank TA-46-22 served the bathroom facilities in Building TA-47-17 which houses a generator originally used for charging submarine batteries used in the Rover Program.

Septic tank TA-46-22 was abandoned in 1972-73 (Gonzales 1981, 11-088) and waste discharged by this system was routed to a sanitary lagoon (SWMU 46-002) which became operational in 1973. Solvents and machine oils from spills or improper waste disposal activities could have resulted in the presence of organic contaminants. However, it is unlikely that contaminants entered the septic system in substantial quantities. This septic tank is not recommended for NFA because of the potential for undocumented cross connecting of industrial waste lines with septic lines.

SWMU 46-003(c) TA-46-49, -50. SWMU 46-003(c) is a subsurface sanitary system consisting of septic tank TA-46-49, a distribution box (TA-46-50), drain lines, and a drain field. Septic tank TA-46-49 served the bathroom facilities, floor drains, roof drains, sinks, acid sinks, and an acid dry well located in Room B-22 of TA-46-24. TA-46-24 contained offices, a staff machine shop, electrical laboratories (including transformers and capacitors), and chemical laboratories (Roberts and Griggs 1992, 11-180; Roberts and Reading 1992, 11-181) where fuel rods were handled. The precise locations of septic tank TA-46-49 and its associated drain field have not been determined. Engineering drawing ENG-R 1524 shows that this septic tank is currently located beneath an asphalt road outside the TA-46 security fence, southeast of Building TA-46-76.

Engineering drawing ENG-C 34339 indicates that in 1968 septic tank TA-46-49 discharged into the sand filter of SWMU 46-003(f). Septic tank TA-46-49 was abandoned in 1972-73 (Gonzales 1981, 11-088) when the buildings it previously served were connected to a sanitary lagoon (SWMU 46-002). According to Engineering drawing ENG-C 21233, an acid sump drain line, modified in 1958, was connected into this septic system for a period of less than one year, then rerouted to outfall 46-004(f). PCOCs from chemical laboratory waste include organics and metals (including mercury).

It should be noted that Engineering drawing ENG-C 22707 specified a leachate-collection outfall. However, field efforts to locate this outfall have been unsuccessful. Engineering Division personnel are unsure if the outfall was ever installed. Should any activity be required in the drain field associated with SWMU 46-003(c) due to the discovery of contaminants, a concentrated effort to determine the presence or absence of this outfall will be undertaken. Until such time, there is no practical method of assessing any risk associated with the potential outfall.

SWMU 46-003(d): TA-46-53, -54. SWMU 46-003(d) is a subsurface sanitary system consisting of septic tank TA-46-53, distribution box TA-46-54, drain lines, and a drain field. Septic tank TA-46-53 served the bathroom facilities of Building TA-46-31. The precise locations of septic tank TA-46-53 and its associated drain field are unknown. Engineering drawing ENG-R 1521 indicates that this septic tank was located about 30 ft northwest of that building. During the Rover Program, TA-46-31 housed test cells with electrical furnaces for thermal testing of graphite/uranium-235/uranium-238 fuel rods (Roberts and Griggs 1992, 11-180; Roberts and Reading 1992, 11-181). Welding experiments involving thorium were conducted at TA-46-31 (H-Division 1960, 11-106).

Sediment samples from septic tank TA-46-53 were taken in 1973. Results are given in Subsection 5.1.1.2.1, Existing Information on Nature and Extent of Contamination.

Septic tank TA-46-53 was abandoned in 1973 (Gonzales 1981, 11-088) and waste discharged by this system was routed to a sanitary lagoon (SWMU 46-002). PCOCs include organics; metals; thorium; plutonium-238, -239/240; uranium-235, -238; and polychlorinated biphenyls (PCBs).

As with SWMU 46-003(c), Engineering drawing ENG-0 22739 for the septic system associated with SWMU 46-003(d) specified a leachate-collection outfall. Field efforts to locate an outfall associated with SWMU 46-003(d) have been unsuccessful and Engineering Division personnel are uncertain if the outfall was ever installed. Should the discovery of contaminants require any activity in the drain field associated with SWMU 46-003(d), a concentrated effort to determine the presence or absence of this outfall will be undertaken. Until such time, no practical method for the assessment of any risk associated with this potentially extant outfall exists.

SWMU 46-003(e): TA-46-66, -67, -68. SWMU 46-003(e) is a subsurface sanitary system consisting of septic tank TA-46-66, siphon tank TA-46-67, distribution box TA-46-68, and a drain field. Septic tank TA-46-66 served the bathroom facility, shower, water cooler, janitorial sink, and mechanical room floor drain of Building TA-46-58. All other drains in Building TA-46-58 emptied into two dry wells [SWMUs 46-004(d) and 46-004(e)] north of the Building. TA-46-58 contained office space, a laboratory, a machine shop, and an equipment room (Roberts and Griggs 1992, 11-180; Roberts and Reading 1992, 11-181).

The precise locations of septic tank TA-46-66 and its associated drain field are unknown. Engineering drawing ENG-C 26080 indicates that this septic tank and its drain field were located approximately 20 ft east of TA-46-58, outside the TA-46 security fence. A distribution box was found in the bottom of Cañada del Buey near the location of septic system 46-003(e). This distribution box, closely matching the design of septic system 46-003(e), is suspected of being TA-46-68. This component is recommended for NFA in Chapter 6 of this work plan. Septic tank TA-46-66 was abandoned in 1972-1973 (Gonzales 1981, 11-088) when the buildings it previously served were connected to a sanitary lagoon (SWMU 46-002). Any contamination would have been the result of accidental spills, improper disposal of laboratory materials, or undocumented cross connection of industrial waste lines with septic lines. PCOCs include organics and metals from laboratory and equipment room activities.

SWMU 46-003(f): TA-46-94, -95, -97. SWMU 46-003(f) is a sanitary system consisting of septic tank TA-46-94, manhole TA-46-95, distribution box TA-46-97, and a sand field (drain field). Septic tank TA-46-94 served the bathroom facilities of Buildings TA-46-2 and TA-46-88. When TA-46-88 was first built, septic tank TA-46-94 served all floor drains and nonrestroom sinks of that building (McCulla 1992, 11-203). Building TA-46-2, a guard station, (formerly located northeast of its present location) had been connected to the SWMU 46-003(a) septic system. TA-46-2 was moved in the mid-1960s to its present location west of TA-46-24 and connected to septic tank TA-46-94. The septic tank is located approximately 150 ft southeast of Building TA-46-88. Visual observation indicates that the sand field (drain field) and distribution box have been removed. TA-46-88 was the core support test facility for the Rover Program. This facility provided a clean-room temperature- and humidity-controlled environment for the testing and certification of hydrogen vessels (Roberts and Reading 1992, 11-182). Beginning in 1968, in addition to waste discharged from septic tank TA-46-94, septic tanks TA-46-8 and TA-46-49 discharged into the sand filter. The septic system was abandoned in 1972-1973 (Gonzales 1981, 11-088) and waste discharged by this system was routed to a sanitary lagoon (SWMU 46-002). Any contamination would have been the result of accidental spills, improper disposal of laboratory materials, or undocumented cross connection of industrial waste lines with septic lines. PCOCs include organics, metals (including mercury), and radionuclides introduced accidentally or improperly from activities occurring in Buildings TA-46-1, TA-46-2, TA-46-24, TA-46-30, and TA-46-76.

SWMU 46-003(f) has an outfall associated with the sand filter which is discussed in Subsection 5.4.1.1.2 (Outfalls Aggregate).

SWMU 46-003(g): TA-46-230. SWMU 46-003(g) is a subsurface sanitary system consisting of septic tank TA-46-230 and a possible seepage pit (LANL engineering personnel are unsure if the seepage pit, dry well, was actually installed). This septic tank is located approximately 50 ft northeast of the northeast corner of Building TA-46-158. Septic tank TA-46-230 was installed to serve the bathroom facilities, water cooler, floor drains, service sinks, laboratory sinks, eyewash sink, and kitchen sink of Building TA-46-158, built in the early 1980s for laser-induced chemistry experiments, and nearby office transportables, TA-46-171, TA-46-226, and TA-46-251. Soon after construction, the Accelerator Technology (AT) and Chemistry and Laser Sciences (CLS) Divisions occupied TA-46-158 for the development of a free electron laser.

Building TA-46-158 was connected to sanitary lagoons (SWMU 46-005) in 1988. However, septic tank TA-46-230 may still be actively receiving waste from an office transportable, the drain lines of which are too low to transport waste to the lagoons. Even though contamination is extremely unlikely, concerns for undocumented drain line connections and anecdotal information about potential radioactive contamination prohibit proposing NFA. PCOCs include organics, metals, and radionuclides [including radioactive products from the free electron laser operations (Michelotti 1993, 11-235).

SWMU 46-004(c): TA-46-61. SWMU 46-004(c) consists of a dry well (TA-46-61), its associated existing drain line, and an associated historic drain line. This system is located approximately 10 ft north of the high bay of Building TA-46-31. Dry well TA-46-61 received industrial waste from TA-46-31 and is still active. TA-46-31 housed test cells with electrical furnaces for thermal testing of graphite/uranium-235/uranium-238 fuel rods (Roberts and Griggs 1992, 11-180; Roberts and Reading 1992, 11-181).

Metals, organics, PCBs, asbestos, thorium, and uranium resulting from Rover Program activities are PCOCs.

An abandoned industrial waste drain pipe [formerly SWMU 46-004(a)] that served a sink in Building TA-46-31 is considered to be part of this SWMU. During the Rover Program, the sink was moved and the existing drain line was constructed. The pipe associated with the original drain connection extended due north approximately 35 ft beneath Building TA-46-31 and associated asphalt to dry well TA-46-61 [SWMU 46-004(c)]. Engineering drawing ENG-C 38763 indicates that this industrial drain line was to have been removed.

The manhole cover visible north of TA-46-31 is believed to be the access to dry well TA-46-61.

SWMU 46-004(d): TA-46-69. SWMU 46-004(d) consists of a single dry well, TA-46-69, located north of Building TA-46-58. SWMU 46-004(d) is connected in series and lies approximately 3 ft west of another dry well, SWMU 46-004(e). SWMU 46-004(d) receives the overflow from SWMU 46-004(e). Both dry wells serve TA-46-58 and both are still in use. Current Laboratory operating procedures do not permit the disposal of hazardous chemicals into these systems. TA-46-58 contains office space, a laboratory, an equipment room, and formerly included a machine shop. Building records list SWMU 46-004(d) as a dry well for an acid drain. Engineering drawing ENG-C 26092 called for a gravel bottom for TA-46-69 and did not have an outlet into Cañada del Buey. PCOCs are identical to SWMU 46-004(e) below.

These dry wells consist of two buried 3-ft diameter concrete cylinders approximately 4 ft in length. The concrete cylinders are stacked vertically, with a nesting joint. Approximately 4 to 6 in. of each dry well remains above ground and is covered with a metal lid.

SWMU 46-004(e): TA-46-70. SWMU 46-004(e) consists of a single dry well, TA-46-70, located north of Building TA-46-58. SWMU 46-004(e) lies approximately 3 ft east of SWMU 46-004 (d), a second dry well that receives the overflow from SWMU 46-004(e). SWMU 46-004(e) has an inlet pipe near its top, and an outlet pipe leading to SWMU 46-004(d). See SWMU 46-004(d) for a description of TA-46-58 activities. This area was included in Environmental Problem #24 (LANL 1989, 0425). Analytical data from this study are discussed in Subsection 5.1.1.2.1. PCOCs include volatiles; semivolatiles; PCBs; metals; mercury; uranium-235, -238; plutonium-238, -239, -240; and thorium-230.

SWMU 46-004(p). SWMU 46-004(p) is approximately 2 x 2 x 10 ft deep dry well lined with corrugated metal pipe, located at the southwest corner of Building TA-46-1. The dry well was constructed for the disposal of alkali-metal waste, but was used for the disposal of a variety of chemical wastes. This dry well served TA-46-1, which was constructed in 1954. TA-46-1 housed offices, two assembly bays, a staff machine shop, a few laboratories for electrical assembly and checkout, general laboratories, and a uranium polishing area. All of these functions were connected with the Rover Program.

During the late 1950s and early 1960s cesium-metal waste was generated in TA-46-1, primarily from the operation of a cesium-plasma diode. All of the cesium used in this effort was of a natural stable isotopic mixture. No radioactive cesium-137 was used. Any solid pieces of cesium or other alkali metals were discarded in the alkali-metal pit, SWMU 46-004(p) (Michelotti 1992, 11-177).

5.1.1.2 Conceptual Exposure Model

The conceptual model is presented in Fig. 5-1-3. Site-specific information on potential release sources, chemicals of concern, migration pathways, and potential receptors is presented in Subsections 5.1.1.2.1 (Existing Information on Nature and Extent of Contamination) and 5.1.1.2.2 (Potential Pathways and Exposure Routes).

5.1.1.2.1 Existing Information on Nature and Extent of Contamination

Table 5-1-1 summarizes PCOCs for septic tanks, drain fields, and dry wells at TA-46. Potential release sources for these contaminants are the contents of septic tanks, dry wells, and subsurface soils around and beneath dry wells/septic tanks and drain lines and in drain fields. PCOCs include volatile and semivolatile organics, hazardous metals, and radionuclides.

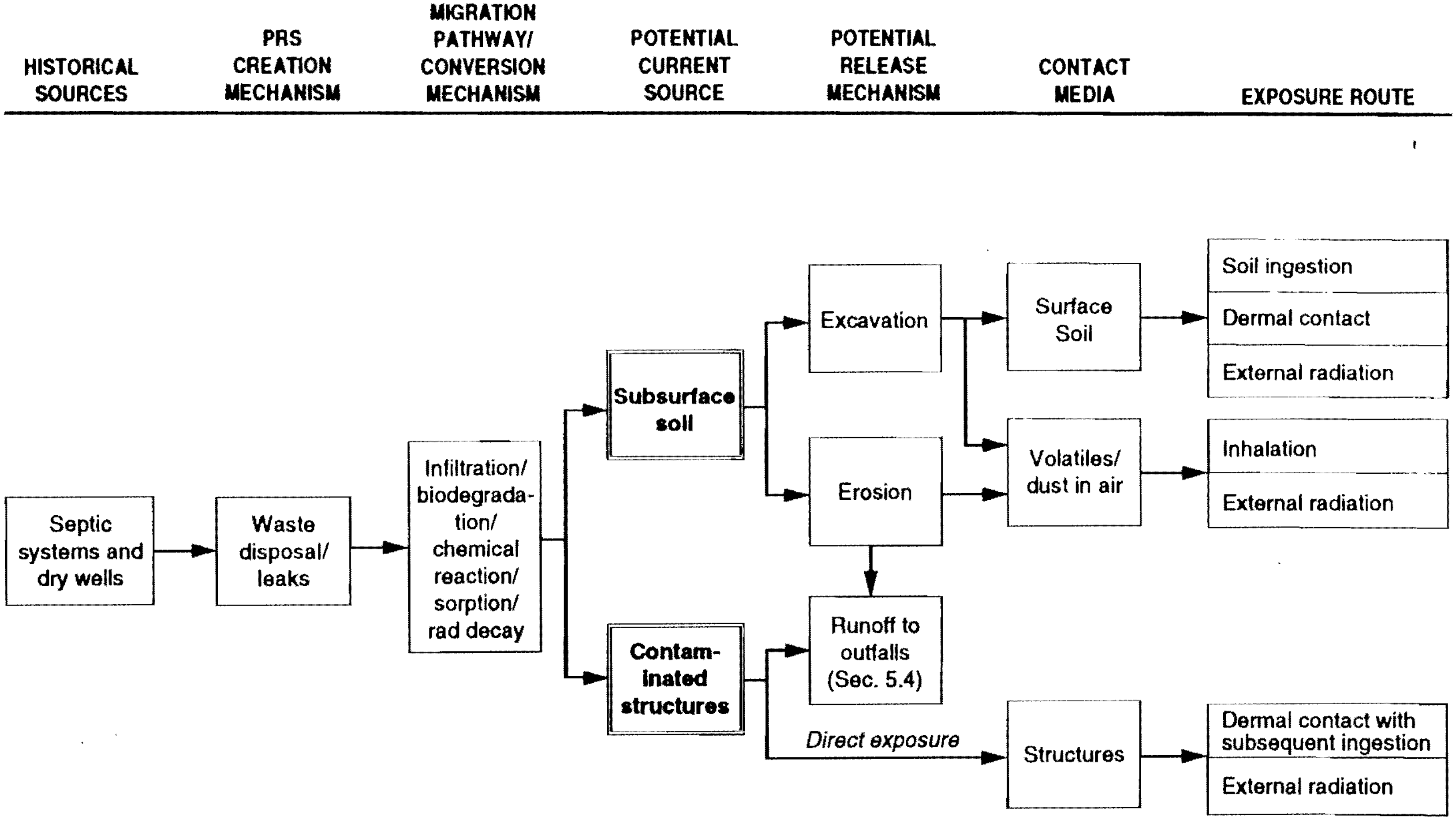


Fig. 5-1-3. Conceptual exposure model for the septic system aggregate at TA-46: Continued Laboratory operations.

Sediment samples taken from septic tank TA-46-53 in 1973 exhibited elevated gross alpha activity of 65 pCi/g. (Schiager 1973, 11-078). Sludge from the septic tank was removed in 1974 (McGinnis 1974, 11-079) and subsequent analyses showed alpha contamination in the sludge and supernatant. No information was given as to possible contamination in the septic drain field. The 1987 Comprehensive Environmental Assessment and Response Program (CEARP) Report mentions that plutonium is a potential problem in septic tank TA-46-53 (DOE 1987, 0264) based on the sampling conducted by McGinnis in 1974 and cited above. However, no historic record documenting any use of plutonium at TA-46 has been found.

A dry well at TA-46-58, SWMU 46-004(e), was part of DOE Environmental Problem #24 (LANL 1989, 0425). Two samples were taken from sludge at the bottom of the dry well. Samples were analyzed for metals, volatile and semivolatile organics, PCBs, and radionuclides. Analytes found above detection levels are summarized in Table 5-1-2.

No data exist for the other PRSs in this aggregate. PCOCs are listed in Table 5-1-1.

5.1.1.2.2 Potential Pathways and Exposure Routes

A summary of exposure mechanisms and human receptors is presented in Table 5-1-3.

Refer to Chapter 4 for a detailed discussion of migration pathways, conversion mechanisms, human receptors, and exposure routes.

5.1.2 Remediation Decisions and Investigation Objectives

A study was performed to compare the costs of removing all or a portion (VCA) of an inactive septic or dry well system with the costs of conducting preliminary screening (ICF Kaiser Engineers 1993, 11-241). This study indicated that it may be less expensive to conduct a VCA of a contaminated system than to fully characterize such a septic system SWMU and then remediate it. Dry wells at TA-46 present similar problems to those of septic systems.

TABLE 5-1-2

CONTAMINATION DETECTED AT SWMU 46-004(e) ENVIRONMENTAL PROBLEM #24[a, b]

CONTAMINANT	CONCENTRATION RANGE [a] (mg/kg)	LOCAL SOIL BACKGROUND (mg/kg)	SOIL SALs (mg/kg)
Metals			
Cadmium	15 - 36.6	0.03-0.52 [c]	80[d]
Chromium	42.8 - 54.5	4.2 - 136[c]	400 (VI)[d]
Copper	2 450 - 2 520	2-18[c]	3 000[d]
Lead	1 730 - 1 930	8-98[c]	500[e]
Mercury	27.7 - 56.7	.007 - .029[c]	24[d]
Silver	120 - 198	<1.6[f]	400[d]
Uranium (total)	11 - 26	1.5-6.7[f]	240[g, d]
Zinc	760 - 1 160	38-71[f]	24 000[d]
Organic Compounds			
Tetrachloroethylene (PCE)	nd[h] - 0.036	0	5.9[d]
Toluene	nd - 0.180	0	890[d]
Fluoranthene	9.6 - 49	0	3 200[d]
Aroclors (PCB)	9.2 - 37	0	0.09[i]
Radionuclides	**(pCi/g)**	**(pCi/g)**	**(pCi/g)**
Cesium-137	0.040 - 0.058[j]	nd - 1.4[k]	4 [l]
Thorium-230	1.1 - 2.1		10 [l]
Uranium-235	0.84 - 0.97[j]		18 [l]
Plutonium-238	nd - 0.015	nd - 0.01[k]	27 [l]
Plutonium-239, -240	nd - 0.536	nd - 0.052[k]	24 [l]

[a] LANL 1989, 0425.

[b] Because of data quality concerns, the Environmental Problem data presented in this table are used only to help identify PCOCs, never as a basis for NFA recommendations.

[c] Ferenbaugh et al. 1990, 0099.

[d] Appendix J of the IWP (LANL 1992, 0768).

[e] EPA 1989, 11-243.

[f] Duffy and Longmire 1993, 11-239.

[g] SAL for chemical toxicity only. Radiological SALs presented in radionuclide section.

[h] nd - not detected.

[i] EPA 1990, 0432.

[j] Field measurements conducted on soil samples at field moisture content (i.e., wet). No laboratory analysis performed.

[k] Purtymun et al. 1987, 0211.

[l] Radionuclide SALs calculated using residual radioactivity (RESRAD) assuming a 10 mrem/yr exposure limit (Assessments Technical Teams 1993, 11-244).

TABLE 5-1-3

EXPOSURE MECHANISMS AND RECEPTORS FOR SEPTIC SYSTEMS AND DRY WELLS AGGREGATE

POTENTIAL AREA OF CONTAMINATION	RELEASE MECHANISMS	CURRENT POTENTIAL RECEPTORS	FUTURE POTENTIAL RECEPTORS
Subsurface soil	Excavation or erosion resulting in wind dispersion, surface water runoff, and infiltration	None	Construction workers and on-site workers
Structures (i.e., septic tanks)	Excavation or erosion exposing structures	None	Construction workers and on-site workers
Sludge inside septic tanks	Leaching to surrounding subsurface soils	None	Construction workers and on-site workers

It is recommended that septic system or dry well VCA removal not begin until the proposed mixed waste facility becomes operational. The rationale for waiting until the mixed waste facility is operational is based on the following:

1. It is possible that some septic systems or dry wells may contain mixed waste; therefore, the Laboratory does not want to conduct VCA removals until the mixed waste facility is available.

2. Although liquid-phase contaminant transport is a potential exposure pathway, this route does not preclude VCA deferral, because PRSs recommended for VCA are all inactive or will be decommissioned under currently planned projects. Once discharge to a system is eliminated, migration of contaminants will no longer be driven by positive head sources, and can be expected to slow drastically.

3. Another potential contaminant exposure pathway is excavation or erosion of subsurface soil. Excavation is the only pathway that exists. Because the Environmental Restoration (ER) Program reviews all excavation permits, the near-term potential for exposure by way of inadvertent excavation is small.

Problem Statement (DQO Step 1). Before construction of a centralized waste water treatment plant, liquid wastes from various laboratory facilities were frequently treated on site in septic systems and dry wells. Typically, a septic system may have serviced bathroom facilities, laboratory sink drains, and laboratory floor drains. Dry wells historically received chemical waste from laboratory operations. Historical records often are insufficient for determining if site activities or practices would have released hazardous and/or radionuclide wastes into a septic system. While most of these septic systems are not believed to present a risk to site excavation workers or to the public, it is clear that some data will be required to give site decision-makers confidence that NFA or some action-oriented decision is appropriate. To establish a basis for problem resolution, two system alternatives and supporting assumptions are presented below for OU 1140 septic systems.

Alternative I. VCA removal of a septic system or dry well is proposed when existing data or site operational information suggest that a system is sufficiently contaminated to warrant corrective action, yet transport of contaminants is believed to be limited to a finite and easily estimated area.

The VCA alternative assumes that:

1. Adequate knowledge about the system is already available to make the determination about desirability of system removal.
2. Contaminants have not been widely dispersed in the environment above concentrations of concern or contaminants may have limited migration away from the source but detectable concentrations would remain near the source to reveal a past release (i.e., contaminants would be detectable near the source because they would not have been completely flushed away).
3. The cost of action is less than collecting data to better define the problem.

Alternative II. Preliminary screening of a septic system or dry well is proposed when it is unknown if site operations discharged significant amounts of contaminants to a septic system.

The preliminary screening alternative assumes that:

1. The approach to preliminary screening is developed on a system basis. A septic system includes the septic tank, distribution box, drain line between the tank and box, and drain field.
2. Exposure scenarios of concern for septic systems or dry wells include worker exposure during construction activities (i.e., excavation) and exposure during potential recreational land uses. Of these two scenarios, exposure resulting from construction activities would be greater and is, therefore, used to develop the preliminary screening strategy.
3. Methods for analyzing PCOCs will detect all PCOCs at concentrations of concern [i.e., screening action levels (SALs)].
4. Ground penetrating radar (GPR) and/or electromagnetic induction (EM) will locate septic system components (i.e., septic tank, distribution box, and drain field lines).
5. Bedrock is at least ten feet below grade. (Although depth-to-bedrock is expected to vary from PRS to PRS, we have assumed this nominal value for sampling plan design. Actual sampling procedures will be modified to accommodate actual field conditions.)

Costs are the key determinant to each of these alternatives and for dealing with system information unknowns. If it is less expensive to remove and dispose of a system rather than to conduct initial sampling and analysis to determine if the system is a problem and of what magnitude, then propose VCA. (See ICF Kaiser Engineers 1993, 11-241).

Decision Process (DQO Step 2). Generic decision approach: the Laboratory's ER Program desires to use the most cost-effective approach for remediating a problem septic system or dry well. If current knowledge is adequate to determine that system contamination is unacceptable and cost estimates indicate that it is less costly to excavate, then take corrective action as soon as practicable. However, if knowledge is so limited that it cannot be determined if system risk is unacceptable, then better definition of the problem may be less costly.

Alternative I. If existing data or site operational information suggest that a septic system or dry well is sufficiently contaminated to warrant corrective action, yet transport of contaminants is believed to be to a limited area, then VCA removal of a septic system will be implemented. The following actions will be recommended based upon confirmatory sampling and analysis of the excavated pit.

1. NFA will be proposed if subsurface contaminant concentrations are determined to be below their SALs or if risks determined by a risk-based limit are determined to be acceptable.
2. Further site study or cleanup will be undertaken if after excavation risks are determined to be unacceptable and further delineation of contaminant of concern (COC) distribution and concentration is necessary.

Alternative II. If it is unknown whether site operations discharged significant amounts of contaminants to a septic system or dry well, then the following screening actions are recommended based upon data from a preliminary system screening:

1. NFA will be proposed if subsurface contaminant concentrations are determined to be below their SALs or if risks determined by a baseline risk assessment are determined to be acceptable;
2. VCA removal will be proposed if a baseline risk assessment determines that site risk potential is unacceptable and further Phase II site investigation is unnecessary to determine contaminant magnitude; or,
3. Phase II investigation will be undertaken if site risks are determined to be unacceptable and further delineation of COC magnitude and extent is necessary.

5.1.3 Data Needs and Data Quality Objectives

Inputs (DQO Step 3). Data needs necessary for supporting decision alternatives I and II are identical. Of particular importance for planning environmental data collections to support decision making (decision alternatives I and II) for septic systems and dry wells is initial specification of PCOCs. Specification of PCOCs is used to ensure that the selection of analytical methods are appropriate to identify PCOCs and to provide data to confirm site COCs, if present.

Concentrations for each site COC will be used to determine if the observed COC concentration is high enough to warrant some remedial action for decision alternative I or to determine if observed values are acceptable for NFA for both decision alternatives. For TA-46 septic systems and dry wells, site activities were varied and involved many metals, radionuclides, volatile organic compounds (VOCs) and semivolatile organic compounds (SVOCs) (see Table 5-1-1). Gross measure of radionuclides (gross alpha, beta, and gamma) will be used to determine if these materials are present above the SAL for the PCOC with highest risk. If the gross radionuclide measure exceeds the SAL for the PCOC with greatest risk, then concentration analyses for specific radionuclides (e.g., uranium or thorium) will be made. While chemicals used at the site were numerous, site operating procedures give no indication that chemicals were disposed of in the septic systems.

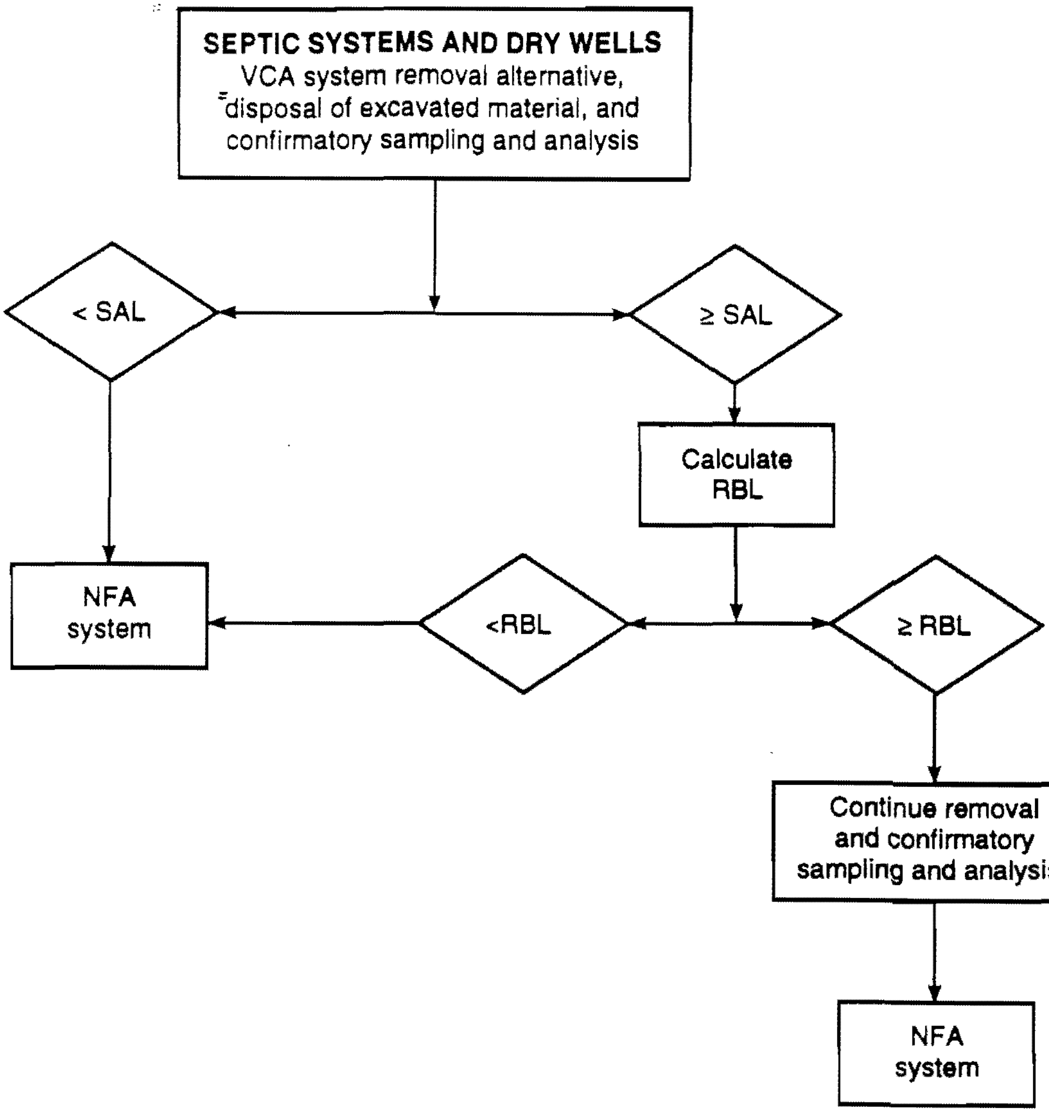
Site engineering plans provide information as to the general location of septic systems and dry wells, but do not provide the detail necessary to locate system components for sampling. Field location of septic system and dry well components shall precede initiation of field sampling procedures.

Boundaries (DQO Step 4). Septic and dry well system spatial boundaries for decision alternative I are defined by excavating volume. The excavation shall extend horizontally one foot beyond the horizontal extent of the system and vertically one foot below the deepest component or to consolidated tuff, whichever is deeper.

Septic system and dry well spatial boundaries for decision alternative II include:

- All septic system components, including the septic tank, distribution box, and drain field.
- Cores will be collected from the surface to a minimum of 5 ft into bedrock. The length of an individual core interval will be 5 ft. If bedrock is encountered at < 5 ft, only two individual core intervals will be necessary to ensure that 5 ft of bedrock is included. If bedrock is encountered at 5 to 10 ft, three 5-ft core intervals will be collected.
- Separate determinations of PCOC concentration will be made for each 5-ft core interval:
    - Field monitors will be used to detect VOCs and to select VOC sample points.
    - Five-foot core intervals will be homogenized prior to sampling for analysis of all other PCOCs in order to create samples indicative of the exposure that construction and on-site workers would be likely to receive (e.g., trenching activity with unsegregated excavated material piled near the trench).
    - Bedrock core samples will be chipped from the surface of the core at 1 ft intervals (5 chip aliquots per core). Chips will be ground and mixed for analysis prior to sub-sampling.

Decision Logic (DQO Step 5). Septic system and dry well decision logic (see Fig. 5-1-4) for decision alternative I is to confirm if contaminant levels remaining in the excavated pit are below some acceptable risk-based limit (RBL). If so, the system is considered to be acceptable and its pit will be backfilled with uncontaminated soil. If the risk-based limit is exceeded by only a small margin, further excavation will occur. If the risk-based limit is determined to be unacceptably exceeded, a Phase II site investigation will be undertaken.



VCA – Voluntary corrective action
NFA – No further action
SAL – Screening action levels for potential contaminants of concern
RBL – Risk-based limit

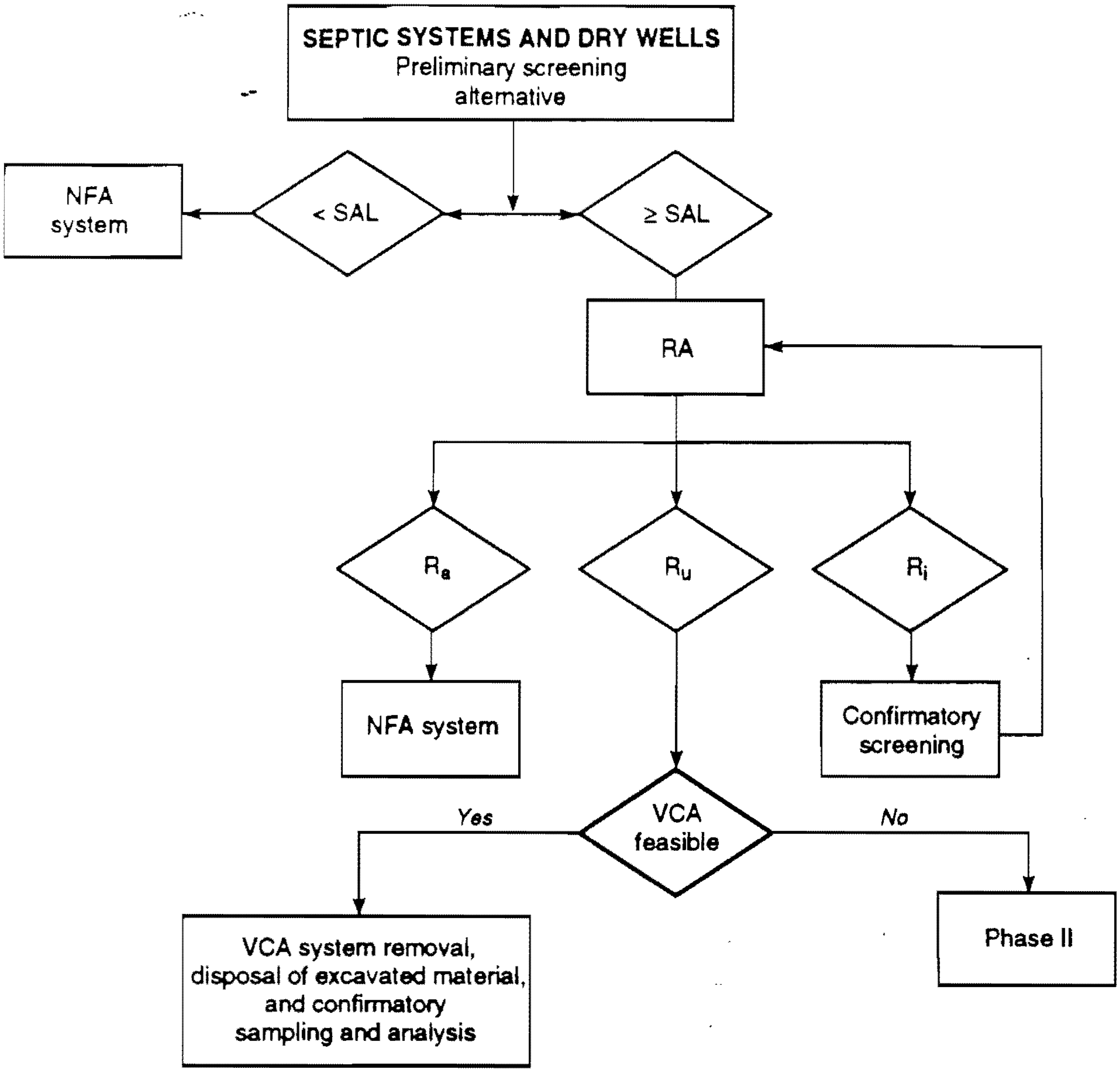
[1] Will not continue removal if bedrock contamination is found; will proceed to Phase II, corrective measures study.

Fig. 5-1-4. Decision logic: Alternative I, VCA removal of septic systems and dry wells.

The decision logic (see Fig. 5-1-5) for decision alternative II (preliminary screening) includes:

- If the concentration of each PCOC in all core samples from each sampling point is not above background, then NFA will be proposed.
- If the concentration of each PCOC in a core sample from each sampling point is below the SAL, then NFA will be proposed.
- If any core concentration exceeds the SAL, then a baseline risk assessment must be performed to determine if a VCA or a Phase II investigation should be implemented.

Design Criteria (DQO Step 6). The design decision rule for decision alternative I is to confirm if remaining contaminant levels in the excavated pit are below some acceptable risk-based limit. Type and number of samples needed for septic systems to determine the adequacy of the VCA removal will be as follows. Soil samples shall be taken (0 to 6 in.) from the bottom of the excavated pit. The following samples shall be taken: two beneath the septic tank, one beneath the distribution box, and one adjacent to the drain line between the septic tank and the distribution box. Two samples shall be taken at the distal end of the drain field. The number of samples at the proximal end of the drain field will be determined by the number of drain lines in the drain field needed to provide a 95% probability of detecting PCOCs from the drain lines if they are present above the SALs. See Table 5-1-4. Type and number of samples needed for dry wells to determine the adequacy of the VCA soil removal will be three surface samples (0 to 6 in.) taken from the bottom of the excavated dry well pits. Excavated materials from septic systems and dry wells will be sampled to determine compliance with RCRA disposal requirements prior to shipment (e.g., if concentrations were above or below land disposal restrictions (LDR) treatment standards).



NFA – No further action
SAL – Screening action levels for potential contaminants of concern
RA – Baseline risk assessment
R_a – Risk acceptable
R_u – Risk unacceptable
R_i – Risk indeterminate
VCA – Voluntary corrective action

Fig. 5-1-5. Decision logic: Alternative II, Preliminary screening of septic systems and dry wells.

TABLE 5-1-4

NUMBER OF BOREHOLES NEEDED TO ATTAIN DESIRED CERTAINTY FOR DETECTING PCOCs IN DRAIN FIELDS*

OUPL's DESIRED CERTAINTY OF DETECTING PCOCs	NUMBER OF DRAIN FIELD LINES*					
	2	3	4	5	6	7-10
≥90%	2	3	3	3	3	3
≥95%	2	3	3	3	3	4
≥99%	2	3	3	3	4	5

* The certainty (or probability) of detecting PCOCs was calculated based on the following rationale: an 8-line drain field could have 4 blocked lines and 4 lines with detectable PCOC concentrations. Therefore, if 3 boreholes are drilled, the probability of drilling boreholes at 3 lines and missing PCOCs at all 3 locations can be computed. This probability is the product of drilling in a clean area on the first attempt (4/8), again on the second attempt (3/7), and again on the third attempt (2/6), which equals 0.0714. If the probability of not detecting PCOCs is 0.0714 or 7%, the probability of detecting PCOCs is 0.9286 or 93%.

Samples for decision alternative II will be collected from three distinct locations of the septic systems for the following reasons:

1. SEPTIC TANK. The septic tank was designed to retain heavy solids present in the waste stream. Some solid-phase PCOCs would therefore have been retained in septic tank sludge, and samples should be collected in the septic tank. However, because sludge was regularly removed from septic tanks and because the tanks may have been backfilled at abandonment, PCOCs may no longer be present in the tank and additional samples should be collected in other parts of the system. Because PCOCs may have penetrated the concrete septic tank, a single borehole will be drilled completely through the tank. (If septic tanks were backfilled at the time of abandonment, boring through the bottom of the tank will not create a new migration pathway. If, during sampling, any tanks are discovered not to have been backfilled, sampling procedures will be modified to avoid creating a new pathway.)

2. DISTRIBUTION BOX. Unlike septic tanks, distribution boxes were neither regularly pumped nor backfilled at abandonment. It is therefore likely that some sludge remnants remain in the

distribution box, and samples should be collected there. Because PCOCs may have penetrated the concrete distribution box, a single borehole will be drilled completely through the box. Because the distribution box is associated with the drain field, which was designed to leak, concerns about a new pathway are unimportant.

3. DRAIN FIELD. The drain fields were designed to be the ultimate discharge point for liquids from the septic system. Therefore, if liquid PCOCs were in the waste stream, they should have reached the drain field and samples should be collected there. Within each drain field, samples will be collected adjacent to the proximal end of the drain lines (nearest the distribution box) because if the waste flow rate was low, or if drain lines were blocked, highest PCOC concentrations would occur there. If, on the other hand, waste flow rates were high and drain lines were not blocked, PCOCs would be distributed throughout the drain field. Either way, sampling at the proximal ends of drain lines will detect PCOCs if present in the drain field. The number of boreholes to be drilled in drain fields will depend on the number of drain lines in the drain field as shown in Table 5-1-4. For septic systems with more than one distribution box and drain field, the number of boreholes will be determined using the total number of drain lines (with a minimum of two boreholes per drain field), disregarding the additional distribution boxes.

See Fig. 5-1-6 for locations of sampling points in a generic septic system. For dry wells three boreholes will be drilled: one through the center of the dry well, one adjacent to the influent line, and one opposite the influent line. Refer to Table 5-1-5 for a summary of septic system and dry well data quality objectives (DQOs).

5.1.4 Phase I Sampling and Analysis Plan

Phase I reconnaissance sampling at TA-46 will focus on determining presence and concentration of PCOCs above SALs. Phase I VCA sampling will focus on determining if PCOCs are present in excess of an acceptable risk-based limit. Potential septic system and dry well contaminants include

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TABLE 5-1-5

DATA QUALITY OBJECTIVE SUMMARY: SEPTIC SYSTEMS AND DRY WELLS

DQO STEP	RATIONALE
1. Problem Statement	
Alternative I (VCA)	• Adequate knowledge about system contamination is available to determine need for system removal
Alternative II (preliminary screening)	• Adequate knowledge about system contamination is unavailable to determine need for system removal
2. Phase I Decisions	
VCA	• Assumes system unacceptably contaminated • System removal with cleanup confirmation; compare to SALs with background removed
Preliminary screening	• Reconnaissance screening • Compare to SALs with background removed
3. Inputs	
Same inputs for VCA and preliminary screening	• Concentration of PCOCs in surface/subsurface soil • Septic system and dry well locations • Analytical methods sensitivity adequate for SALs
4. Boundaries	
VCA	• Excavation of the system and 1 ft of surrounding soil/bedrock • All system components (including septic system drain field and dry well gravel)
Preliminary screening	• Boreholes from surface to below bedrock (include 5 ft of bedrock) • Field screening to select VOC sample locations • Each 5 ft core interval of a borehole will be homogenized to represent a sample for analysis
5. Decision Logic	
VCA	• Excavate septic system and confirm if remaining contaminants are less than acceptable risk-based limit
Preliminary screening	• Compare maximum sample concentration to SAL. If less than SAL, propose NFA. If greater than SAL, compute baseline risk assessment and consider alternative actions
6. Design Criteria	
VCA	• For most septic systems, 8 surface soil samples and for dry wells 3 surface soil samples are collected from the excavation pit to calculate if risk is acceptable • Excavated materials are sampled to determine disposal requirements
Preliminary screening	• 4 to 7 boreholes are drilled in each septic system (one through the septic tank, 1 through the distribution box, and 2 to 5 in the drain field) • 3 boreholes are drilled for each dry well (one through the dry well, one at the inlet line, one opposite the inlet) • Typical decision certainty of finding PCOC problem greater than 95%

metals (mercury, beryllium, lead, silver, and cadmium), radionuclides (uranium and thorium), VOCs [trichloroethylene (TCE) and trichloroethane (TCA)], and SVOCs [polycyclic aromatic hydrocarbons (PAHs) and PCBs]. Refer to Appendixes D (Field Investigation Approach and Methods), E (Sample Data Base Summary), and H (OU 1140 Maps) for additional OU 1140 field sampling information.

Engineering Surveys. Engineering surveys will be performed to precisely locate surface structures and to approximately locate subsurface structures. Engineering surveys will also locate all sample collection locations (Table 5-1-6).

TABLE 5-1-6

ENGINEERING SURVEYS AT SEPTIC SYSTEMS AND DRY WELLS AGGREGATE

SURVEYS	REFERENCE
Geodetic mapping	Appendix D
Surface geophysics	Appendix D

Geophysical surveys will be performed to locate subsurface components of TA-46 septic systems. Various geophysical methods are available to locate subsurface septic system components. The Laboratory's ER Program technical team with expertise in these techniques will be consulted for the most appropriate method(s). Currently, the use of EM and GPR surveys are tentatively planned to locate septic systems at TA-46.

Field Screening. Phase I investigation will be initiated with a radiation field survey of the septic system and dry wells aggregate. Radiation survey and organic vapor screening will be performed according to methods found in Laboratory Standard Operating Procedures (SOPs), which are in preparation.

Appropriate health and safety precautions will be undertaken according to the Laboratory's ER Program SOPs (LANL 1993, 0875). Any accessible residual sludge, sediments, or water contained in septic tanks or other subsurface structures (e.g., distribution box, manhole, etc.) will be field screened for radioactivity.

Sample Control. All samples will be field screened for radioactivity, metals, and organic vapors to identify gross concentrations of contaminants using methods found in the Laboratory's SOPs, which are in preparation.

All samples will be initially analyzed in the field analytical laboratory. Gamma spectrometry will be used to quantify radionuclides present in surface soil samples. X-ray fluorescence will be used to detect gross concentrations of metals. Results of the field laboratory analysis will guide selection of samples (including both positive and negative findings) to be submitted for analytical laboratory analysis. All analytical laboratory samples will be analyzed for all PCOCs (hazardous and radioactive). Field quality assessment samples will be collected according to guidance provided in the latest revision of the Installation Work Plan (IWP) (LANL 1992, 0768). Any duplicate samples planned for collection are listed in Appendix E along with a complete listing of sample and analysis information. See Appendix D, Subsection 2.8 of this work plan for a discussion of quality control duplicate samples. See Table 5-1-7 for a complete list of sample and analysis information.

Sample control activities in the field will be performed according to LANL-ER-SOPs 01.01 to 01.06.

5.1.4.1 Sampling

Sampling Rationale. Two distinct corrective action alternatives have been developed for the TA-46 septic system and dry wells aggregate (Table 5-1-8). The first consists of preliminary screening with field surveys, sample collection, and laboratory analysis of samples. Drain lines connecting septic system components will not be sampled as a portion of this preliminary screening alternative. Rationale for no specific Phase I investigation of drain lines is that the most probable contamination areas are the tank, distribution box, and drain field. Positive contamination in any of these three components will result in a Phase II investigation that would also require sampling of drain lines.

The second corrective action is the VCA removal of a septic system. The VCA alternative consists of excavation and removal of all septic system components (tank, box, drain line, and drain field) and surrounding soil.

Table 5-1-7

Summary of OU 1140 TA-46 Septic Systems and Dry Wells Site Surveys, Sampling and Analysis

Structure Sample Total 59
Surface Sample Total 17
Subsurface Sample Total 45

					Field Surveys			Samples				Field Screening						Field Lab.						Laboratory Analyses																
	PRS	Outfall Field ID	PRS Type Outfall Type	Phase 1 Approach	Land Survey	Geophysics	Radiation	Sampled Media	Structure	Surface	Subsurface	Gross Alpha	Gross Gamma/Beta	Organic Vapor	Combustible gas/oxygen	X-Ray Fluorescence	Lithologic Logging	Gross Alpha	Tritium	Soil Moisture	Gamma Spectroscopy	PCB	VOA	Gamma Spectroscopy	Isotopic Americium	Total Uranium	Isotopic Uranium	Isotopic Plutonium	Isotopic Thorium	Isotopic Cesium	VOA (SW 8240)	Semivolatiles (SW 8270)	TCLP	Metals (SW 6010)	PCB (SW 8080)	Asbestos	Mercury	Herbicides	Pesticides	Aggregate
(1)	46-003-a		Septic Sys./Tank	Reconn	1	1	1	Sludge/Tuff	3	0	0	1	1	1		1	1	1		1	1	1	1	1			1		1		1	1		1	1		1			5.1
(2)	46-003-a		Septic Sys./Manhole	Reconn	1	1	1	Sludge/	2	0	0	1	1	1		1		1			1	1	1	1			1		1		1	1		1	1		1			5.1
(3)	46-003-a		Septic Sys./Dist. Box	Reconn	1	1	1	Sludge/Tuff	3	0	0	1	1	1		1	1	1		1	1	1	1	1			1		1		1	1		1	1		1			5.1
(4)	46-003-a		Septic Sys./Dist. Box	Reconn	1	1	1	Sludge/Tuff	3	0	0	1	1	1		1	1	1		1	1	1	1	1			1		1		1	1		1	1		1			5.1
(5)	46-003-a		Septic Drain field	Reconn	1	1	1	Soil/Tuff	0	0	12	1	1	1		1	1	1		1	1	1	1	1			1		1		1	1		1	1		1			5.1
(6)	46-003-b		Septic Sys./Tank	Reconn	1	1	1	Sludge/Tuff	3	0	0	1	1	1		1	1			1			1								1	1								5.1
(7)	46-003-b		Septic Sys./Dist. Box	Reconn	1	1	1	Sludge/Tuff	3	0	0	1	1	1		1	1			1			1								1	1								5.1
(8)	46-003-b		Septic Drain field	Reconn	1	1	1	Soil/Tuff	0	0	6	1	1	1		1	1			1			1								1	1								5.1
(9)	46-003-c		Septic Sys./Dist. Box	Reconn	1	1	1	Sludge/Tuff	3	0	0	1	1	1		1	1	1		1	1	1	1	1			1				1	1		1	1		1			5.1
(10)	46-003-c		Septic Sys./Tank	Reconn	1	1	1	Sludge/Tuff	3	0	0	1	1	1		1	1	1		1	1	1	1	1			1				1	1		1	1		1			5.1
(11)	46-003-c		Septic Drain field	Reconn	1	1	1	Soil/Tuff	0	0	9	1	1	1		1	1	1		1	1	1	1	1			1				1	1		1	1		1			5.1
(12)	46-003-c		Dry Well	Reconn	1	1	1	Sludge	1	0	0	1	1	1		1	1	1			1	1	1	1			1				1	1		1	1		1			5.1
(13)	46-003-d		Septic Sys./Tank	VCA	1	1	1	Soil/Tuff	0	4	0	1	1	1		1	1	1			1	1	1	1			1	1	1		1	1		1	1	1				5.1
(14)	46-003-d		Septic Drain field	VCA	1	1	1	Soil/Tuff	0	5	0	1	1	1		1	1	1			1	1	1	1			1	1	1		1	1		1	1	1				5.1
(15)	46-003-e		Septic Siphon Tank	Reconn	1	1	1	Sludge/Tuff	3	0	0	1	1	1		1	1	1		1	1	1	1	1			1	1			1	1		1						5.1
(16)	46-003-e		Septic Sys./Dist. Box	Reconn	1	1	1	Sludge/Tuff	3	0	0	1	1	1		1	1	1		1	1	1	1	1			1	1			1	1		1						5.1
(17)	46-003-e		Septic Sys./Tank	Reconn	1	1	1	Sludge/Tuff	3	0	0	1	1	1		1	1	1		1	1	1	1	1			1	1			1	1		1						5.1
(18)	46-003-e		Septic Drain field	Reconn	1	1	1	Soil/Tuff	0	0	12	1	1	1		1	1	1		1	1	1	1	1			1	1			1	1		1						5.1
(19)	46-003-f		Septic Sys./Tank	Reconn	1	1	1	Sludge/Tuff	3	0	0	1	1	1		1	1	1		1	1	1	1	1			1				1	1		1	1		1			5.1
(20)	46-003-f		Septic Sys./Manhole	Reconn	1	1	1	Sludge/Tuff	3	0	0	1	1	1		1	1	1		1	1	1	1	1			1				1	1		1	1		1			5.1
(21)	46-003-f		Septic Sys./Dist. Box	Reconn	1	1	1	Sludge/Tuff	3	0	0	1	1	1		1	1	1		1	1	1	1	1			1				1	1		1	1		1			5.1
(22)	46-003-f		Sand filter	Reconn	1		1	Soil/Tuff	0	0	6	1	1	1		1	1	1		1	1	1	1	1			1				1	1		1	1		1			5.1
(23)	46-003-g		Septic Sys./Tank	Reconn	1	1	1	Sludge/Tuff	3	0	0	1	1	1		1	1	1		1	1	1	1	1							1	1		1	1					5.1
(24)	46-003-g		Septic Dry Well	Reconn	1	1	1	Sludge/Tuff	6	0	0	1	1	1		1	1	1		1	1	1	1	1							1	1		1	1					5.1
(25)	46-004-c		Dry Well	VCA	1	1	1	Soil/Tuff	0	2	0	1	1	1		1	1	1					1	1			1		1		1	1		1	1	1				5.1
(26)	46-004-c		Dry Well	Reconn	1	1	1	Sediment/	2	0	0	1	1	1		1	1	1			1		1	1			1		1		1	1		1	1					5.1
(27)	46-004-d		Dry Well	Reconn	1	1	1	Sediment/	2	0	0	1	1	1		1	1	1			1		1	1			1	1	1	1	1	1		1	1		1			5.1
(28)	46-004-e		Dry Well	Reconn	1	1	1	Sediment/	2	0	0	1	1	1		1	1	1			1		1	1			1	1	1	1	1	1		1	1		1			5.1
(29)	46-004-p		Dry Well	Reconn	1	1	1	Sediment/	2	0	0	1	1	1		1		1			1		1	1			1				1	1		1	1	1	1			5.1
(30)	46-004-d		Dry Well	VCA	1	1	1	Soil/Tuff	0	2	0	1	1	1		1	1	1					1	1			1				1	1		1						5.1
(31)	46-004-e		Dry Well	VCA	1	1	1	Soil/Tuff	0	2	0	1	1	1		1	1	1					1	1			1	1	1	1	1	1		1	1		1			5.1
(32)	46-004-p		Dry Well	VCA	1	1	1	Soil/Tuff	0	2	0	1	1	1		1	1						1								1	1		1		1				5.1

Table 5-1-7

Summary of OU 1140 TA-46 Septic Systems and Dry Wells Waste Characterization, Sampling and Analysis

Structure Sample Total 80
Surface Sample Total 0
Subsurface Sample Total 0

					Field Surveys			Samples				Field Screening						Field Lab.						Laboratory Analyses																
	PRS	Outfall Field ID	PRS Type Outfall Type	Phase 1 Approach	Land Survey	Geophysics	Radiation	Sampled Media	Structure	Surface	Subsurface	Gross Alpha	Gross Gamma/Beta	Organic Vapor	Combustible gas/oxygen	X-Ray Fluorescence	Lithologic Logging	Gross Alpha	Tritium	Soil Moisture	Gamma Spectroscopy	PCB	VOA	Gamma Spectroscopy	Isotopic Americium	Total Uranium	Isotopic Uranium	Isotopic Plutonium	Isotopic Thorium	Isotopic Cesium	VOA (SW 8240)	Semivolatiles (SW 8270)	TCLP	Metals (SW 6010)	PCB (SW 8080)	Asbestos	Mercury	Herbicides	Pesticides	Aggregate
(1)	46-003-d		Septic System-WC	VCA-WC			1	Soil/Tuff	30	0	0	1	1	1		1								1		1							1							5.1
(2)	46-003-e		Dry Well-WC	VCA-WC			1	Soil/Tuff	10	0	0	1	1	1		1								1		1							1							5.1
(3)	46-004-c		Dry Well-WC	VCA-WC			1	Soil/Tuff	10	0	0	1	1	1		1								1		1							1							5.1
(4)	46-004-d		Dry Well-WC	VCA-WC			1	Soil/Tuff	10	0	0	1	1	1		1								1		1	1	1	1	1			1							5.1
(5)	46-004-e		Dry Well-WC	VCA-WC			1	Soil/Tuff	10	0	0	1	1	1		1								1		1	1	1	1	1			1							5.1
(6)	46-004-p		Dry Well-WC	VCA-WC			1	Soil/Tuff	10	0	0	1	1	1		1								1		1							1							5.1

TABLE 5-1-8

ALTERNATIVES FOR SEPTIC SYSTEM SWMUs

SWMU	CORRECTIVE ACTION ALTERNATIVES
46-003(a)	Preliminary screening
46-003(b)	Preliminary screening
46-003(c)	Preliminary screening
46-003(d)	VCA
46-003(e)	Preliminary screening
46-003(f)	Preliminary screening
46-003(g)	Preliminary screening
46-004(c)	VCA
46-004(d)	VCA
46-004(e)	VCA
46-004(p)	VCA

Samples will be collected from beneath excavated septic system components to confirm that COCs are below SALs or below risk-based cleanup levels (see Fig. 5-1-4).

A separate set of samples will be collected after excavation and removal of septic systems. These waste characterization (WC) samples will be gathered to classify the excavated materials as hazardous, radioactive, or mixed waste. Any hazardous waste will need to be analyzed to demonstrate that the requirements of land disposal restrictions (40 CFR 268) are met. WC samples are not directly related to the establishment of contaminant levels above or below SALs. This fact applies to the remainder of this investigation.

5.1.4.1.1 Septic Tank, Distribution Box, and Dry Well - Preliminary Screening

Sampling of septic tanks, distribution boxes, and dry wells will be performed by the drilling of a vertical borehole into and through the center of the structures. Continuous core will be collected from these boreholes. Samples of residual materials will be collected from any septic tanks or distribution boxes discovered not to have been backfilled. Refer to Figs. 5-1-7 through 5-1-16 for borehole locations.

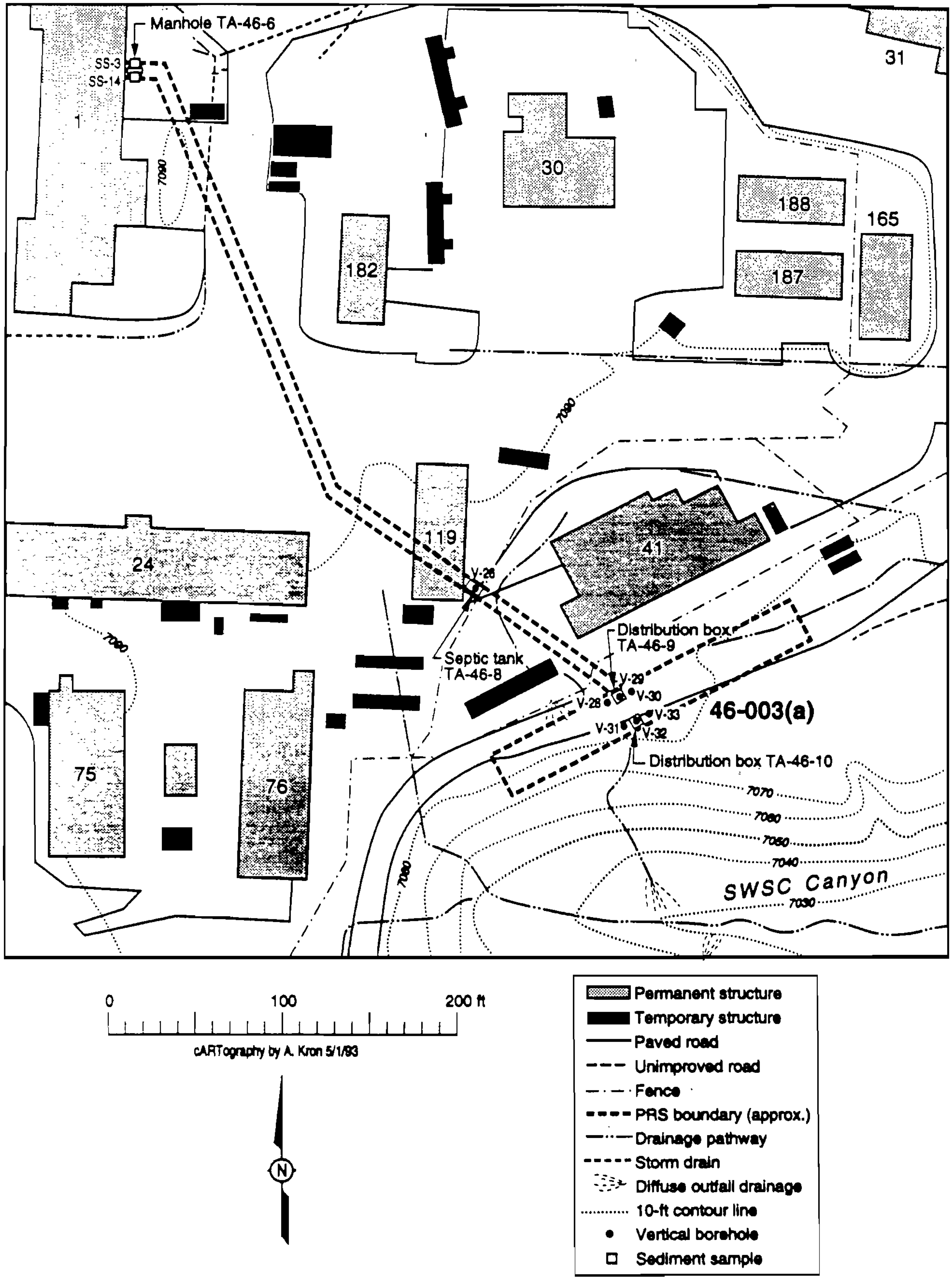


Fig. 5-1-7. Sampling locations at PRS 46-003(a).

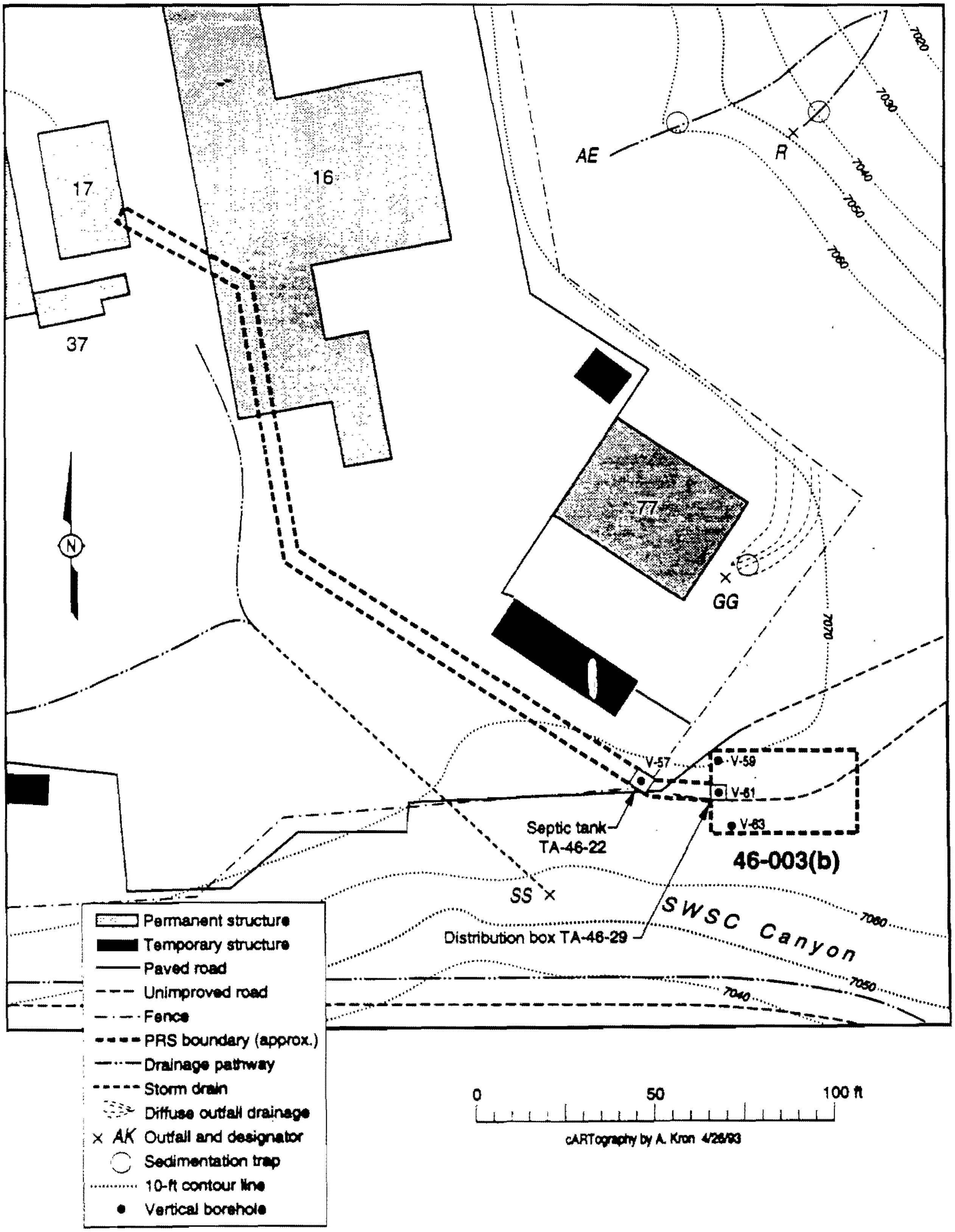


Fig. 5-1-8. Sampling locations at PRS 46-003(b).

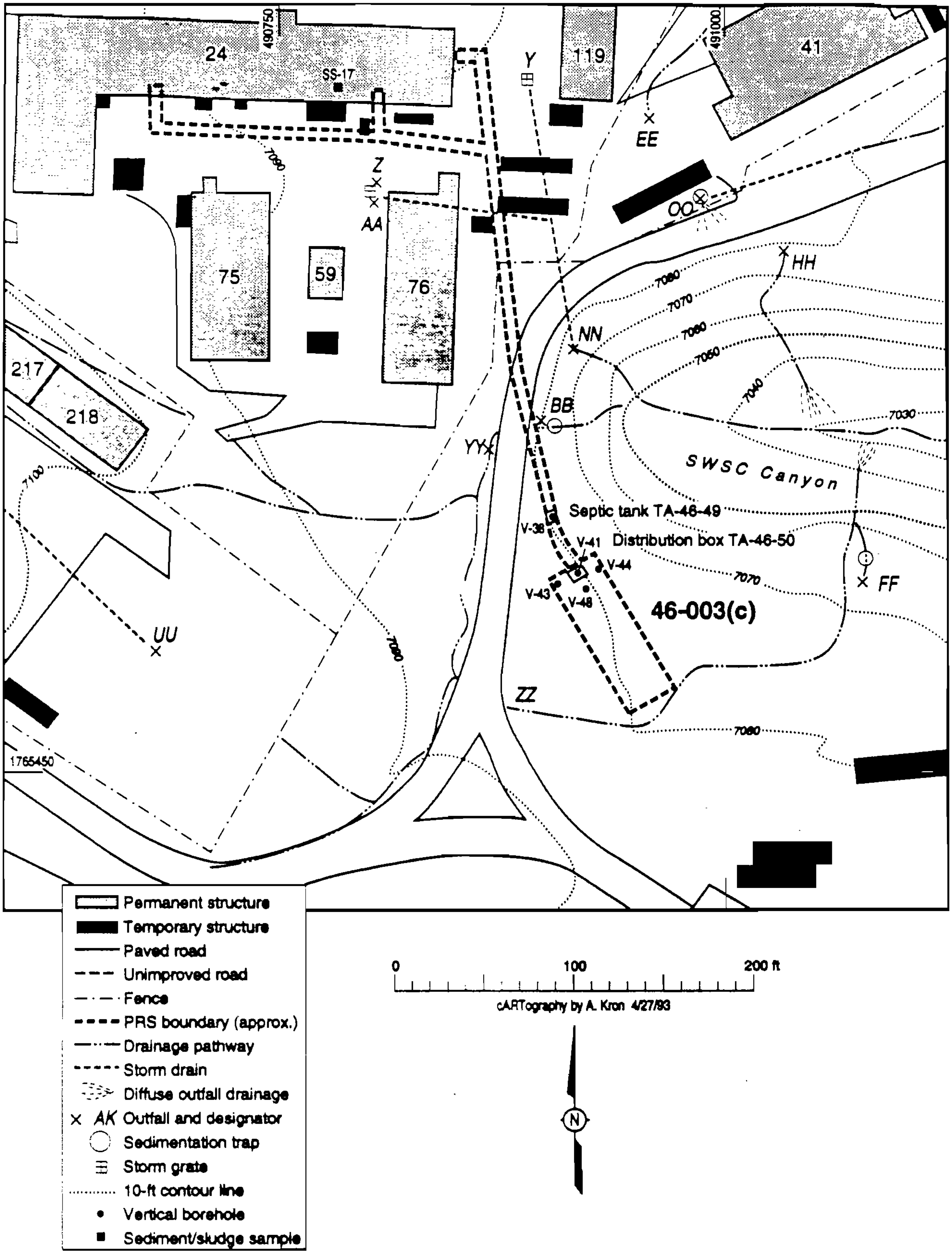


Fig. 5-1-9. Sampling locations at PRS 46-003(c).

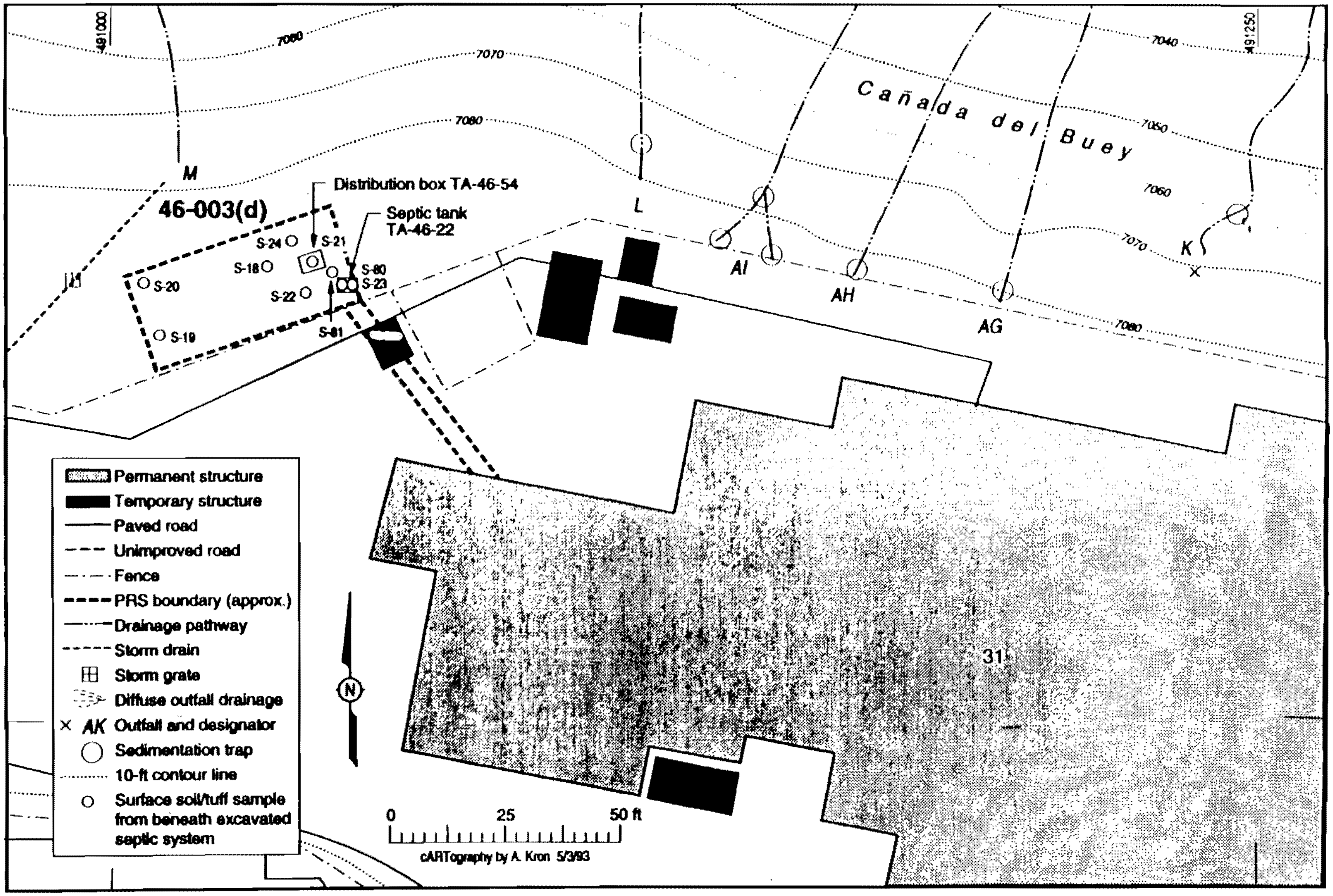


Fig. 5-1-10. **Sampling locations at PRS 46-003(d).**

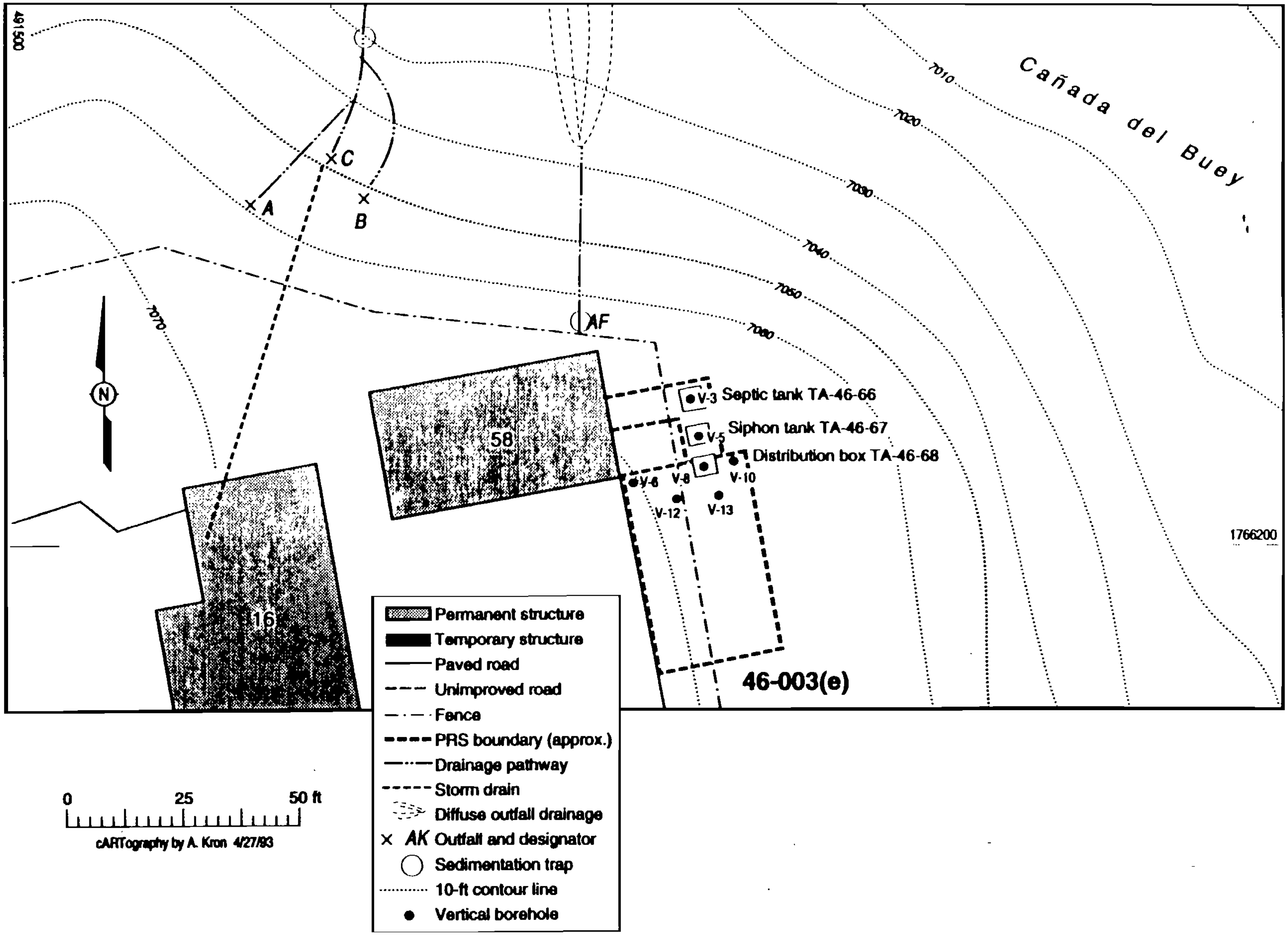


Fig. 5-1-11. Sampling locations at PRS 46-003(e).

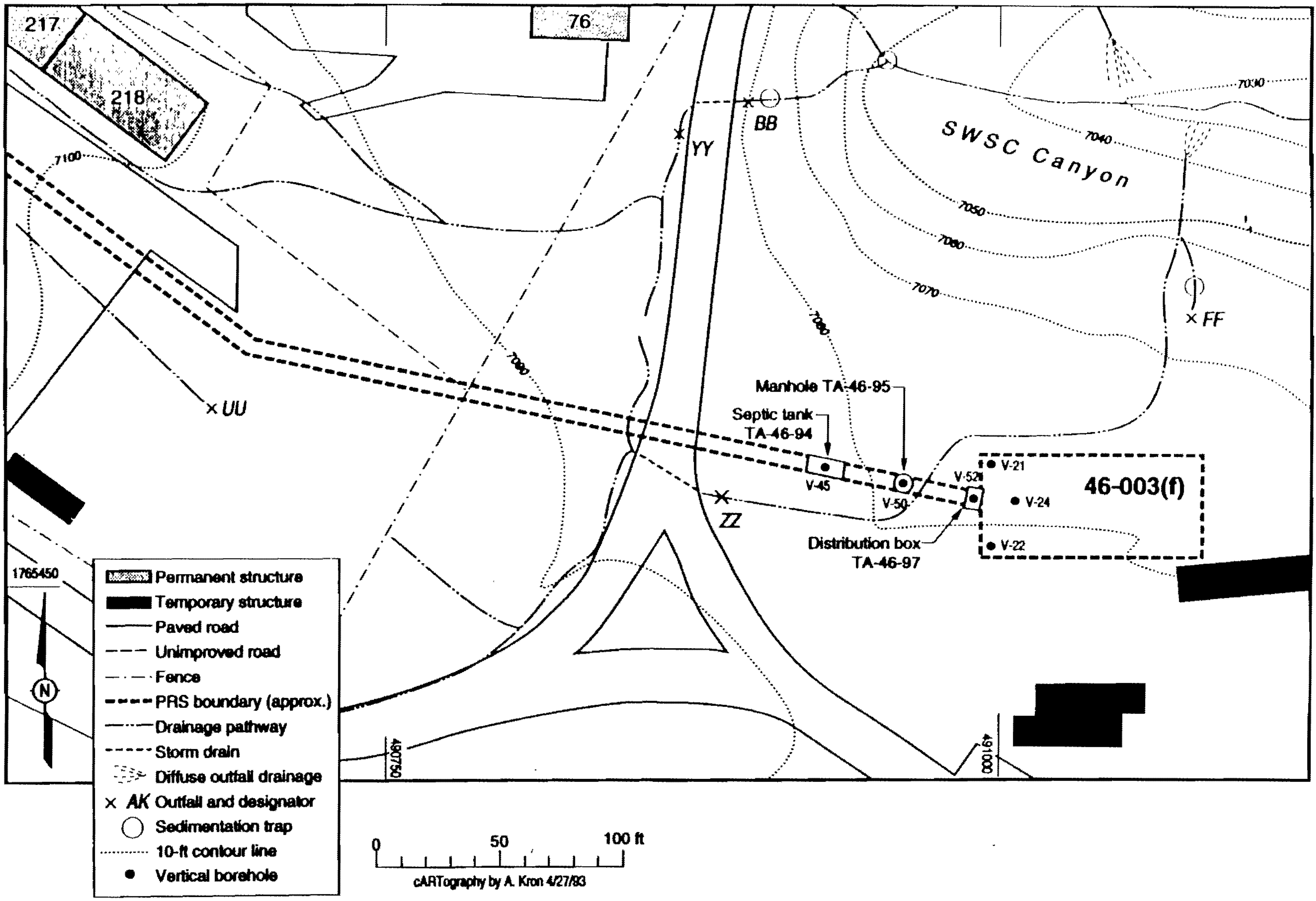


Fig. 5-1-12. **Sampling locations at PRS 46-003(f).**

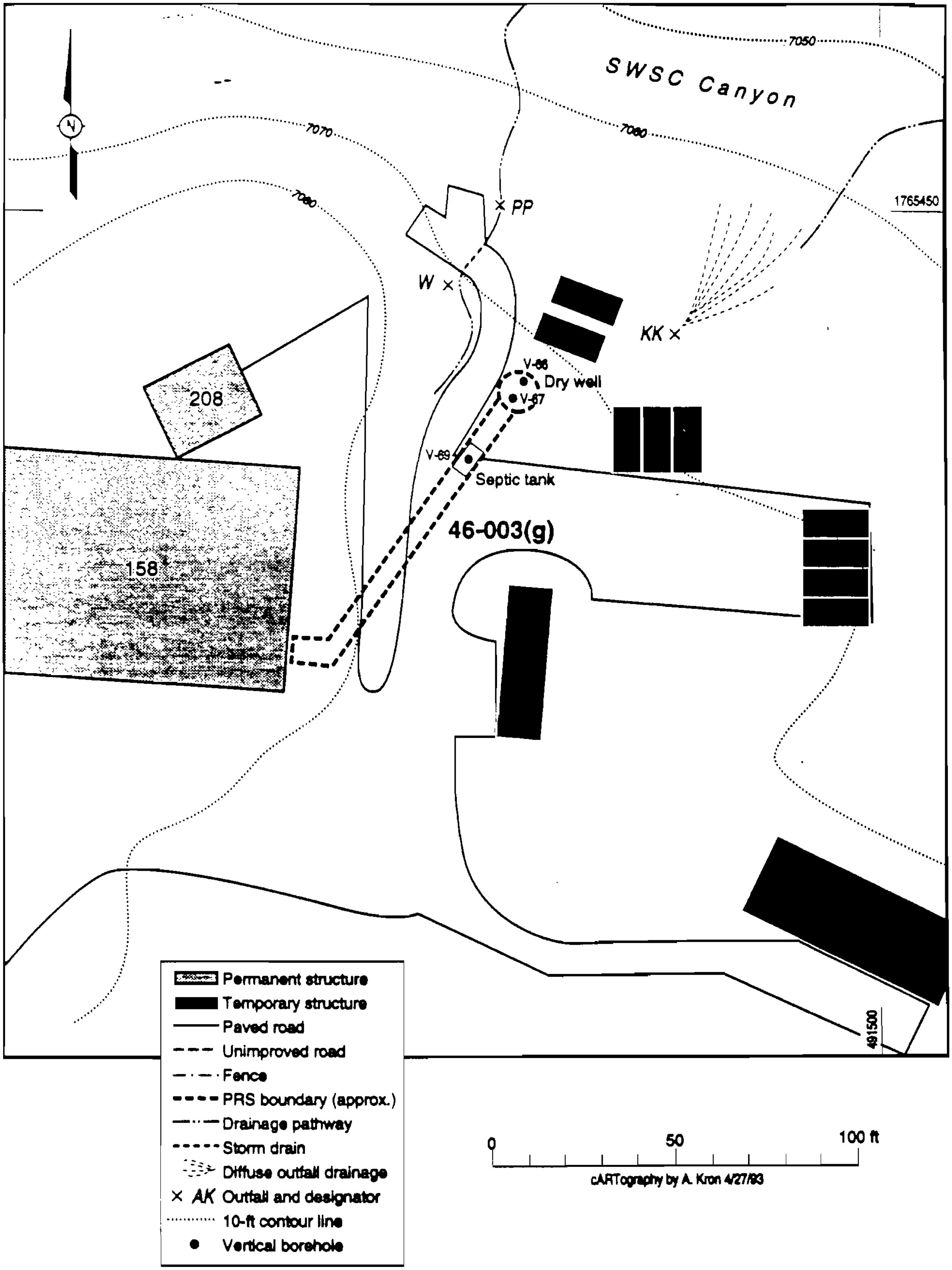


Fig. 5-1-13. Sampling locations at PRS 46-003(g).

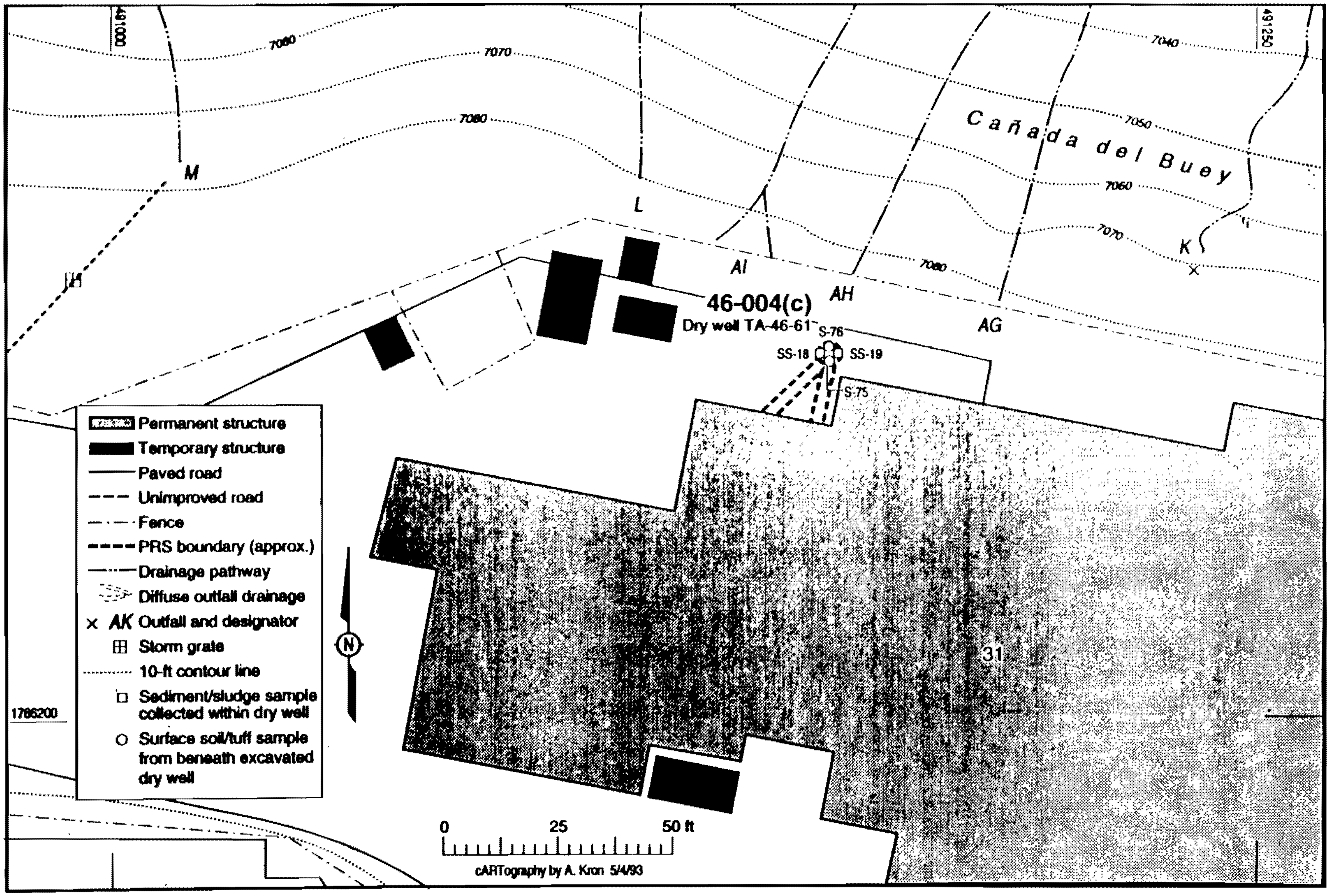


Fig. 5-1-14. Sampling locations at PRS 46-004(c).

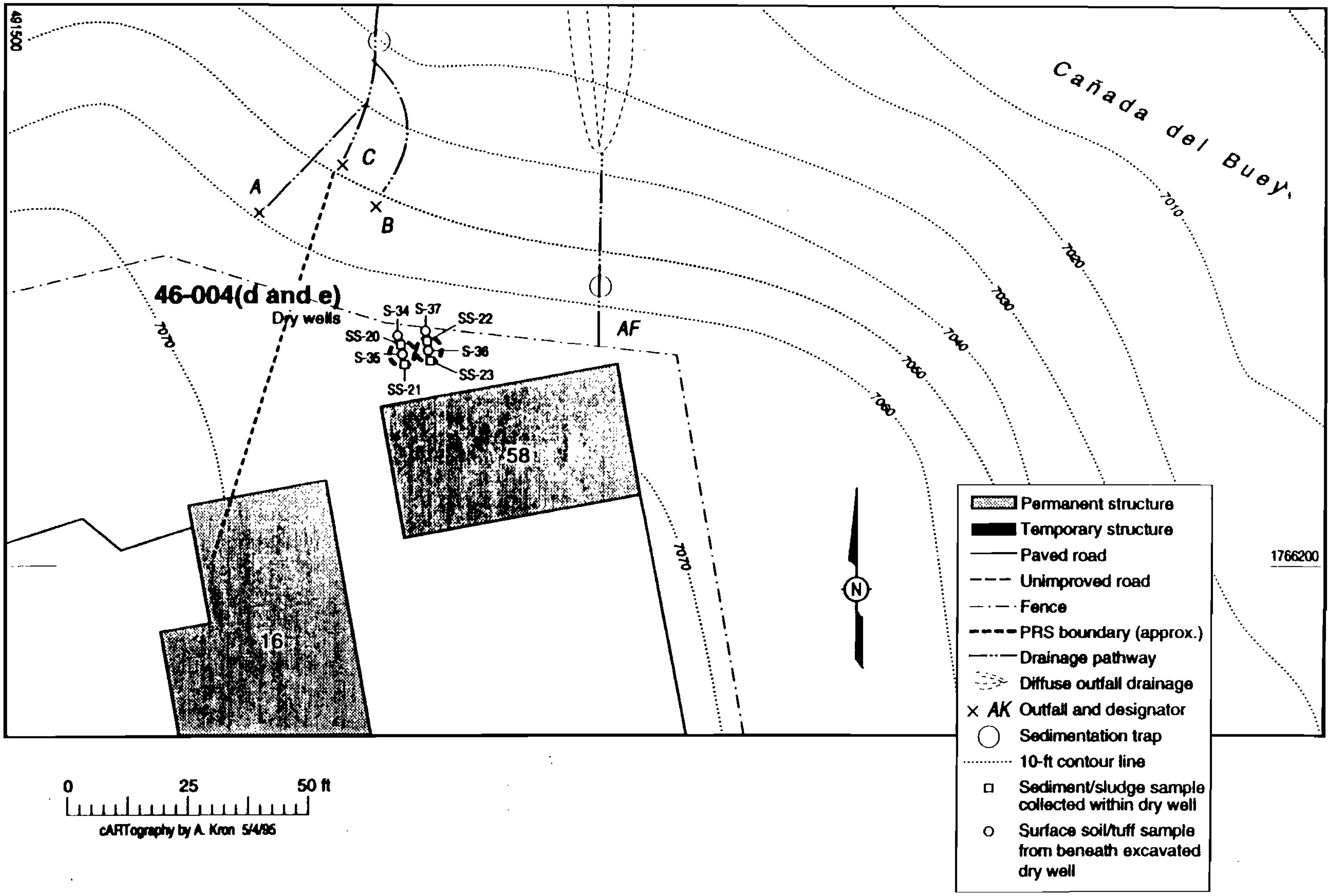


Fig. 5-1-15. Sampling locations at PRS 46-004(d and e).

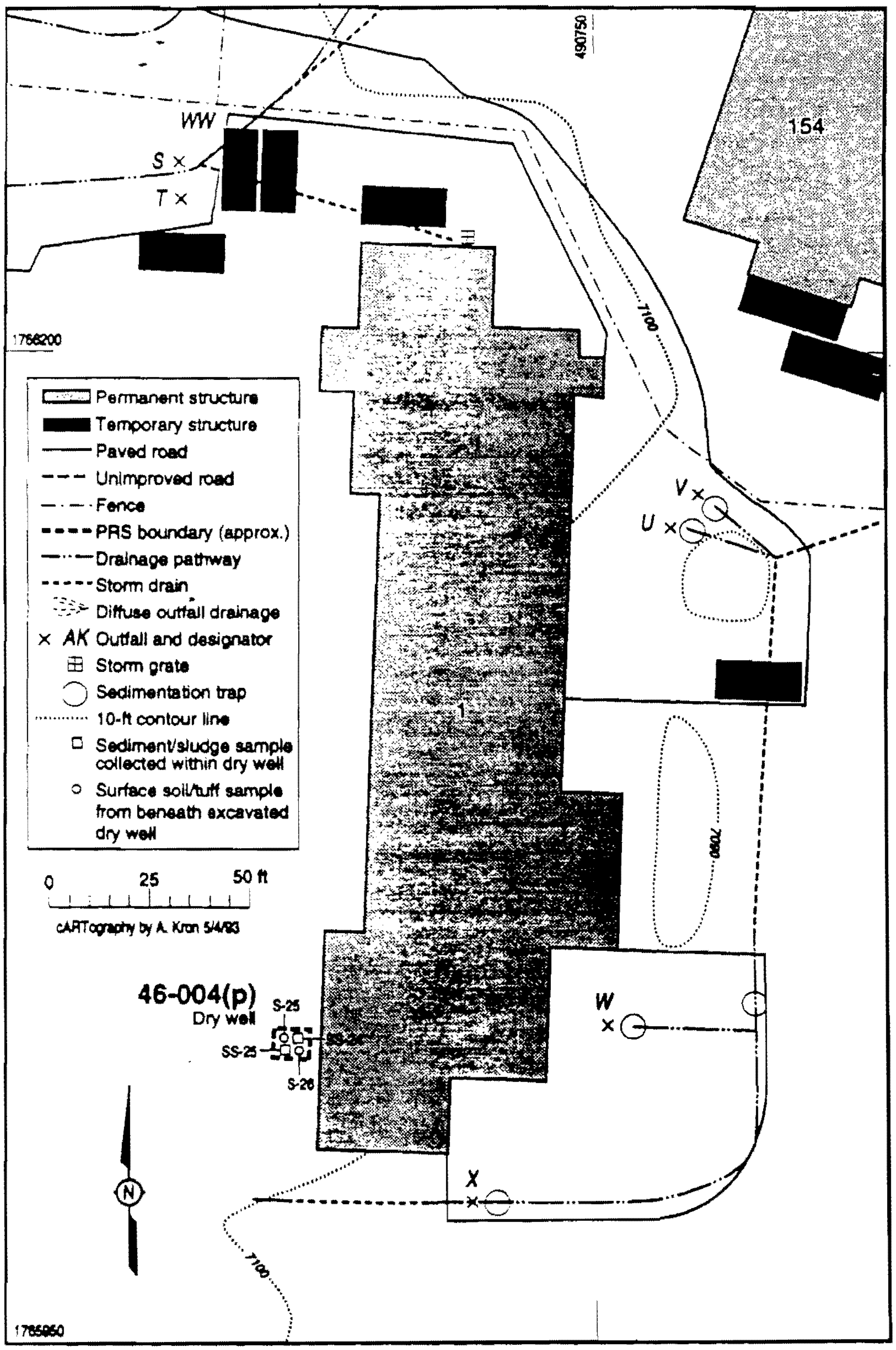


Fig. 5-1-16. Sampling locations at PRS 46-004(p).

Septic tank and dry well specimen selection will consist of the collection of one specimen for VOC per 5-ft core run. The analytical sample for VOC will be 0.2 ft minimum in length. The VOC sample selection will be made with the benefit of organic-vapor field screening instrumentation. In the absence of distinguishing field screening, hydrologic or geologic observations, one specimen will be taken from the midpoint of each 5-ft core.

Analysis for other PCOCs (such as metals, SVOCs, and radionuclides) will be performed on a field homogenized sample created from material removed from each 5-ft core run. Unconsolidated core materials will be combined into a homogenized sample. Homogenized samples from consolidated rock core will be produced by chipping the surface every 12 in. within a 5-ft core. These chips will be mechanically combined to generate a single, homogenized sample that represents the 5-ft interval.

Septic system boreholes will be drilled through the soil layer as well as through the first 5 ft of tuff. In most cases, this will involve a total of approximately 15 ft. If contaminants are present from the septic system, the zone where these contaminants are most likely to be found is below the drain field and above the tuff. Therefore, the following is proposed.

- Field screening (for organic vapors and radiation) both soil and tuff samples. Analysis of the soil samples in the field mobile laboratory (for radiation, PCBs, and VOCs) and in the analytical laboratory (for all PCOCs).

- If any soil contamination is found by field screening or at a concentration above the SAL by field mobile laboratory analysis, analysis of the tuff sample in the field mobile laboratory and in the analytical laboratory.

- If no contamination is found by field screening or at a concentration above the SAL by field mobile laboratory analysis, no field mobile or analytical laboratory analysis of the tuff sample.

- If any contaminant is found in a soil sample at a concentration above its SAL by analytical laboratory analysis (after concentrations are found to be below

SALs by field mobile laboratory analysis), re-sampling the tuff (assuming that the tuff sample holding time has been exceeded) and sample analysis in the field mobile laboratory and in the analytical laboratory.

The approach of not analyzing the tuff sample initially provides an opportunity to control analytical costs (i.e., to avoid analytical costs for up to 15 samples). If re-sampling tuff is necessary because of exceeded holding time, additional costs should not be significant. The re-sampling can be conducted during Phase II investigation (i.e., when field personnel and field equipment are already mobilized).

Boreholes will be drilled with a hollow-stem auger drilling rig and continuous core or equivalent. Core will be recovered in nominal 5-ft runs. Procedural control of drill site activities will be according to LANL-ER-SOP-04.01, R1, Drilling Methods and Drill Site Management. Field logging of core will be controlled by LANL-SOP-12.01, Field Logging, Handling, and Documentation of Borehole Materials.

5.1.4.1.2 Drain Field Sampling - Preliminary Screening

Drain field sampling will consist of drilling two to four vertical boreholes positioned adjacent to the drain lines composing the drain field. Placement of drain field boreholes will generally be inside the drain field at the end nearest the distribution box. Nominal planned depth for boreholes will be approximately 15 ft (through the soil layer and through the first 5 ft of tuff). See Subsection 5.1.4.1.1 above for specifics of coring and specimen collection.

5.1.4.1.3 Sampling After Removal of Septic System or Dry Well - VCA

Site preparation will consist of excavating the overburden above and around each system to locate its boundaries. The system will then be completely excavated.

After full excavation of a system, samples will be collected (0 to 6 in.) beneath the newly-exposed surface. The placement of these sample locations will be guided by the logic used for the placement of vertical boreholes in a septic system that has not been VCA-removed. This use of the DQOs established for non-VCA systems will be modified if the results of field screening indicate elevated reading at other points on the exposed surface. If field screening is negative, then eight samples will be gathered for the typical septic system; two from beneath the septic tank, one from below the distribution box, one adjacent to the drain line between the tank and the box, and four from the area beneath the excavated drain field. Approximately 15 separate samples for waste characterization will be collected from excavated soil associated with septic components.

A typical dry well will have two samples collected for analysis from beneath the excavated well. Approximately 10 separate samples for WC will be collected from excavated soil associated with dry wells.

Non-WC samples will be collected using techniques prescribed in LANL-ER-SOP-06.09, Spade and Scoop Method for Collecting Soil Samples.

All septic system components and excavated materials will remain on site until confirmatory sample analysis results are obtained. Components and excavated materials will be controlled according to LANL-ER-SOP-01.06, Management of RFI-Generated Waste.

If analytical results confirm that PCOCs are below SALs, the septic system will be considered for NFA. However, if SALs are exceeded, investigation of the septic system (or dry well) will proceed to a risk assessment. If risks are determined to be unacceptable, a Phase II investigation will be conducted.

5.1.4.2 SWMU Sampling Summaries

See Table 5-1-9 for a list of boreholes required for septic systems.

SWMU 46-003(a). See Fig. 5-1-7. This septic system is located south of Building TA-46-41. It consists of a septic tank (TA-46-8), two distribution boxes (TA-46-9 and TA-46-10), an active manhole (TA-46-6), and a double-branching drain field with each branch composed of three drain lines. The drain field of SWMU 46-003(a) is located almost entirely within the boundaries of SWMU 46-009(a), an abandoned landfill (see Subsection 5.5).

Sampling at this SWMU will consist of seven cored boreholes: one at the septic tank, one in each of the two distribution boxes, and two in each of the

TABLE 5-1-9

SEPTIC SYSTEM BOREHOLE SUMMARY

SWMU	STRUCTURES	NUMBER OF STRUCTURE BOREHOLES	NUMBER OF DRAIN FIELD PROXIMAL END BOREHOLES	NUMBER OF BOREHOLES IN TOTAL SYSTEM
46-003(a)	1 septic tank	1	4	7
	2 distribution boxes	2		
	1 manhole			
46-003(b)	1 septic tank	1	2	4
	1 distribution box	1		
46-003(c)	1 septic tank	1	3	5
	1 distribution box	1		
46-003(e)	1 septic tank	1	4	7
	1 siphon tank	1		
	1 distribution box	1		
46-003(f)	1 septic tank	1	3	6
	1 manhole	1		
	1 distribution box	1		
46-003(g)	1 septic tank	1	0	3
	1 dry well	2		

two drain field branches. Two sludge samples will be collected from the interior of the active manhole.

SWMU 46-003(b). See Fig. 5-1-8. This septic system is located south east of Building TA-46-17 and includes a septic tank (TA-46-22), a distribution box, and a drain field with two drain lines. Sampling at this septic system will consist of four vertical, cored boreholes; one at the septic tank, one in the distribution box, and two in the drain field.

SWMU 46-003(c). See Fig. 5-1-9. This septic system is located southeast of Building TA-46-76 and includes a septic tank (TA-46-49), a distribution box, and a drain field with four drain lines. One of the drain lines extends to a potential overflow/outfall.

Sampling at this septic system will consist of five vertical, cored boreholes; one at the septic tank, one at the distribution box, and three in the drain field.

Additionally, one sludge sample will be collected from the dry well in Building TA-46-24, Room B30.

SWMU 46-003(d). See Fig. 5-1-10. This septic system is located northwest of Building TA-46-31 and will be removed as a VCA. After the septic tank (TA-46-22), distribution box (TA-46-54), drain field, and connecting drain lines are excavated, a total of nine soil samples will be collected in excavated surfaces beneath the removed components (five beneath the drain field, one beneath the distribution box, two beneath the septic tank, and one adjacent to the drain line connecting the tank to the box). All sample locations will be taken with the benefit of field screening data to locate maximum PCOCs.

If, during excavation, an outfall is discovered (see Subsection 5.1.1.1), it will be sampled according to the DQOs presented in Subsection 5.4.

Thirty samples for WC will be collected from excavated soil.

SWMU 46-003(e). See Fig. 5-1-11. This septic system is located southeast of Building TA-46-58 and includes a septic tank (TA-46-66), a siphon tank (TA-46-67), a distribution box (TA-46-68), and a drain field with eight drain lines.

Sampling at this septic system will consist of seven vertical, cored boreholes; one at the septic tank, one in the siphon tank, one in the distribution box, and four in the drain field.

SWMU 46-003(f). See Fig. 5-1-12. This septic system/sand filter system is located southeast of Building TA-46-76. The drain field/sand filter component originally included over 10 drain field lines but has been completely removed. The remaining system includes a septic tank (TA-46-94), a manhole (TA-46-95), and a distribution box (TA-46-97). The distribution box may have been removed. Therefore, the distribution box will not be drilled into if the box can not be located.

Sampling at this septic system will consist of six vertical, cored boreholes; one at the septic tank, one in the manhole, one in the distribution box, and three in the drain field. If the distribution box has been removed, then the sample associated with that structure will not be taken. The distribution box would receive no further investigation unless further investigation of the SWMU is indicated by other data.

The boreholes will be drilled with a hollow-stem auger drilling rig and a continuous core system or equivalent system and will be bored to a depth of approximately 5 ft into the tuff. Core will be recovered in nominal 5-ft runs. Procedural control of drill site activities will be in accordance with LANL-ER-SOP-04.01, Drilling Methods and Drill Site Management.

One analytical sample, 0.2 ft minimum in length, will be removed from the cores at the point where the highest radioactivity and/or organic vapor measurements are detected in that 5-ft run during field screening. One analytical sample will be collected at the total depth (TD) of each core. Procedural control of core handling will be in accordance with LANL-SOP-12.01, Field Logging, Handling, and Documentation of Borehole Materials.

SWMU 46-003(g). See Fig. 5-1-13. This septic system is located northeast of Building TA-46-158 and consists of a septic tank (TA-46-230) connected to a dry well. If a geophysical survey verifies the existence of this dry well, sampling will consist of boring three vertical, cored boreholes; one at the septic tank, and two in the dry well. Boreholes will extend to a nominal depth of 15 ft at the septic tank and at the dry well.

SWMU 46-004(c). See Fig. 5-1-14. This dry well is located on the north side of Building TA-46-31 and will be VCA removed. Prior to excavation, two sludge/sediment samples will be taken. After the dry well (TA-46-61) is excavated, a total of two soil samples will be collected in the excavated surface beneath the dry well and analyzed for PCOCs.

Ten samples for WC will be collected from excavated soil.

SWMU 46-004(d). See Fig. 5-1-15. This dry well (one of two adjacent wells) is located on the north side of Building TA-46-58 and will be removed as a VCA. Prior to excavation, two sludge/sediment samples will be taken. After the dry well is excavated, a total of two soil samples will be collected in the excavated surface beneath the dry well and analyzed for PCOCs.

Ten samples for WC will be collected from excavated soil.

SWMU 46-004(e). See Fig. 5-1-15. This dry well, adjacent to dry well SWMU 46-004(d), is located north of Building TA-46-58 and will be removed as a VCA. Prior to excavation, two sludge/sediment samples will be taken. After the dry well is excavated, a total of two soil samples will be collected in the excavated surface beneath the dry well and analyzed for PCOCs.

Ten samples for WC will be collected from excavated soil.

SWMU 46-004(p). See Fig. 5-1-16. This dry well is located on the west side of Building TA-46-1 and will be removed as a VCA. Prior to excavation, two sludge/sediment samples will be taken. After the dry well is excavated, a total of two soil samples will be collected in the excavated surface beneath the dry well and analyzed for PCOCs.

Ten samples for WC will be collected from excavated soil.

5.2 Lagoon Systems

5.2.1 Background

The lagoon systems aggregate consists of PRSs 46-002 and 46-005. PRSs have been included in this aggregate on the basis of similar historical use and similar investigation and remediation approaches. See Fig. 5-2-1 for the location of these PRSs. Table 5-2-1 provides a summary of the PRSs.

TABLE 5-2-1

LAGOON SYSTEMS AGGREGATE

PRS	DESCRIPTION	STATUS	PCOCs
46-002	Sanitary disposal waste system on south-facing wall of SWSC Canyon	Inactive	Uranium-235, -238; plutonium-238, -239, -240; thorium; mercury and other metals; VOCs; SVOCs; PCBs
46-005	Sanitary waste disposal system on north-facing wall of SWSC Canyon	Inactive	Activation products, metals, VOCs, SVOCs, PCBs

5.2.1.1 Description and History

PRS 46-002. PRS 46-002 consists of a large surface impoundment or lagoon (TA-46-149), the drain lines that connect to it, a siphon box, and three sand filters. The lagoon system was constructed in the early 1970s to receive sanitary waste from buildings in the fenced area of TA-46. The lagoon is located at the top of the south-facing wall of SWSC Canyon. The walls and floor of the lagoon are lined with butyl rubber. The lagoon connects to the siphon box via an outlet box. In addition to flow to the siphon box, there is the potential for overflow from the lagoon via Outfall JJ (see Table 5-4-4 for a complete list of outfalls). The sand filters lie on a shelf midway down the side of the canyon. They consist of three 35 x 40 ft fields of sand contained by concrete walls approximately 1.5 ft high. The ground and concrete walls are lined with butyl rubber to contain the effluent, and an outlet box leads from the sand filters to an outfall at the edge of the shelf. This outfall is identified in Subsection 5.4 as the Outfall II associated with PRS 46-002. Subsection 5.4 provides the plan for the RFI of the outfalls.

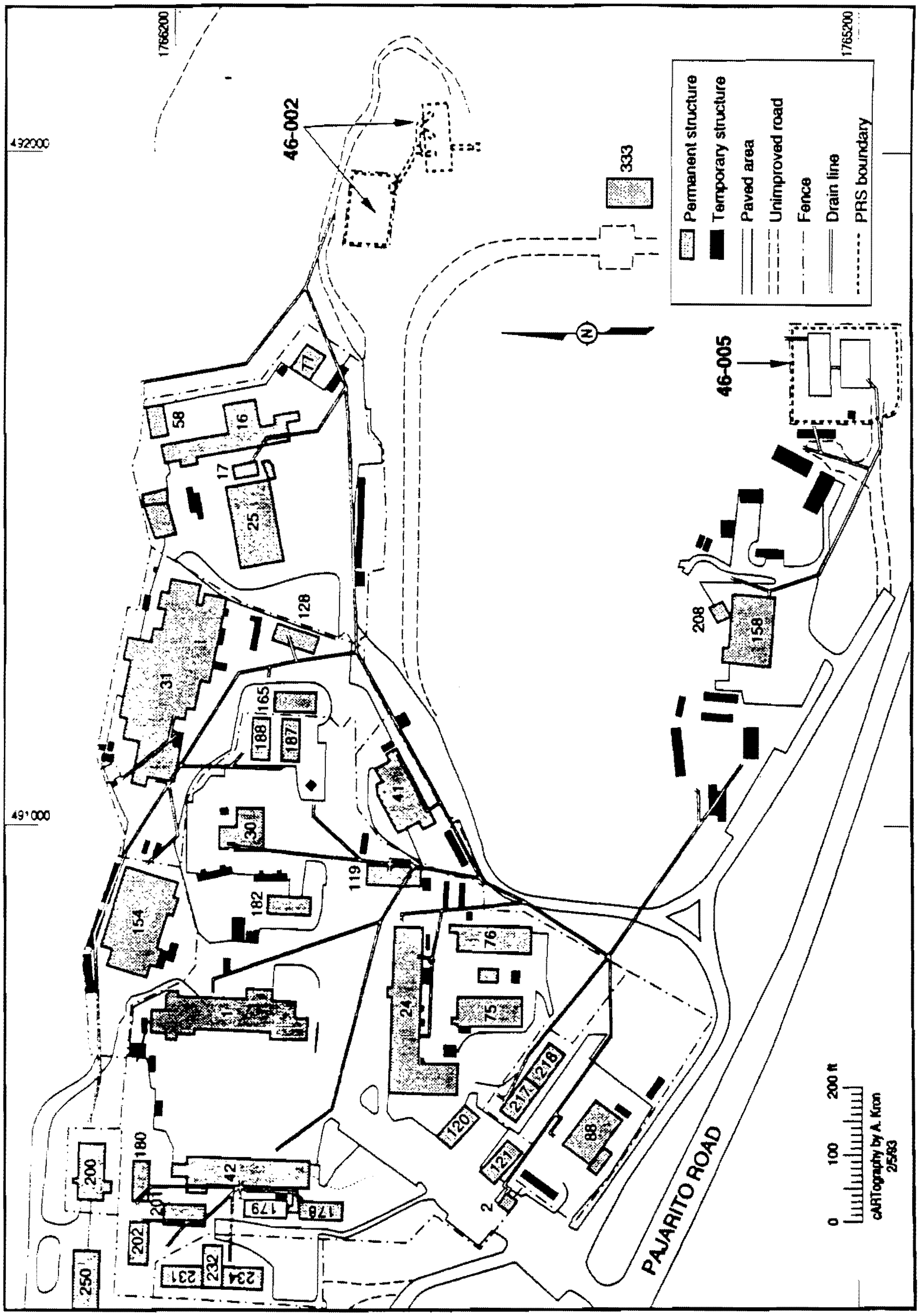


Fig. 5-2-1. Location of PRSs in the lagoon system aggregate at OU 1140 (TA-46).

The lagoon system functioned in the following manner from the time of construction through 1990. The lagoon received effluent from the connecting drain lines. Effluent flowed from the lagoon through the outlet box along a pipe to the siphon box, then down to pipes that open just above the sand filters. The effluent flowed from the pipes onto small concrete pads in the center of the fields of sand, and was dispersed as it splashed against the concrete pads. Since 1990, the system has continued in operation, but effluent has been pumped directly from the lagoon and removed to another waste water treatment facility. The siphon box and sand filter have been inactive since 1990.

During the period when the sand filters were active, the top 6 in. of sand and sludge in the sand filter were removed approximately once every two or three months and taken to Material Disposal Area (MDA) G. The sand beneath this top layer along with unused sand was pushed over the side of the canyon [this is the origin of PRS 46-009(b) discussed in Subsection 5.5]. The filters were then replenished with clean sand.

PRS 46-005. This PRS consists of a pair of surface impoundments (lagoons) and the drain lines that connect them to Building TA-46-158. The system was constructed in the late 1970s. The lagoons are located near the edge of the north-facing wall of SWSC Canyon. From 1980 to 1987, the lagoons contained salt brine, and were involved in solar energy experiments. During this period of operation, there is no known evidence that contaminants were introduced to the system. In 1987, the impoundments were drained of the brine, and the sanitary waste lines from TA-46-158 were connected. The system currently serves as a sanitary waste facility for TA-46-158.

The system functions as follows. The sanitary waste line from TA-46-158 connects to the upper, southern-most lagoon. The upper lagoon has an overflow drain to the lower lagoon, which in turn has an overflow line to an outfall (EPASSS12S) into SWSC Canyon. This outfall, LL, is discussed in Subsection 5.4.

5.2.1.2 Conceptual Exposure Model

5.2.1.2.1 Existing Information on Nature and Extent of Contamination

PRS 46-002. The 1986 CEARP field survey indicated that chemical drains were connected to the sanitary sewer system (DOE 1987, 0264). Other reports have revealed radionuclide contamination in some septic tanks; therefore, the potential contaminants include certain radionuclides, metals, and organics. A waste water treatment plant report on radiation analysis of sludge indicates that in 1985 the sludge from PRS 46-002 was 600 pCi/g gross alpha and 79 pCi/g gross beta (LANL 1985, 11-225).

PRS 46-005. The two units were used for solar energy experiments and contained sodium chloride (table salt) solution. In 1982, one of the ponds leaked for approximately 30 days, losing approximately 10 000 to 20 000 kg of salt plus minor quantities of swimming pool chemicals (Hull 1993, 11-242). While this release does not present a human health concern, it will need to be considered as part of the ecological risk assessment. After the removal of the sodium chloride solution, the units were used as surface impoundments connected to the TA-46 sanitary waste line (Engineering drawing ENG-C 45310). The area of the PRS is estimated to be 500 sq ft. Potential contamination is unknown. No other data are available on the PRSs in this aggregate.

5.2.1.2.2 Potential Pathways and Exposure Routes

The conceptual model (Fig. 5-2-2) presents historical sources of contamination, migration pathways and conversion mechanisms, potential current sources, release mechanisms, contact media, and exposure routes for the lagoon systems.

A summary of exposure mechanisms and human receptors is presented in Table 5-2-2.

Surface water located in these PRSs could overflow, resulting in the accumulation of contaminants in sedimentation traps in drainages. Refer to Chapter 4 for a detailed discussion of the migration pathways, conversion mechanisms, human receptors, and exposure routes.

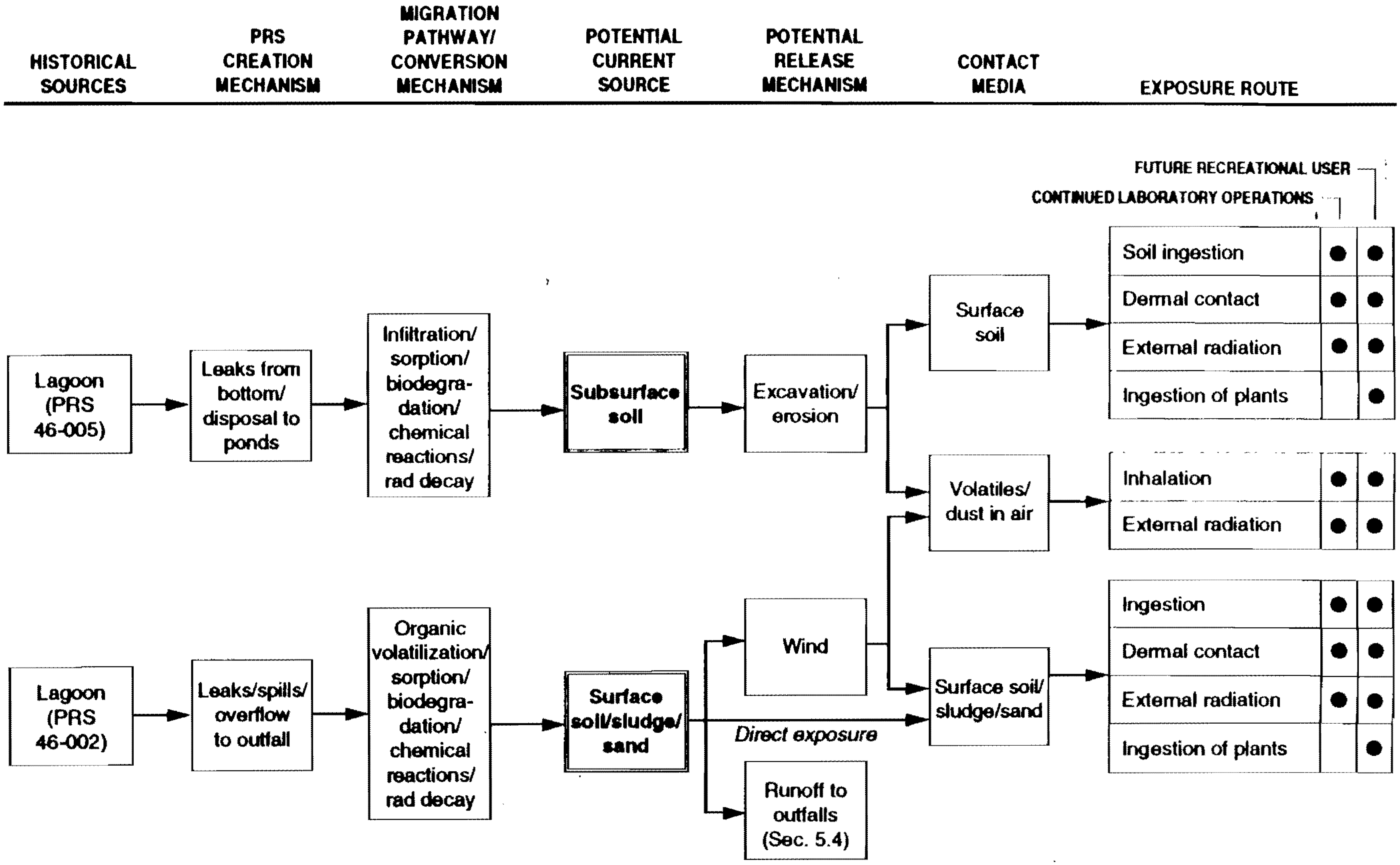


Fig. 5-2-2. Conceptual exposure model for the lagoon system aggregate at TA-46.

TABLE 5-2-2

EXPOSURE MECHANISMS AND RECEPTORS FOR LAGOON SYSTEMS AGGREGATE

POTENTIAL AREA OF CONTAMINATION	RELEASE MECHANISMS	CURRENT RECEPTORS UNDER CURRENT CONDITIONS	FUTURE POTENTIAL RECEPTORS
Surface soil surrounding sand filters	• Erosion, resulting in wind dispersion • Surface water runoff and infiltration • Volatilization • External irradiation	On-site workers and construction workers	• Recreational users, construction workers, and on-site workers
Sediments in drainage channels	• Wind dispersion • Runoff	On-site workers and construction workers	• Recreational users and construction workers
Subsurface soil beneath lagoons and sand filters	• Excavation or erosion, resulting in surface release mechanisms	None	• Recreational users, construction workers, and on-site workers
Concrete structures and linings	• Surface water overflow • External irradiation	On-site workers and construction workers	• Recreational users, construction workers, and on-site workers
Sand in sand filters	• Surface water overflow • External irradiation	On-site workers and construction workers	• Recreational users, construction workers, and on-site workers
Sludge in lagoons and siphon box	• Erosion, resulting in wind dispersion • Surface water overflow and infiltration • Volatilization • External irradiation	On-site workers and construction workers	• Recreational users, construction workers, and on-site workers

5.2.2 Remediation Decisions and Investigation Objectives

Problem Statement (DQO Step 1). The flow of effluent from laboratory drain lines, together with potential leaks in the lagoons and connected structures, may have resulted in contamination of the surrounding subsurface soils and surface soils in the vicinity of the PRS 46-002 sand filters. Because of the variety of laboratory activities at TA-46 and the many drain line connections to the lagoon systems, the list of PCOCs must be broad, including radionuclides, metals, VOCs, and SVOCs. The laboratories of

TA-46, however, were not known to use production-level quantities of any PCOC because they were experimental chemistry labs. Furthermore, any PCOCs introduced to the lagoon would have been significantly diluted. Thus, although the list of PCOCs is broad, none is expected to be found at hazardous levels.

The problem addressed by the Phase I investigation is to establish the presence or absence of PCOCs at each of the two PRSs in this aggregate.

Decision Process (DQO Step 2). The objective of the Phase I investigation will be reconnaissance screening to determine if PCOCs exist in the soils surrounding the lagoon structures, and/or the sludge within the structures, in concentrations above SALs. If all concentrations are determined to be below SALs in a particular PRS, NFA will be proposed for that PRS. If the Phase I investigation reveals that any concentration is above SALs in any PRS, a baseline risk assessment will be conducted for that PRS, supported if necessary by a Phase II sampling plan. A separate decision will be made for each PRS.

The drain lines associated with these PRSs are not part of the Phase I investigation. The drain lines are currently proposed for deferred action (see Chapter 6). However, if the investigation of the lagoon systems reveals contamination above SALs, the drain lines will be located and sampled during Phase II.

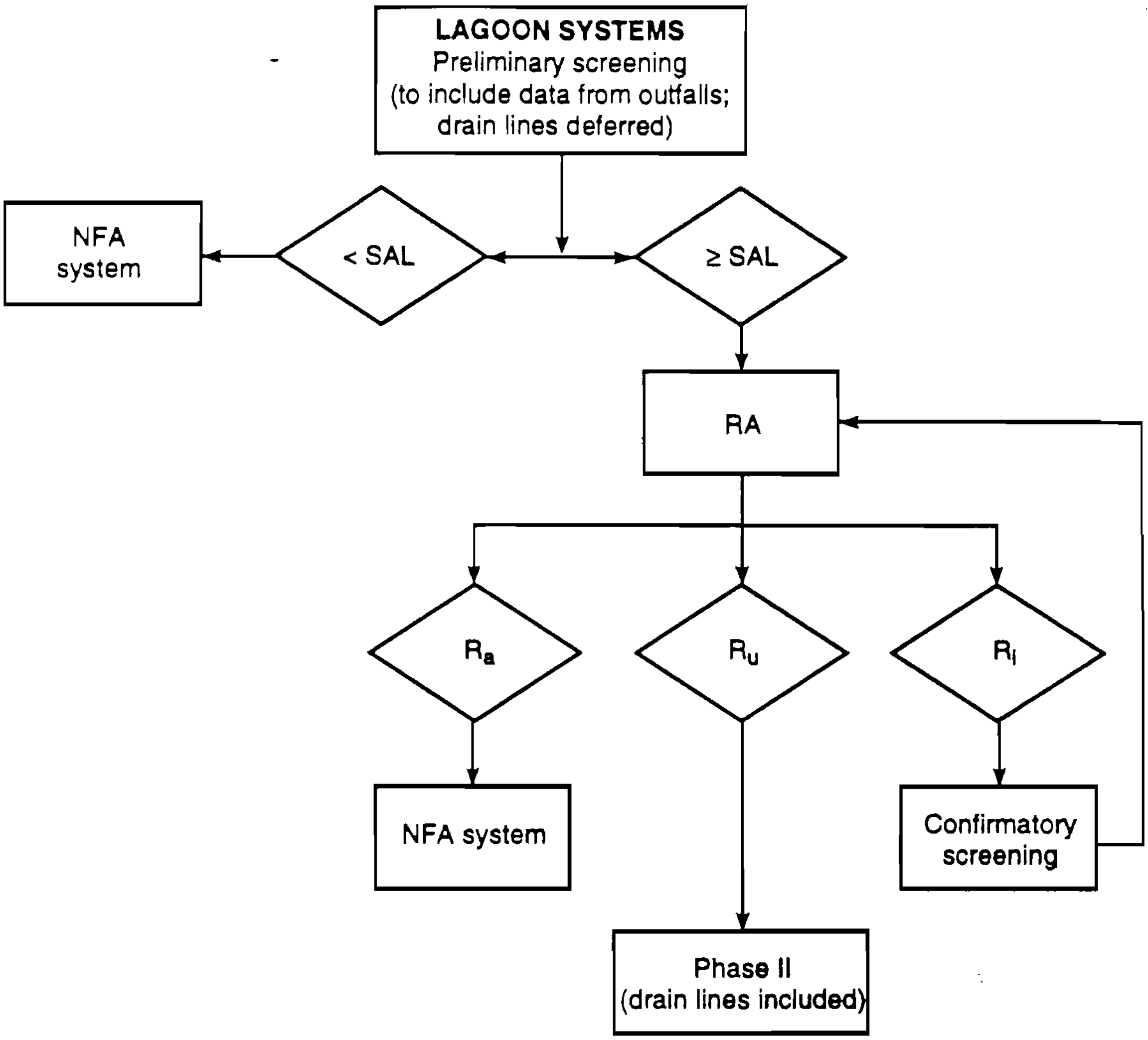
The potential options for remediating the lagoon systems are removal of the systems and any contaminated soils, or removing lagoon contents and filling and capping the lagoon. The decision will be supported by data on contaminant levels and migration gathered in a Phase II sampling plan if necessary.

5.2.3 Data Needs and Data Quality Objectives

See Fig. 5-2-3 for a summary of the decision logic for this aggregate.

Inputs (DQO Step 3). The primary data needs are concentrations of PCOCs in sludge, surface and subsurface soil, and tuff.

Boundaries (DQO Step 4). The boundaries of the regions of potential contamination for PRS 46-002 are as follows.



NFA	–	No further action
SAL	–	Screening action levels for potential contaminants of concern
RA	–	Baseline risk assessment
R_a	–	Risk acceptable
R_u	–	Risk unacceptable
R_i	–	Risk indeterminate

Fig. 5-2-3. Decision logic for lagoon systems (preliminary screening).

1. The soil and tuff around and under the lagoon and sand filters, including deep subsurface tuff and immediate subsurface soils underlying the lagoon liners.
2. The sand in the sand filters and soil adjacent to the filters.
3. Sludge contained within the lagoon structures.

The boundaries of the regions of potential contamination for PRS 46-005 include the soil and tuff around and under the lagoons, and sludge within the lagoon structures.

In each case, specific sampling points will be placed at locations judged most likely to contain the highest concentrations of PCOCs. For vertical boreholes designed to investigate subsurface contamination at PRS 46-002, the shallow-angle core will be recovered in nominal 5-ft runs and 0.2 ft samples will be selected either from the mid-point of each 5-ft run or from a point selected based on field screening. The 0.2 ft specimens will be indicative of likely exposure scenarios for this aggregate (e.g., erosion, wind dispersion).

Note that the investigation of outfall drainage channels and the areas of the canyon floor to which they lead are discussed in Subsection 5.4, and will not be considered in this subsection.

Decision Logic (DQO Step 5). The Phase I sampling plan will generate concentration values for each PCOC for individual sample locations. If any concentration is above the SAL, a baseline risk assessment will be conducted for that PRS, supported if necessary by a Phase II sampling plan. Exceedances of SALs in outfall samples collected will be taken into account as part of the decision-making process. In addition, the drain lines associated with the PRS will be scheduled for location and sampling during Phase II. If no exceedances of SALs are detected, NFA will be proposed for these PRSs.

Design Criteria (DQO Step 6). For each PRS in this aggregate, reconnaissance sampling will be designed so that there is a 90% probability of detecting contamination above SALs if as much as 10% of the site is contaminated above SALs. The 10% figure reflects an expectation that the various release mechanisms and complex boundary conditions applicable to this site will lead to a significantly heterogeneous distribution of PCOCs. The stringency of this criterion, plus the fact that sampling boundaries have been carefully determined, provide confidence that COCs will be found if they are present. These criteria will also be enhanced by means of biased sampling. In addition, results from samples taken for other aggregates will be used to support Phase I decision-making for this aggregate as appropriate and possible. Specifically, analytical data generated from samples collected for Subsection 5.4 (Outfalls) will be used for evaluation of the presence of PCOCs.

Table 5-2-3 is a summary of the DQO specifications for this aggregate.

TABLE 5-2-3

DQO SUMMARY – LAGOON SYSTEMS AGGREGATE

DQO STEP	RATIONALE
Problem statement	• Establish presence/absence of PCOCs
Decision process	• Reconnaissance screening • Compare to SALs
Inputs	• Concentration of PCOCs in surface and subsurface soil, tuff, and sludge
Boundaries	• Soil and tuff underneath and sludge contained within lagoon structures; sand in the filters; soil around the filters
Decision logic	• Compare maximum sample concentration to SAL • If SAL exceeded, continue investigation (baseline risk assessment), and include drain lines • Make separate decision for each PRS • Consider outfall data
Design criteria	• 90% probability of detecting contaminants when 10% of PRS is contaminated above SALs • Enhanced by biased sampling

5.2.4 Phase I Sampling and Analysis Plan

Phase I reconnaissance sampling will focus on determining the presence and concentration of PCOCs above SALs in lagoon systems at TA-46. Potential lagoon contaminants include mercury and other metals; uranium-235, -238; plutonium-238, -239, -240; thorium; PCBs; VOCs; and SVOCs. Please refer to Appendixes D, E, and H for additional OU 1140 field sampling information. These appendixes are: Field Investigation Approach and Methods, Sample Data Base, and Maps.

Engineering Surveys. Engineering surveys will be performed to precisely locate all surface structures and approximately locate subsurface structures. Engineering surveys will locate all sample collection locations (Table 5-2-4). Geophysical surveys will be performed to locate subsurface components of TA-46 lagoons. Various geophysical methods are available to locate subsurface lagoon system components. The Laboratory ER Program technical team that maintains expertise in these techniques will be consulted for the most appropriate method(s). Tentatively the use of EM and GPR surveys are planned to locate the lagoon systems at TA-46. Table 5-2-4 summarizes the engineering surveys to be conducted at this aggregate.

TABLE 5-2-4

ENGINEERING SURVEYS AT LAGOON SYSTEMS AGGREGATE

SURVEYS	REFERENCE
Geodetic mapping	Appendix D
Surface geophysics	Appendix D

Field Screening. This Phase I investigation will be initiated with a field survey of the PRS aggregate for radiation and organic vapors. The radiation survey and organic vapor screening will be performed according to the methods found in the Laboratory's SOPs, which are in preparation.

Appropriate health and safety precautions will be undertaken according to the Laboratory's ER Program SOPs (LANL 1993, 0875). Any accessible residual sludge, sediments, or water present in the containment structures will be field screened for radioactivity.

Sample Control. All samples will be field screened for radioactivity, metals, and organic vapors to identify gross concentrations of contaminants using the methods found in the Laboratory's SOPs, which are in preparation.

All samples will be initially analyzed in the field analytical laboratory. Gamma spectrometry will be used to quantify the radionuclides present in surface soil and sludge samples. X-ray fluorescence will be used to detect gross concentrations of metals. The results of the field laboratory analysis will guide the selection of samples (including both positive and negative findings) to be submitted for analytical laboratory analysis. All analytical laboratory samples will be analyzed for all potential contaminants of concern (hazardous and radioactive). Field quality assessment samples will be collected according to the guidance provided in the latest revision to the IWP. Any duplicate samples planned to be collected are listed in Table E-1. See Appendix D Subsection 2.8 for a discussion of quality control sample duplicates. See Table 5-2-5 for a complete listing of sample and analysis information.

Sample control activities in the field will be performed according to LANL-ER-SOPs 01.01 to 01.06.

5.2.4.1 Sampling

Sampling Rationale. Four sampling techniques will be employed to determine the concentrations of PCOCs at the TA-46 lagoon systems. 1) Surface soil/tuff samples will be collected on the perimeter of the sand filters. 2) Sediment/sludge samples will be gathered in the lagoons and sand filters proper. 3) After the lagoon liners have been removed, soil samples will be taken from the newly-exposed surfaces. 4) A shallow-angle cored borehole will be drilled beneath the SWMU 46-002 lagoon system in the tuff to determine the presence of PCOCs in the deep subsurface.

5.2.4.2 PRS Sampling Summaries

PRS 46-002. Upon completion of the engineering survey, sampling will begin and will include the collection of sludge/sediment samples from the main containment structures (lagoon and sand filters). Hand corer or Ponar grab sampler methods will be used to collect two samples from inside the bottom of the sewage lagoon. The samples will be located in the center of the sewage lagoon in the sludge pit (see Fig. 5-2-4). Sampling technique will be controlled by LANL-ER-SOP-06.14, Sediment Material Collection.

Spade and scoop or grab sample methods will be used to collect three samples from near the center surface of each compartment of the sand filter (see Fig. 5-2-4). Sample collection will be controlled by LANL-ER-SOP-06.11, Stainless Steel Surface Soil Sampler, or

Table 5-2-5

Summary of OU 1140 TA-46 Lagoon Systems Site Surveys, Sampling and Analysis

Structure Sample Total 22
Surface Sample Total 6
Subsurface Sample Total 31

					Field Surveys			Samples				Field Screening						Field Lab.						Laboratory Analyses																
	PRS	Outfall Field ID	PRS Type Outfall Type	Phase 1 Approach	Land Survey	Geophysics	Radiation	Sampled Media	Structure	Surface	Subsurface	Gross Alpha	Gross Gamma/Beta	Organic Vapor	Combustible gas/oxygen	X-Ray Fluorescence	Lithologic Logging	Gross Alpha	Tritium	Soil Moisture	Gamma Spectroscopy	PCB	VOA	Gamma Spectroscopy	Isotopic Americium	Total Uranium	Isotopic Uranium	Isotopic Plutonium	Isotopic Thorium	Isotopic Cesium	VOA (SW 8240)	Semivolatiles (SW 8270)	TCLP	Metals (SW 6010)	PCB (SW 8080)	Asbestos	Mercury	Herbicides	Pesticides	Aggregate
(1)	46-002		Sewage lagoon	Reconn	1	1	1	Sludge/Sediment	2	0	0	1	1	1		1		1			1	1	1	1			1	1	1		1	1		1	1		1			5.2
(2)	46-002		Sand Filters	Reconn	1	1	1	Soil/Sediment	3	0	0	1	1	1		1		1			1	1	1	1			1	1	1		1	1		1	1		1			5.2
(3)	46-002		Lagoon Syst.	Reconn	1	1	1	Soil/Tuff	0	6	0	1	1	1		1		1			1	1		1			1	1	1			1		1	1		1			5.2
(4)	46-002		Sewage Lagoon	Reconn	1	1	1	Tuff /Corehole	0	0	31	1	1	1		1	1	1		1	1	1	1	1			1	1	1		1	1		1	1		1			5.2
(5)	46-002		Siphon Tank	Reconn	1	1	1	Sludge/Sediment	1	0	0	1	1	1		1		1			1	1	1	1			1	1	1		1	1		1	1		1			5.2
(6)	46-002		Lagoon Syst.	Reconn	1	1	1	Soil/Tuff	4	0	0	1	1	1		1		1			1	1		1			1	1	1			1		1	1		1			5.2
(7)	46-005		Fmr. Solar Ponds,	Reconn	1	1	1	Sludge/Sediment	4	0	0	1	1	1		1		1			1	1	1	1			1				1	1		1	1					5.2
(8)	46-005		Fmr. Solar Ponds,	Reconn	1	1	1	Soil/Tuff	8	0	0	1	1	1		1		1			1			1			1					1		1	1					5.2

Table 5-2-5

Summary of OU 1140 TA-46 Lagoon Systems Waste Characterization, Sampling and Analysis

Structure Sample Total 20
Surface Sample Total 0
Subsurface Sample Total 0

					Field Surveys			Samples					Field Screening						Field Lab.						Laboratory Analyses															
	PRS	Outfall Field ID	PRS Type Outfall Type	Phase 1 Approach	Land Survey	Geophysics	Radiation	Sampled Media	Structure	Surface	Subsurface		Gross Alpha	Gross Gamma/Beta	Organic Vapor	Combustible gas/oxygen	X-Ray Fluorescence	Lithologic Logging	Gross Alpha	Tritium	Soil Moisture	Gamma Spectroscopy	PCB	VOA	Gamma Spectroscopy	Isotopic Americium	Total Uranium	Isotopic Uranium	Isotopic Plutonium	Isotopic Thorium	Isotopic Cesium	VOA (SW 8240)	Semivolatiles (SW 8270)	TCLP	Metals (SW 6010)	PCB (SW 8080)	Asbestos	Mercury	Herbicides	Pesticides	Aggregate
(1)	46-002		Sewage Lagoon Liner	VCA-WC			1	Sludge	10	0	0		1	1	1										1		1							1		1		1			5.2
(2)	46-005		Sewage Lagoon Liner	VCA-WC			1	Sludge	10	0	0		1	1	1										1		1							1							5.2

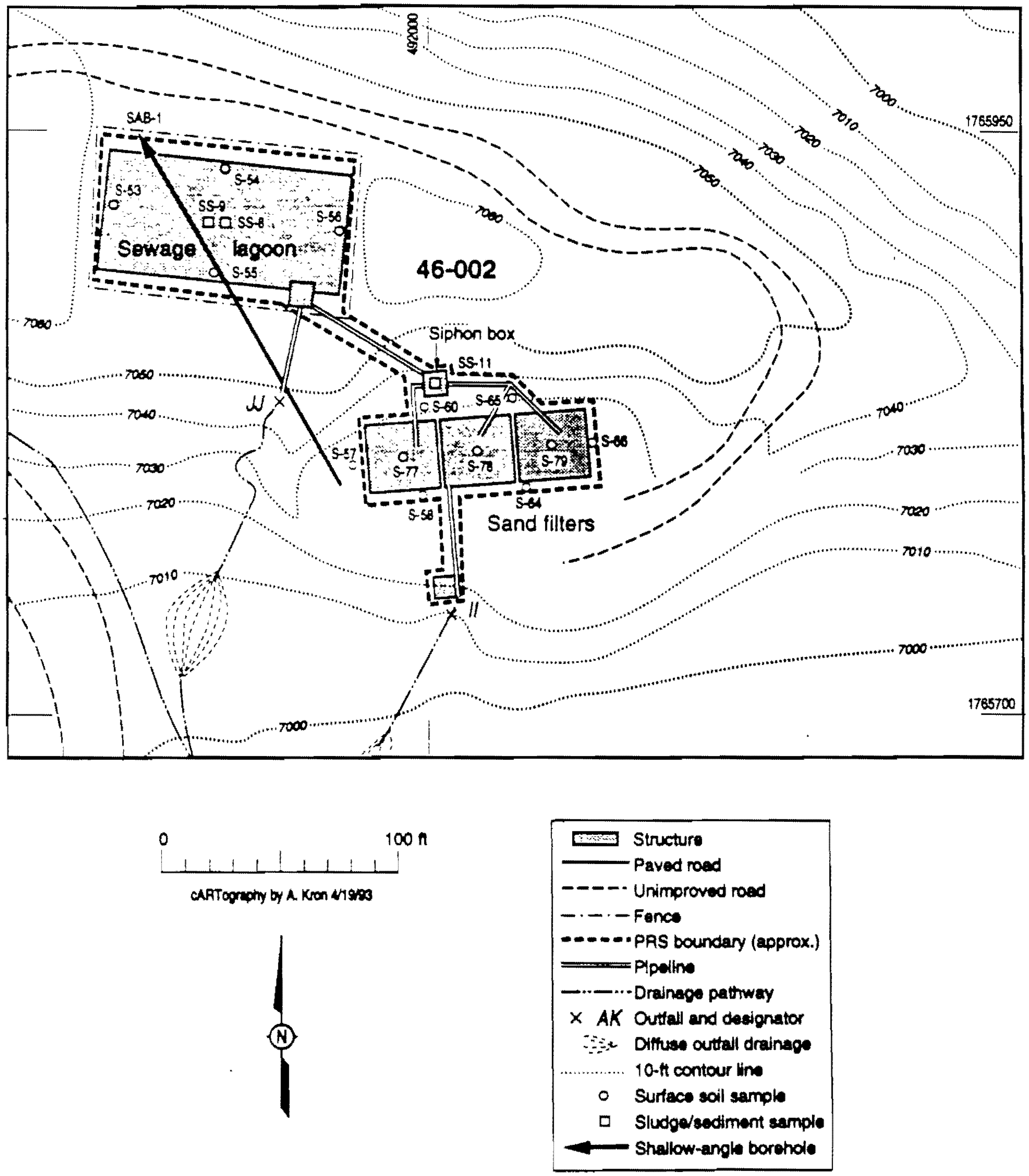


Fig. 5-2-4. Sampling locations at PRS 46-002.

LANL-ER-SOP-06.09, Spade and Scoop Method for Collection of Soil Samples. Surface soil samples will be collected around the perimeter of the sand filters. Six surface samples will be collected at the sand filters, two on the north and south sides (evenly spaced) and one on each end. These samples will be biased by the use of field screening techniques. If the results of the laboratory analyses of the contents of the lagoons indicate PCOCs above SALs, then an intermediate VCA/remediation should be carried out before further sampling. The contents (including the butyl liner) should be removed and the containment structure cleaned up to minimize the danger to personnel performing sampling and characterization activities. Visual inspection of the containment structure(s) is necessary at this point. After the liner has been removed, four surface samples will be taken from the newly-exposed surfaces.

Surface sample locations will be near the center of each side on the lowest surface unless visual evidence or field-screening data suggest other locations.

The discovery that PCOCs are below SALs will result in a recommendation for NFA and that the sewage lagoon and filters be emptied, visually inspected, and backfilled. A separate set of samples will be collected after the excavation and removal of the lagoon liner to classify the excavated materials as hazardous, radioactive, or mixed waste. Any hazardous waste component will need to be analyzed to demonstrate that requirements of the land disposal restrictions (40 CFR 268) are met. These WC samples are not directly related to the establishment of contaminant levels above or below SALs.

A shallow-angle cored borehole will be drilled underneath the lagoon structure from a position to the south of the sewage lagoon. The borehole will be drilled to a length of approximately 150 ft. The borehole will be oriented from approximately southeast to northwest. It will be initiated near the lagoon overflow line and proceed beneath the lagoon structure and terminate beyond its north edge (see Fig. 5-2-5). This bearing will allow the borehole to transect fractures in the tuff that may act as preferred conduits for leaking fluids. The capacity to intercept fractures efficiently is the primary reason to utilize an angled borehole at this site. Numerous vertical

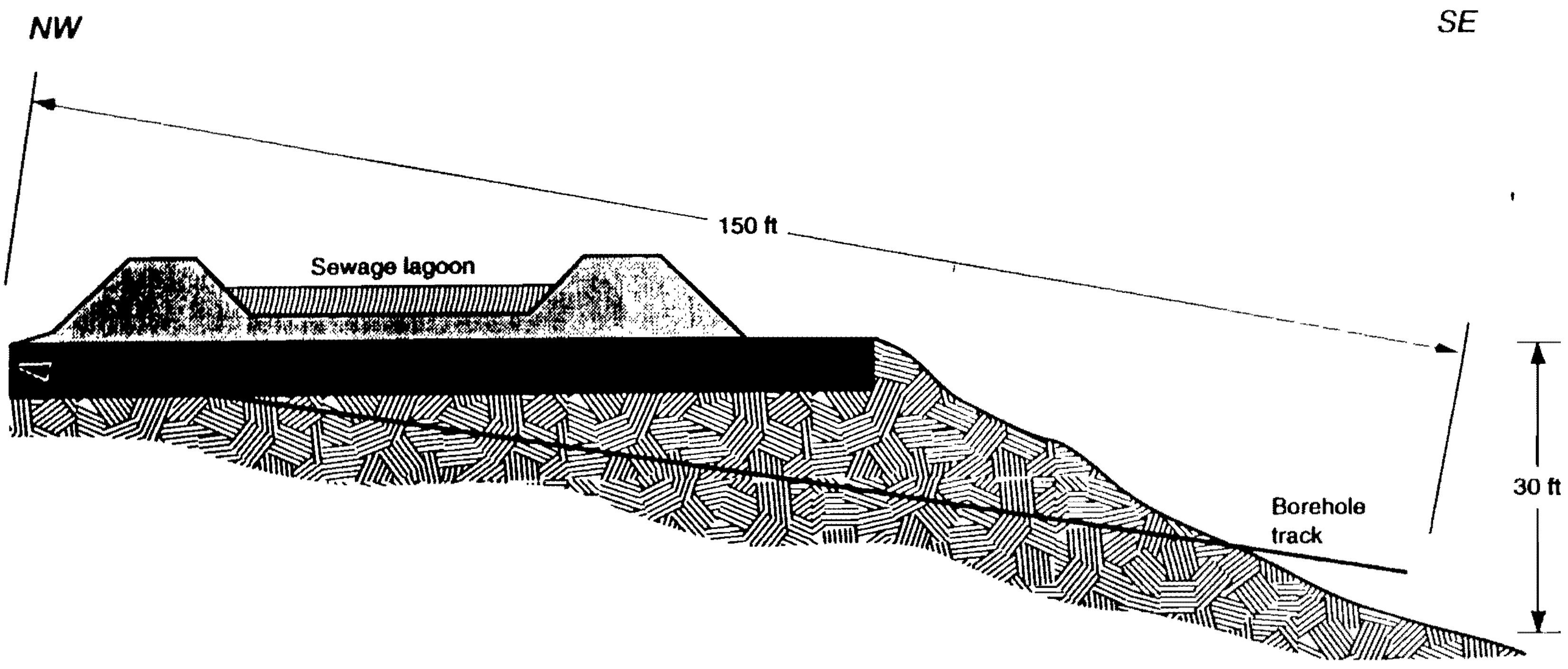


Fig. 5-2-5. Cross section view, shallow-angle borehole at PRS 46-002.

boreholes would be required to achieve the same performance as a single horizontal borehole.

The borehole will be drilled with an air rotary drilling rig and continuous core system (or equivalent). Core will be recovered in nominal 5-ft runs. Procedural control of drill site activities will be according to LANL-ER-SOP-04.01, Drilling Methods and Drill Site Management. Field logging of core will be controlled by LANL-SOP-12.01, Field Logging, Handling, and Documentation of Borehole Materials.

One analytical sample (specimen), 0.2 ft minimum in length, will be removed from each core run. Specimens for full laboratory analysis will be selected to maximize the probability of detecting contaminants if present. This selection will be guided by field-screening for radioactivity and organic vapors, moisture content variations, fracture locations, or other hydrologic or geologic observations (see Appendix D). In the absence of any distinguishing features, one specimen will be collected from the midpoint of each 5-ft run.

PRS 46-005. Upon completion of engineering surveys, sampling will begin and will include the collection of sludge/sediment samples from the lagoons. Hand corer or Ponar grab sampler methods will be used to collect two samples from inside the bottom of each of the sewage lagoons. Each of the two lagoons will be sampled at one-half the distance between the north and south sides, and one-third the way across the lagoon in from the east and west sides respectively (see Fig. 5-2-6). Sampling technique will be controlled by LANL-ER-SOP-06.14, Sediment Material Collection.

If the results of the laboratory analyses of the contents of the lagoons indicate PCOCs above SALs, then an intermediate VCA/remediation should be carried out before further sampling. The contents (including the butyl liner) should be removed and the containment structure cleaned up to minimize the danger to personnel performing sampling and characterization activities. Visual inspection of the containment structure(s) is necessary at this point. After the liners have been removed, eight surface samples will be taken from the newly-exposed surfaces. Surface sample locations will be near the center of each side on the lowest surface unless visual evidence or field-screening data suggest other locations.

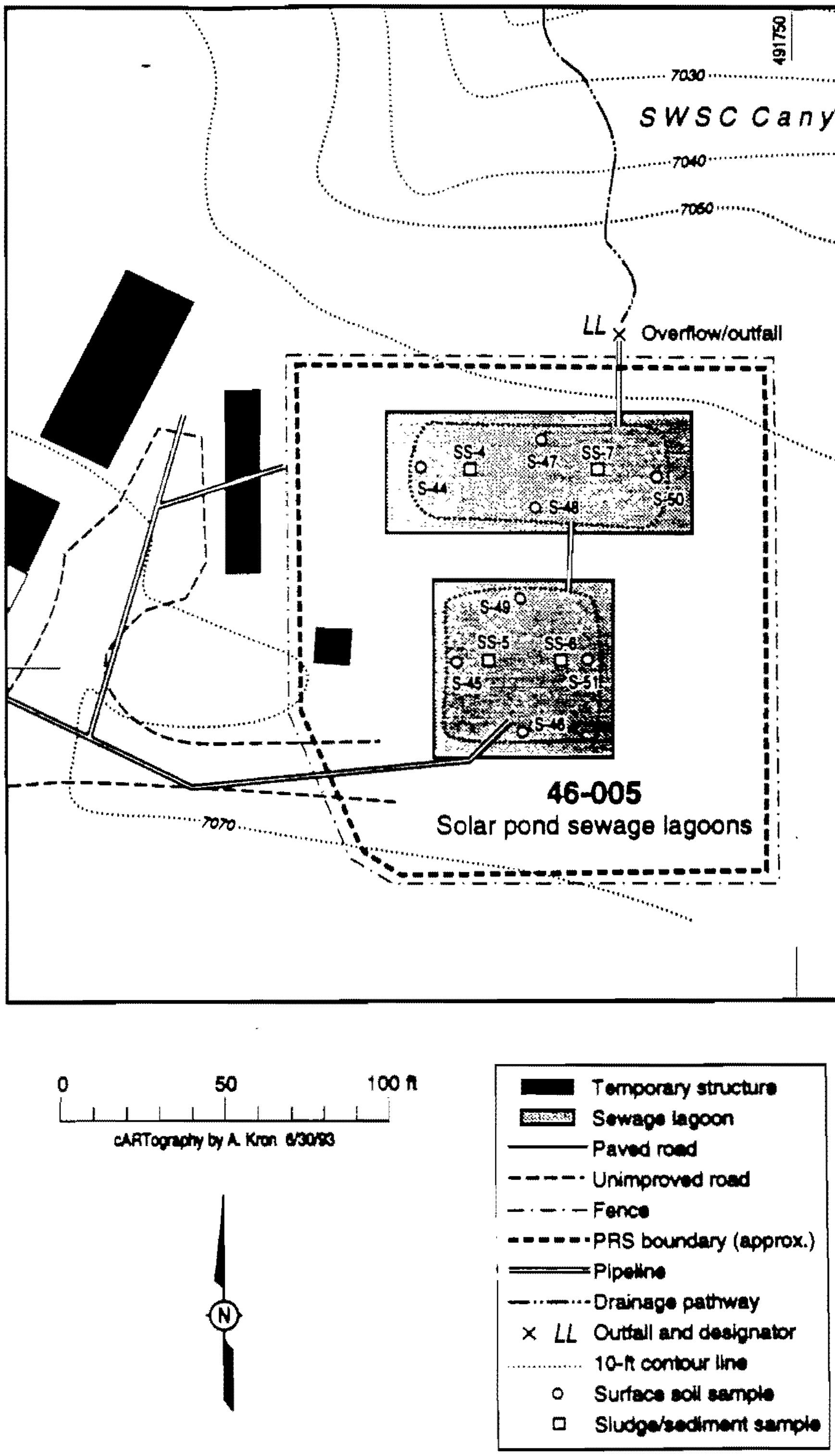


Fig. 5-2-6. Sampling locations at PRS 46-005.

The discovery that PCOCs are below SALs will result in a recommendation for NFA and that the sewage lagoons be emptied, visually inspected, and backfilled. A separate set of samples will be collected after the excavation and removal of the lagoon liner to classify the excavated materials as hazardous, radioactive, or mixed waste. Any hazardous waste component will need to be analyzed to demonstrate that requirements of the land disposal restrictions (40 CFR 268) are met. These WC samples are not directly related to the establishment of contaminant levels above or below SALs, as is true for most of the remainder of this investigation.

5.3 Surface Releases

5.3.1 Background

PRSs in this aggregate are surface areas that may have received hazardous waste, either as programmatic disposal or as spills and leakage from storage containers. The PRSs are aggregated by the following characteristics: all are surface areas; the amount and extent of contamination is unknown; the history of exposure to waste streams at each site is unknown; and conceptual models, sampling plans, and sampling techniques are similar. Figure 5-3-1 shows the location of the surface-release PRSs.

5.3.1.1 Description and History

Table 5-3-1 lists the location, description, and PCOCs for each surface release PRS. The PCOC listing is based on archival information and interviews during the course of investigation of each PRS and represents the best judgment of the OU 1140 team members. It may not agree with PCOCs listed in the 1990 SWMU Report (LANL 1990, 0145). For example, evidence indicates that solvents were used extensively at TA-46. For that reason all samples from unpaved surface PRSs will be analyzed for VOCs. Samples from paved surfaces will not be analyzed for VOCs since these compounds would have evaporated, been transported as runoff, or paved over during the intervening years. Since VOCs may soak through asphalt, a limited number of samples may be taken from beneath asphalt.

SWMU 46-003(f) is a septic system that includes the site of an abandoned sand filter as a surface component. The filter is located in a level, 60- x 75-ft depression on the south rim of SWSC Canyon. Part of the area was excavated into tuff; the rest is now covered with grasses and weeds. The entire septic system was abandoned and the sand cleaned from the filter bed when the sewage lagoon (TA-46-002) was built in 1973. The subsurface component of the SWMU is described in Subsection 5.1.1.1. The outfall is described in Subsection 5.4.1.1. North of the site near the rim of the canyon is a 15-ft-square area that contains concrete chunks piled when the filter was abandoned and destroyed. PCOCs include metals, VOCs, SVOCs, and uranium.

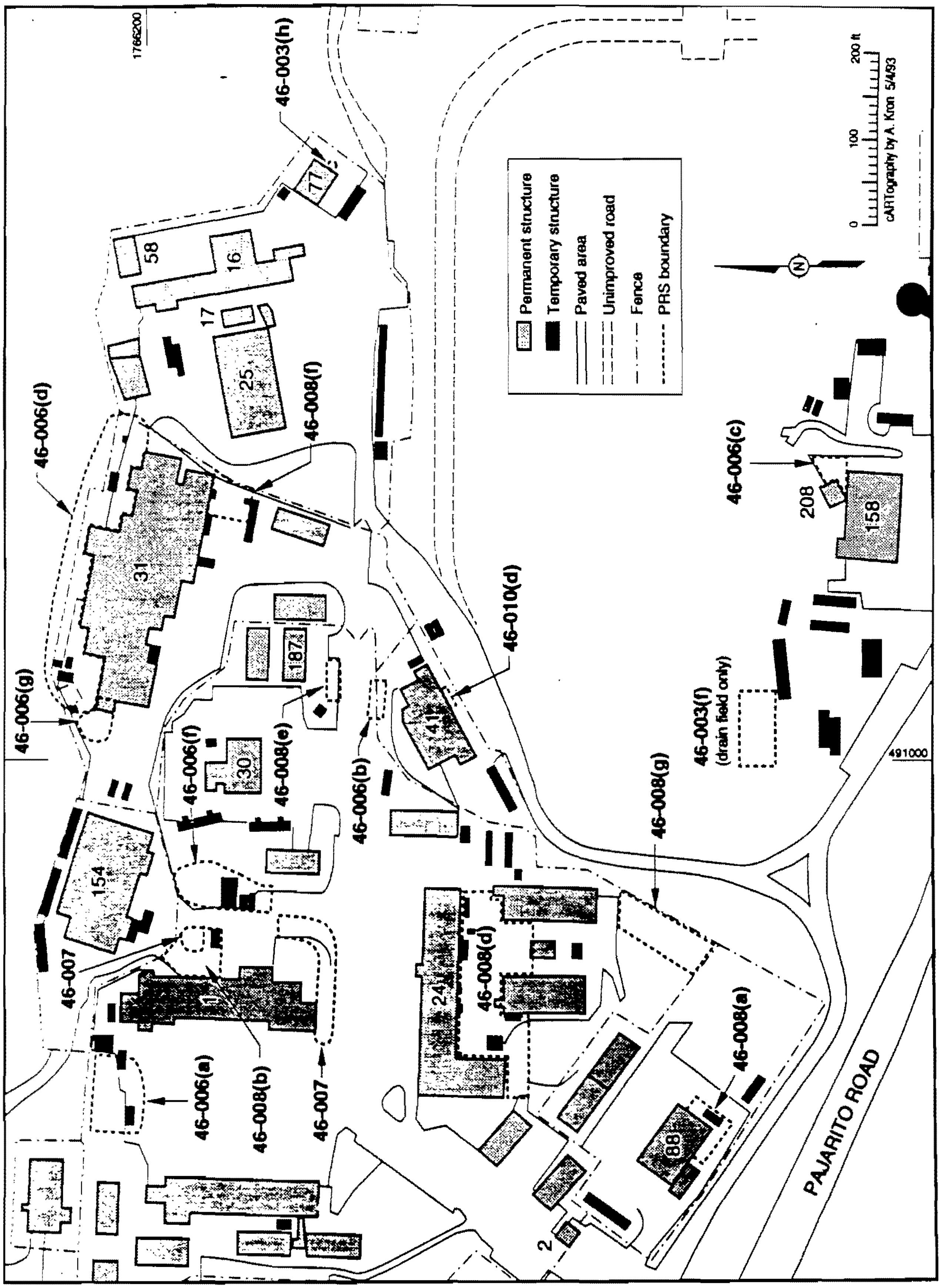


Fig. 5-3-1. Location of PRSs in the surface releases aggregate at OU 1140 (TA-46).

TABLE 5-3-1

SURFACE RELEASE PRSs AT TA-46

PRS	LOCATION	DESCRIPTION	PCOCs
46-003(f)	SE of TA-46-76	Sand filter	Metals; mercury; uranium-235, -238; VOCs;SVOCs
46-003(h)	E of TA-46-77	Sink drain	Metals, VOCs, SVOCs
46-006(a)	W of TA-46-1	Drum storage	Metals; uranium-234, -235, -238; cesium-137; americium-241; SVOCs; VOCs; PCBs; pesticides
46-006(b)	N of TA-46-41	Drum storage	Metals; uranium-235, -238; PCBs; oils*; SVOCs
46-006(c)	E of TA-46-158	Drum storage	Metals, SVOCs, PCBs, oils*
46-006(d)	N of TA-46-31	Surface disposal	Metals; uranium-235, -238; plutonium-238, -239, -240; VOCs; SVOCs; PCBs; oils*; mercury
46-006(f)	E of TA-46-1	Storage shed	Metals; uranium-235, -238; VOCs; SVOCs; PCBs; asbestos; mercury
46-006(g)	W of TA-46-31	Storage shed	Uranium-235, -238; oils*; SVOCs; VOCs
46-007	SW of TA-46-1	Surface disposal	Metals; uranium-235, -238; VOCs; SVOCs; mercury; copper
46-008(a)	E of TA-46-88	Drum storage	Metals, SVOCs, VOCs
46-008(b)	E of TA-46-1	Drum storage	PCBs, oils*
46-008(d)	S of TA-46-24	Drum storage	Metals; uranium-235, -238; VOCs; SVOCs; oils*
46-008(e)	S of TA-46-187	Drum storage	Metals; VOCs; SVOCs; PCBs; oils*; uranium-235, -238
46-008(f)	S of TA-46-31	Drum storage	Metals; uranium-235, -238; VOCs; SVOCs; oils*
46-008(g)	S of TA-46-76	Drum storage	VOCs, SVOCs, PCBs, oils*
46-010(d)	S of TA-46-41	Drum storage	Metals, VOCs, SVOCs, PCBs, asbestos

*Oils will be analyzed for polycyclic aromatic hydrocarbons (PAHs).

SWMU 46-003(h) is a 6-ft-square area of soil beneath a 1-in.-diameter pipe protruding about 6 in. from the east wall of Building TA-46-77 and exiting about 1 ft aboveground. Effluent discharges directly on the soil beneath the pipe. A chunk of concrete under the pipe serves as a splash guard. No erosion channel has formed on the level ground, which is unpaved and sparsely covered with weeds.

Outfall GG serves a sink in TA-46-77. The 30 x 40 ft building is a metal structure on a concrete foundation. It was constructed in the early 1960s as a warehouse for general storage in support of test laboratory TA-46-16. Dunne (1976, 11-081) indicated that waste was being discharged without treatment. TA-46-77 is now a welding and machine shop facility. VOCs, SVOCs, and metals may have been discarded in the sink. There is no indication that uranium was ever brought into this building.

SWMU 46-006(a) is a concrete and asphalt pad at the north end of the parking lot between TA-46-1 and TA-46-42. The pad is level, but the SWMU drains into an adjacent ditch leading to a culvert and Outfall P discussed in Subsection 5.4.1.1. The entire affected area is about 70 x 100 ft. The 1986 CEARP field survey crew reported fifteen 55-gallon drums at this SWMU. All drums were oily-looking and some of the drums were leaking. Oil had drained into the ditch. The drain was worked on just before the 1986 survey, making it difficult to see how far the oil had moved. The drums contained dielectric oil (Perkins 1986, 11-089). This area was included in Environmental Problem #19 (LANL 1989, 0425). The following contaminants were detected at low levels: metals; uranium-234, -235, and -238; cesium-137; americium-241; VOCs; SVOCs; PCBs; and pesticides. Data for this study are discussed in Subsection 5.3.1.2.1.

SWMU 46-006(b) is a 20 x 50 ft paved area containing oil stains remaining from a storage shed, TA-46-197, once located about 40 ft north of Building TA-46-41. The entire area around the SWMU is covered with asphalt and slopes to a storm drain about 30 ft south of the shed site. Outfall QQ for this drain is described in Subsection 5.4.1.1. The shed was 40 ft long x 8 ft high x 8 ft deep with a sheet-metal roof and plywood sides. The north side was open. The shed was installed before 1977; it was removed in 1990.

TA-46-197 was used for short term storage of oil drums, vacuum pumps, optical tables, other laboratory equipment, and PCB-containing oil. The 1986 CEARP survey crew reported 55-gallon drums and other oily equipment stored both inside and outside of the shed (Perkins 1986, 11-089). Oil was leaking from under the back of the shed. East of the shed was an oil spill which had moved into the storm drain. Discolored soils at the canyon outfall of the storm drain were also noted. PCOCs are metals; PCBs; SVOCs; uranium-235, -238; and oils.

SWMU 46-006(c) is a 15 x 30 ft, stained section of asphalt on the east side of Building TA-46-158. The SWMU is located upslope above a grated storm drain which emerges on the side of the steep bank sloping down to the east. The entire east side of the building is paved with a 25-ft-wide asphalt strip.

Asphalt curbing directs all runoff from this sloping strip into the storm drain, which empties to a ditch extending about 100 ft across a gently sloping bench to the steep south wall of SWSC Canyon. The outfall, designated PP, is described in Subsection 5.4.1.1.

The 1986 CEARP field survey noted leaking drums on the asphalt. Oil spilled into the storm drain and was moving toward the canyon (Perkins 1986, 11-089). The drums have been removed. Satellite accumulation area, SWMU 46-010(f), located upslope under a roofed area, also drains to this ditch. It is recommended for NFA in Subsection 6.2.2. The TA-46-158 complex houses laser experiments. PCOCs at 46-006(c) include metals, SVOCs, PCBs, and oils. Uranium was not used in or around the building.

SWMU 46-006(d) is an unpaved, historic informal disposal area located along the north side of Building TA-46-31. The 50 x 350 ft area is level 5 to 15 ft beyond the building, then drops steeply to the TA-46 perimeter fence. Most of this area is vegetated with weedy species. Beyond the fence the ground drops sharply 60 ft into Cañada del Buey. East and west of the SWMU are asphalt paved delivery and parking areas which contain storage and handling facilities. Garbage, including beverage cans and food wrappings, is scattered about.

Engineering drawing ENG-C 42679, sheet 2, indicates that a washdown drain from Room 111A discharges onto SWMU 46-006(d). Oils and possibly other materials were spilled (or dumped) onto the SWMU from TA-46-31, a large laboratory building where multiple types of experiments have been conducted. It now houses laser experiments. For the 1986 CEARP survey the inspector lists 55-gallon drums, old cans, rusty chemical storage units, and a thick layer of oil on the back porch. "All along the canyon side are evidences of oil spills. The whole area looks unused with much debris and strong smell of oil." (Perkins 1986, 11-089). PCOCs are mercury and other metals; uranium-235 and -238; plutonium-238, -239, and -240; VOCs, SVOCs, and PCBs. This area was included in Environmental Problem #25 (LANL 1989, 0425). Analytical data from this study are discussed in Subsection 5.3.1.2.1. An industrial drain and dry well, 46-004(a,c), and the septic system 46-003(d) discussed in Subsection 5.1.1, are located within this SWMU, as is SWMU 46-004(b), a concrete tub that is recommended for NFA in Subsection 6.1.

SWMU 46-006(f) is TA-46-36, a 20 x 30 ft metal building located 50 ft east of Building TA-46-1. It was constructed about 1955 as a storage building with double, sliding, metal doors on the west and a single door on the southeast. The concrete or asphalt floor is 6 to 8 in. below grade with a sloping asphalt ramp from double doors to floor. The sliding doors face an asphalt roadway; the remaining area around the building is unpaved.

The building and surrounding area have been used as a storage area, a disposal area for surplus equipment, and an unloading point for new equipment. Items included furnaces, electronic equipment, oils, alkali metals, asbestos products, beryllium alloys, potassium dichromate, lead bricks, mercury, other metals, oils, and small amounts of PCBs (Erickson 1992, 11-211). PCOCs include metals; uranium-235, -238; VOCs; SVOCs; PCBs; and asbestos.

SWMU 46-006(g) is a storage shed at the west end of TA-46-31. From 1982 to 1984 the shed housed a vacuum pump used in experiments involving plasma vaporization of depleted-uranium powder. Pump oil spilled in the shed, which was later used only for storage (Anderson 1992, 11-216). Contaminants of concern include uranium-235, -238; VOCs; and oils. This area is adjacent to SWMU 46-006(d) and runoff drains into that SWMU.

SWMU 46-007 is a partially paved ditch located on the south side of Building TA-46-1, plus the drainage path of this ditch along the east side of the building. The ditch is one-to-several feet deep, 3 to 6 ft wide, and 175 ft long. Much of the ditch is now paved with asphalt. Drainage is to Cañada del Buey by man-made watercourses and culverts. The drainage path has been altered several times to accommodate construction projects. The present canyon outfall is via a culvert that daylights to the north of TA-46-397, described as Outfall M in Subsection 5.4.1.1.

During the late 1950s and early 1960s, used apparatus from a cesium-plasma diode operation was deposited in the ditch and cleaned using butanol and kerosene. Researchers used only natural cesium, an unregulated substance, never the radioactive isotope, cesium-137. Other substances, such as solvents, were also discarded in the ditch. Large pieces of cesium metal were discarded in the alkali-metal pit, SWMU 46-004(p) (Michelotti 1992, 11-177). The ditch also receives roof drain effluent and storm water runoff. After the cesium plasma diode effort ended, the ditch received copper-containing waste from heat pipe research. A green stain from this operation remains on the tuff at the head of the ditch. The pit, ditch, and downslope areas may be contaminated with a variety of chlorinated and hydrocarbon solvents. Mercury was spilled in the south bay of TA-46-1 (Hyatt 1957, 11-003). Some floor drains [SWMUs 46-004(s) and 46-004(b2)] from the building emptied into the ditch. Because of these multifaceted uses over the years, it is not known what contaminants may be present. An inactive drum storage area, SWMU 46-008(b), is located beside the ditch. Satellite accumulation area, SWMU 46-010(a) is located at the head of the ditch on the south dock. It is recommended for NFA in Subsection 6.2.2. PCOCs from all activities around this ditch include mercury; other metals; uranium-235, -238; VOCs; and SVOCs.

SWMU 46-008(a) is a 20-ft-square paved area east of TA-46-88 where, in the March 1986 CEARP survey, the inspector noted 28 nitric acid drums. One was marked "waste" and was leaking. Other drums contained cyclohexane, pump oil, and methanol. He noted "In back (to the east) were 30 very rusty nitric acid containers, a junk pile, 28 very rusty... 55 gallon drums" (Perkins 1986, 11-089). PCOCs include metals, SVOCs, VOCs, and oils.

Satellite accumulation area 46-001 is located just south of this area. It is recommended for NFA in Subsection 6.2.2.

SWMU 46-008(b) is an inactive, unpaved, 20-ft-square storage area about 15 ft east of TA-46-1 near manholes TA-46-6 and TA-46-15. It slopes east to the drainage ditch of SWMU 46-007 and is covered with grasses and weeds. Any spills from this location flowed east downhill into the ditch. In the unlikely event of a spill entering either manhole TA-46-6 or TA-46-15, there would be overlap with SWMU 46-004(g) or SWMU 46-003(a). The SWMU Report identifies this area as contaminated with petroleum products, oils, and PCBs (LANL 1990, 0145).

SWMU 46-008(d) is a 100 x 200 ft paved storage area located on the south side of Building TA-46-24. The 1986 CEARP inspector listed the following as "outside items" at that building: ethylene glycol, butyl ether, two unmarked plastic jugs, unchained cylinders, plastic bottles of pump oil, two unmarked 55-gallon drums, old vacuum pumps, and something marked "velo site #6." He remarked also that the side of the building had an oily spill. "On the 'hill' above 24 are 3 old 55 gallon drums and 2 vessels which appear to have contained radioactive material" (Perkins 1986, 11-089). This hill is south of the building and is included in the SWMU. PCOCs include metals; uranium-235, -238; VOCs; SVOCs; and oils. Satellite accumulation area 46-010(b) is located against the building within the SWMU boundaries. It is recommended for NFA in Subsection 6.2.2.

SWMU 46-008(e) is a partially paved storage area located south of Building TA-46-187. It is 20 x 35 ft, level, and covered with grasses and weeds. There are some traces of asphalt in the soil, suggesting that it may have been paved at some point. The area drains to the east, into a storm sewer just outside the TA-46 perimeter fence. Four barrels alleged to have contained waste vacuum oil were stored here at the time of the 1986 CEARP survey (DOE 1987, 0264). This area has been used as a storage area since the 1950s, and was the site of a storage shed removed sometime before 1988 (Michelotti 1993, 11-227). PCOCs include metals, VOCs, SVOCs, PCBs, and oils.

SWMU 46-008(f) is a paved storage area located on the southeast side of TA-46-31. The SWMU Report mentions four barrels of oil which may have been either product or waste (LANL 1990, 0145). The March 1986 CEARP survey noted "two 55-gal. drums, containers labeled methanol, 3 old cans, drums and unmarked cylinders... The whole area looks unused with much debris and a strong smell of oil" (Perkins 1986, 11-089). The 50 x 100 ft area is level and paved with asphalt except for a narrow strip along the fence. No obvious staining is noticeable, although the area has historically been used for general storage. Drainage direction is unclear. Satellite accumulation area 46-010(c) is located within this area. It is recommended for NFA in Subsection 6.2.2. PCOCs are SVOCs; VOCs; uranium-235, -238; mercury; possibly other metals; and oils.

SWMU 46-008(g) is a 25 x 50 ft, unpaved storage area located south of TA-46-76. The site is a broad, level, grassy area bisected by a channel draining east into SWSC Canyon at Outfall BB. Runoff from a parking lot also drains through the channel. The SWMU Report cites the Revised Implementation Plan in response to DOE Environmental Survey Team Preliminary Report, January 12, 1990, noting the storage of 20 drums directly on the ground, and that the drums contained dielectric oil which had not been analyzed for PCBs, chlorinated solvents, or hydraulic fluid (LANL 1990, 0145). The drums were stored next to a drainage ditch; the outfall is discussed in Subsection 5.4.1. PCOCs are VOCs, SVOCs, PCBs, and oils.

SWMU 46-010(d) is an unpaved storage area located on the south side of warehouse TA-46-41. The 10 x 25 ft weedy area is level near the building but slopes rather steeply down to the SWSC road. This SWMU is a RCRA satellite accumulation area but has a prior history of hazardous material storage. The 1986 CEARP survey mentions unmarked and rusting drums at the site. PCOCs include metals, VOCs, SVOCs, and PCBs.

5.3.1.2 Conceptual Exposure Model

5.3.1.2.1 Nature and Extent of Contamination

SWMU 46-006(a). Two TA-46 sites were included in the DOE Los Alamos National Laboratory Sampling and Analysis Data Document. Environmental Problem #19 (LANL 1989, 0425) addressed SWMU 46-006(a), the storage area west of TA-46-1. Three soil samples at depths of 0 to 6 in. were taken; one on the side of the ditch and two below it "under a pipe" (Fig. 5-3-2). Samples were analyzed for inorganic metals, VOCs, PCBs, pesticides, radionuclides, and high explosives. Table 5-3-2 lists contaminants detected, concentration range, local background range, and SALs above background. The quality control check against standard solutions for these data indicates that chromium and cadmium values may be high by 156% and 30 to 50% respectively.

Pesticide values may be high by a factor of seven; VOC results may be biased low. Because of these limitations, these data will not be used in decision making, but are presented as information only.

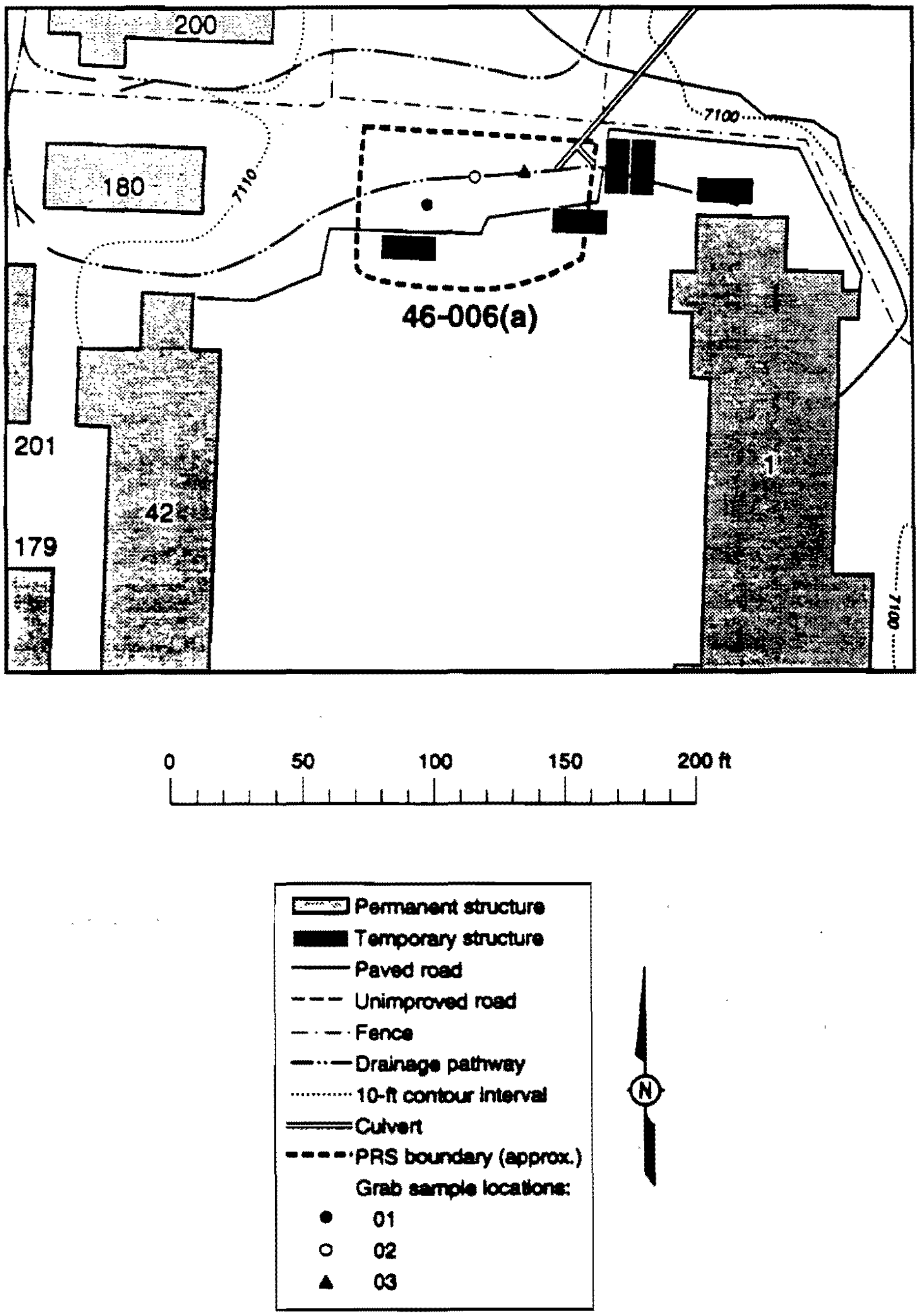


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Fig. 5-3-2. Approximate sampling locations for Environmental Problem #19.

TABLE 5-3-2

CONTAMINATION DETECTED AT SWMU 46-006(a) ENVIRONMENTAL PROBLEM #19[a, b]

CONTAMINANT	CONCENTRATION RANGE[a] (mg/kg)	LOCAL SOIL BACKGROUND (mg/kg)	SOIL SALs (mg/kg)
Metals			
Barium	102 - 134	120-810[c]	5 600[d]
Cadmium	nd[e] - 4.6	0.03-0.52[c]	80[d]
Chromium	14.3 - 21.7	4.2 - 136[c]	400 (VI)[d]
Copper	14.3 - 82.7	2-18[c]	3 000[d]
Uranium (total)	6 - 9	1.5-6.7[f]	240[g, d]
Zinc	74.9 - 112	38-71[c]	24 000[d]
Organic Compounds			
1,1,1-Trichloroethane (TCA)	nd - 0.005	0	1 000[d]
Aroclors (PCB)	nd - 2	0	0.09[h]
Alpha-BHC	nd - 0.16	0	0.1[h]
Chlordane	nd - 1.3	0	0.5[h]
DDD	nd - 0.073	0	3[h]
DDT	nd - 0.132	0	2[h]
Endosulfan	nd - 2.7	0	4[h]
Radionuclides	**(pCi/g)**	**(pCi/g)**	**(pCi/g)**
Cesium-137	0.134 - 1.373[i]	nd - 1.4[j]	4[k]
Uranium-234	nd - 267[i]		86[k]
Uranium-235	0.78 - 14.84[i]		18[k]
Americium-241	nd - 9.3[i]		22[k]

[a] LANL 1989, 0425.

[b] Because of data quality concerns, the Environmental Problem data presented in this table are used only to help identify PCOCs never as a basis for NFA recommendations.

[c] Ferenbaugh et al. 1990, 0099.

[d] Appendix J of the IWP (LANL 1992, 0768).

[e] nd - not detected.

[f] Duffy and Longmire 1993, 11-239.

[g] SAL for chemical toxicity only. Radiological SALs presented in radionuclide section.

[h] EPA 1990, 0432.

[i] Field measurements conducted on soil samples at field moisture content (i.e., wet). No laboratory analysis performed.

[j] Purtymun et al. 1987, 0211.

[k] Dorries 1993, 11-237.

One sample taken in a stained area on the side of the ditch contained pesticides. All three samples contained PCBs (0.3 to 2 ppm). SWMU Report references to Environmental Problem #19 showing thorium-232, plutonium-238, plutonium-239, -240, strontium-90, (LANL 1990, 0145) are in error; all reported results were "less than" (<) values.

SWMU 46-006(d). Environmental Problem #25 (LANL 1989, 0425) included samples from SWMU 46-006(d). Six soil grab-samples were collected; locations were at the east and west ends of Building TA-46-31, at the northeast corner of the middle bay, and outside the fence to the northwest (Fig. 5-3-3). Sample locations were chosen on the basis of visual stains. Samples were analyzed for VOCs, SVOCs, metals, radionuclides, and pesticides.

Data on SVOCs are imprecise because of very high concentrations of oils in all samples. Five polycyclic aromatic hydrocarbons (phenanthrene, fluoranthene, pyrene, benzo(a)anthrene, and crysene) were found below contract-required quantitation limits in two samples. These may be false positives due to the high concentrations of oils. One sample near the east end of TA-46-31 contained the highest levels. No pesticides were detected. Contaminants detected are listed in Table 5-3-3.

No data exist for the other PRSs in this aggregate.

5.3.1.2.2 Potential Pathways and Exposure Routes

The conceptual model (Fig. 5-3-4) presents historical sources of contamination, migration pathways and conversion mechanisms, potential current sources, release mechanisms, contact media, and exposure routes for the surface releases. A summary of exposure mechanisms and human receptors is presented in Table 5-3-4. Refer to Chapter 4 for a detailed discussion of the migration pathways, conversion mechanisms, human receptors, and exposure routes.

5.3.2 Remediation Decisions and Investigation Objectives

Problem Statement (DQO Step 1). This aggregate consists of numerous areas of known and suspected releases of hazardous constituents onto surface soils or pavement at TA-46. In each case constituents may be

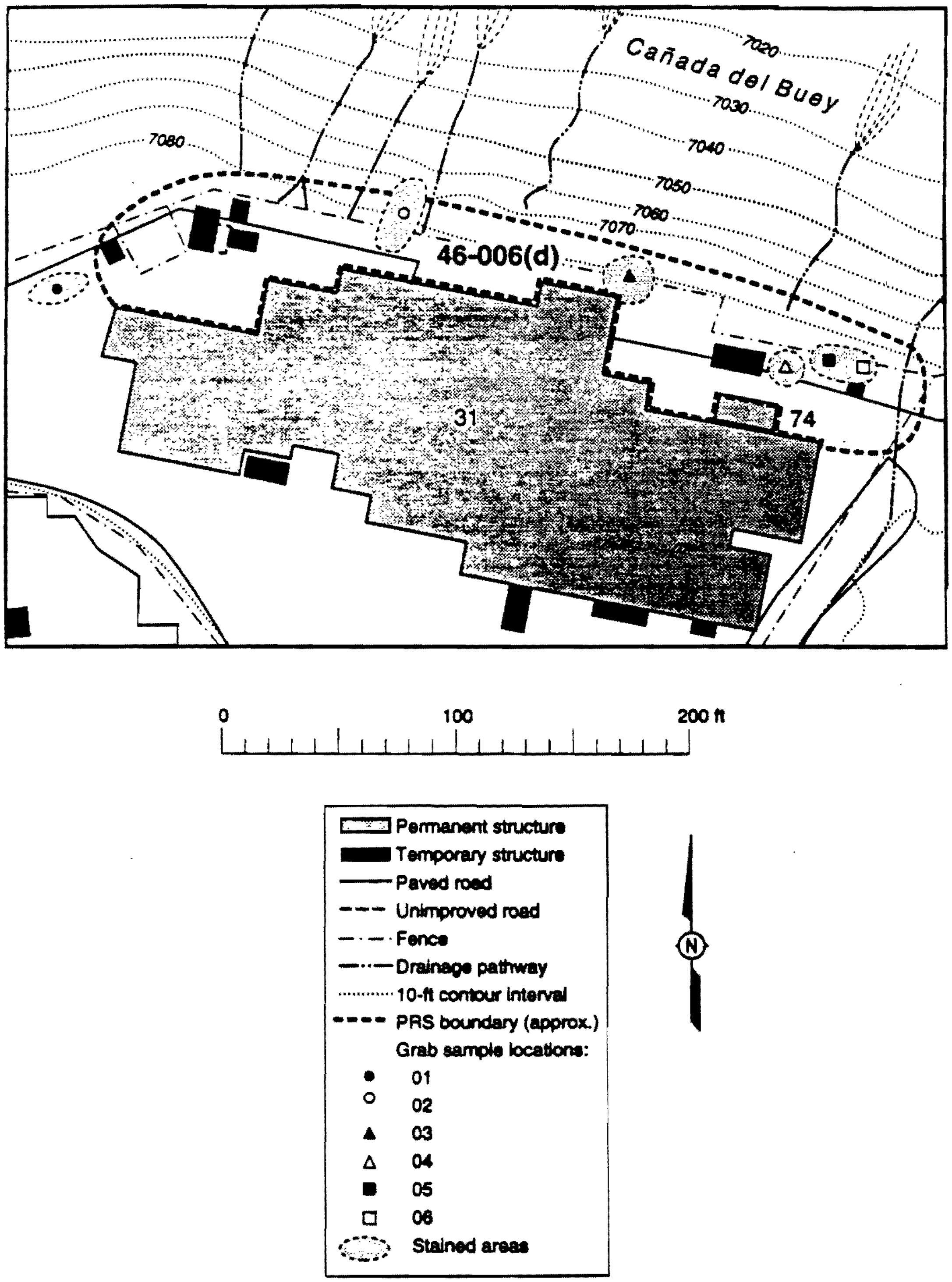

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Fig. 5-3-3. Approximate sampling locations for Environmental Problem #25.

TABLE 5-3-3

CONTAMINATION DETECTED AT SWMU 46-006(d) ENVIRONMENTAL PROBLEM #25[a, b]

CONTAMINANT	CONCENTRATION RANGE [a] (mg/kg)	LOCAL SOIL BACKGROUND (mg/kg)	SOIL SALs (mg/kg)
Metals			
Barium	37.3 - 69.8	120-810[c]	5 600[d]
Beryllium	nd[e] - 0.52	1.1-3.3[c]	0.16[d]
Chromium	nd - 20.8	4.2 - 136[c]	400 (VI)[d]
Copper	16.1 - 179	2-18[c]	3 000[d]
Lead	nd - 55.5	8-98[c]	500[f]
Mercury	nd - 20.3	.007 - .029[c]	24[d]
Nickel	nd - 12.2	1.6 - 19[c]	1 600[d]
Silver	nd - 3.5	<1.6[g]	400[d]
Uranium (total)	3 - 89	1.5-6.7[g]	240[h, d]
Zinc	66 - 341	38-71[c]	24 000[d]
Organic Compounds			
1,1,1-Trichloroethane (TCA)	nd - 0.012	0	1 000[d]
Acenaphthene	nd - 0.061	0	4 800[d]
Benzo(a)anthracene	nd - 1.3	0	
Benzo(a)pyrene	nd - 4.9	0	0.1[d]
Benzo(b)fluoranthene	nd - 6.8	0	
Benzo(g,h,i)perylene	nd - 2.7	0	
Benzo(k)fluoranthene	nd - 5.4	0	
Bis(2-Chloroethoxy)methane	nd - 0.039	0	
Chrysene	nd - 1.3	0	
Dibenzo(a,h)anthracene	nd - 3.7	0	
Dibenzofuran	nd - 0.077	0	
Fluoranthene	nd - 0.16	0	3 200[d]
Indeno(1,2,3-cd)pyrene	nd - 5.7	0	
Pyrene	nd - 0.4	0	2 400[d]
Aroclors (PCB)	nd - 6.2	0	0.09[i]

Table 5-3-3 (continued)

CONTAMINATION DETECTED AT SWMU 46-006(d) ENVIRONMENTAL PROBLEM #25[a, b]

CONTAMINANT	CONCENTRATION RANGE [a] (mg/kg)	LOCAL SOIL BACKGROUND (mg/kg)	SOIL SALs (mg/kg)
Radionuclides	**(pCi/g)**	**(pCi/g)**	**(pCi/g)**
Cesium-137	.028 - .363[i]	nd - 1.4[k]	4[f]
Uranium-235	nd - 1.92[j]		18[f]
Uranium-238	nd - 52.7[j]		59[f]
Plutonium-238	nd - 0.125	nd - 0.01[k]	27[f]
Plutonium-239, -240	.012 - 1.31	nd - 0.052[k]	24[f]

[a] LANL 1989, 0425.

[b] Because of data quality concerns, the Environmental Problem data presented in this table are used only to help identify PCOCs, never as a basis for NFA recommendations.

[c] Ferenbaugh et al. 1990, 0099.

[d] Appendix J of the IWP (LANL 1992, 0768).

[e] nd - not detected.

[f] Dorries 1993, 11-237.

[g] Duffy and Longmire 1993, 11-239.

[h] SAL for chemical toxicity only. Radiological SALs presented in radionuclide section.

[i] EPA 1990, 0432.

[j] Field measurements conducted on soil samples at field moisture content (i.e., wet). No laboratory analysis performed.

[k] Purtymun et al. 1987, 0211.

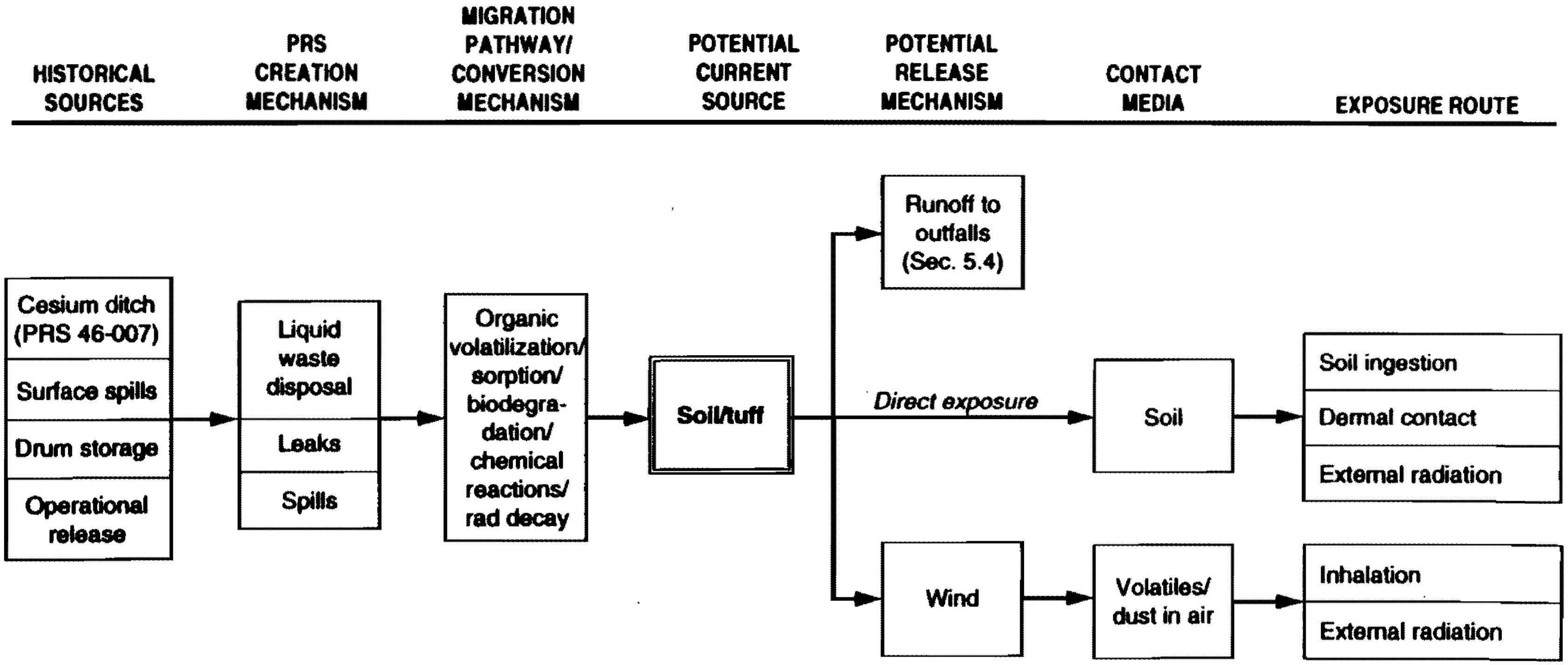


Fig. 5-3-4. **Conceptual exposure model for the surface releases aggregate at TA-46: Continued Laboratory operations.**

TABLE 5-3-4

EXPOSURE MECHANISMS AND RECEPTORS FOR SURFACE RELEASES

POTENTIAL AREA OF CONTAMINATION	RELEASE MECHANISMS	CURRENT POTENTIAL RECEPTORS	FUTURE POTENTIAL RECEPTORS
Surface soil	• Erosion, resulting in wind dispersion • Surface water runoff and infiltration • Volatilization • External irradiation	On-site workers and construction workers	On-site workers and construction workers

present in hazardous concentrations. There are numerous uncertainties regarding the existence and extent of potential releases. The Phase I problem is to determine the presence or absence of any contamination.

In all cases the area of potential contamination has been determined to be restricted to the surface or near-surface soils and pavement near the PRS. In cases where spread of contaminants via an outfall is suspected, the outfall is treated in Subsection 5.4

Decision Process (DQO Step 2). The objective of the Phase I investigation for this aggregate will be reconnaissance sampling to determine if PCOCs in concentrations above SALs exist in surface soils surrounding each PRS. If concentrations are below SALs for a particular PRS, there will be no further investigation of the PRS. If the Phase I investigation reveals that concentrations may be above SALs, it will be followed by further investigation aimed at conducting a baseline risk assessment, including Phase II sampling if required.

The remediation options for PRSs that pose a health risk will typically be removal of the contaminated soils. Since many of the areas of potential contamination are under pavement, the removal of soils may be delayed until decontamination and decommissioning (D&D), especially when it is not anticipated that migration of the contaminant will create health risks or increase removal costs.

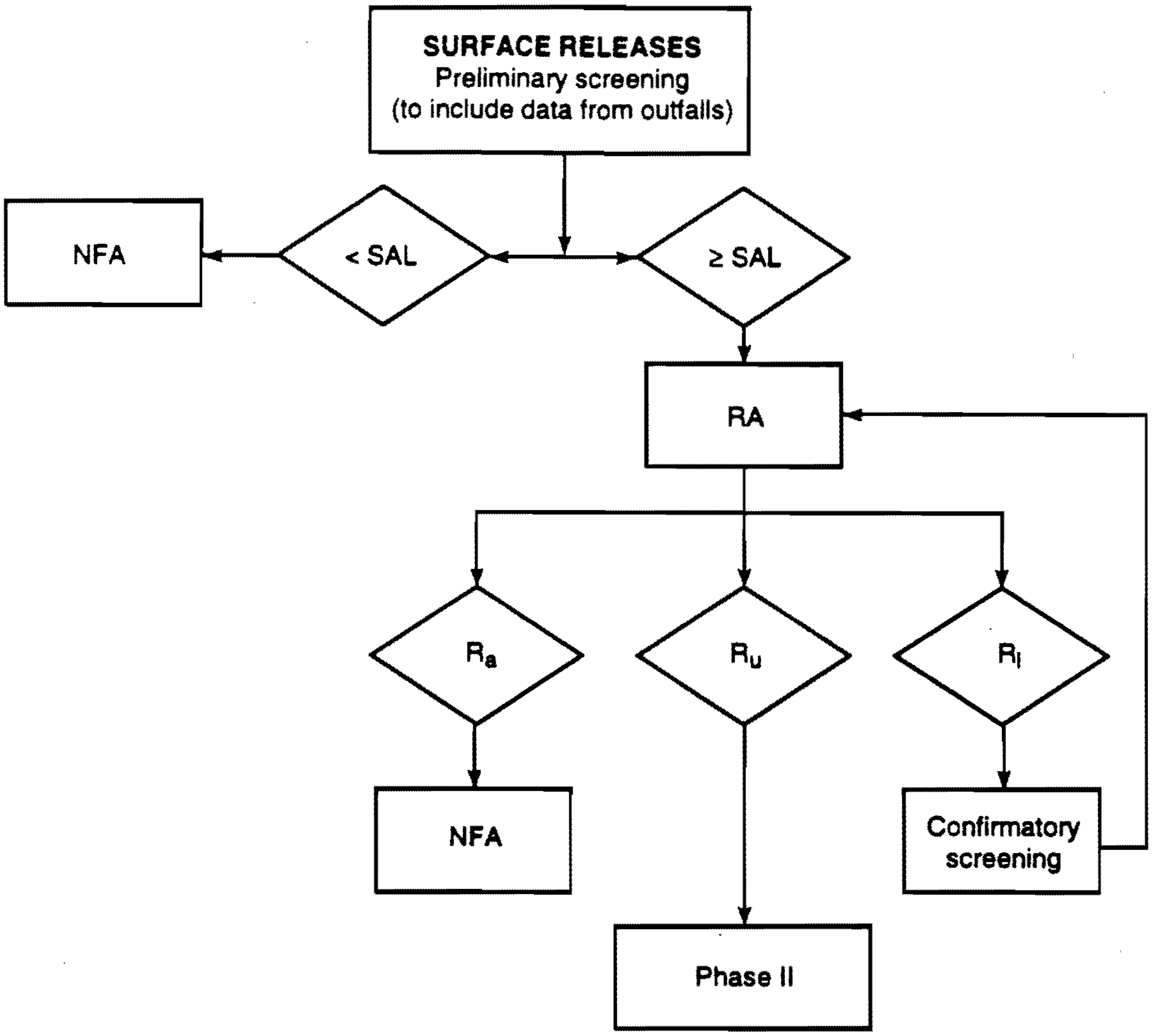
5.3.3 Data Needs and Data Quality Objectives

Inputs (DQO Step 3). The primary data needs are concentrations of PCOCs in surface soils and on pavements. Table 5-3-1 identifies PCOCs for each PRS.

Boundaries (DQO Step 4). For each PRS the boundaries consist of surface soils in the vicinity of the suspected release. Surface soil is defined in Table D-4. For paved surfaces boundaries will extend to 12 in. beneath the bottom of the pavement. For the two PRSs to be hand-augered, boundaries will extend to a depth of 18 in. or bedrock, whichever is encountered first. See Subsection 5.3.4 for a PRS-specific description of sampling boundaries. In each case specific sampling points will be placed at locations judged most likely to contain the highest concentration of PCOCs.

Decision Logic (DQO Step 5). The Phase I sampling plan will generate concentration values for each PCOC at each PRS. If any concentration is above the SAL, that PRS will be the focus of a baseline risk assessment including a Phase II sampling plan, if necessary. If no concentrations in samples collected for this aggregate exceed SALs, but if data collected for the outfall aggregate (Subsection 5.4) suggest the presence of COCs at a given surface release PRS, then that PRS will be the focus of Phase II sampling to determine the nature and extent of contamination. Otherwise, NFA will be proposed for the PRS. See Fig. 5-3-5 for a summary of the decision logic.

Design Criteria (DQO Step 6). For each PRS reconnaissance sampling will be designed so that there is a 90% probability of detecting contamination above SALs if as much as 50% of the area is contaminated above SALs. (The 50% figure was selected based on an expectation that any remaining contamination from surface releases will be found in a highly homogeneous pattern. All of the release mechanisms listed in Table 5-3-4 would tend to create such a pattern.) These criteria will be enhanced by the use of biased sampling. In addition, results from samples taken for other aggregates will be used to support Phase I decision-making for this aggregate as appropriate and possible. Specifically, analytical data generated from samples collected for Subsection 5.4 (Outfalls) will be used for evaluation of the presence of PCOCs resulting from surface releases.



NFA – No further action
SAL – Screening action levels for potential contaminants of concern
RA – Baseline risk assessment
R_a – Risk acceptable
R_u – Risk unacceptable
R_i – Risk indeterminate

Fig. 5-3-5. Decision logic for surface releases (preliminary screening).

A summary of each DQO step, with a brief rationale for each step, is given in Table 5-3-5.

5.3.4 Phase I Sampling and Analysis Plan

Phase I reconnaissance sampling will focus on determining the presence and concentration of PCOCs above SALs at surface release sites at TA-46. Potential surface release contaminants include metals, radionuclides, VOCs, SVOCs, PCBs, asbestos, and oils. For detailed discussions, refer to Appendix D for field investigation approach and methods, Appendix E for a summary of the data base, and Appendix H for maps.

TABLE 5-3-5

DQO SUMMARY FOR SURFACE RELEASES

DQO STEP	RATIONALE
Problem statement	• Establish presence or absence of PCOCs
Decision process	• Reconnaissance screening • Compare concentrations to SALs
Inputs	• Concentration of PCOCs in soils and on pavement
Boundaries	• Soil and pavement in vicinity of PRS
Decision logic	• Compare maximum sample concentration to SAL • If SAL is exceeded, continue investigation • Make separate decision for each PRS • Outfall data may contribute to decision
Design criteria	• 90% probability of detecting contaminants above SALs when 50% of area is contaminated • Enhance probability by judgmental sampling

Engineering Surveys. Engineering surveys will be performed to precisely locate all surface release PRSs and sample collection locations (Table 5-3-6). Geomorphologic surveys will be performed to generate maps of the drainages associated with surface releases.

Field Screening. This Phase I investigation will be initiated with a field survey of the PRS aggregate for radiation and organic vapors. The radiation survey and organic vapor screening will be performed according to the methods found in Laboratory SOPs, which are in preparation.

TABLE 5-3-6

ENGINEERING SURVEYS FOR SURFACE RELEASES

SURVEYS	REFERENCE
Geodetic mapping	Appendix D
Geomorphologic mapping	Appendix D

Appropriate health and safety precautions will be undertaken according to the Laboratory's ER Program SOPs (LANL 1993, 0875).

Sample Control. All samples will be field screened for radioactivity, metals, and organic vapors to identify gross concentrations of contaminants using the methods found in Laboratory SOPs, which are in preparation.

All samples will initially be analyzed in the field analytical laboratory. Gamma spectrometry will be used to identify radionuclides present in the samples. X-ray fluorescence will be used to detect gross concentrations of metals. Field laboratory analyses will determine the selection of samples to be submitted for analytical laboratory analysis. All analytical laboratory samples will be analyzed for all PCOCs, both hazardous and radioactive. Field quality assessment samples will be collected according to guidance provided in the Installation Work Plan (LANL 1992, 0768). All scheduled duplicate samples are listed in Table E-1. See Appendix D, Subsection 2.8, for a discussion of Quality Control Samples.

Sample control activities in the field will be performed according to LANL-ER-SOPs 01.01 to 01.06.

5.3.4.1 Sampling

Sampling Rationale. Phase I decisions for the surface release aggregate will utilize analytical results from the outfall aggregate investigation. The analytical results of outfall sampling will act as an indicator to whether additional surface release sampling should be performed.

The rationale for this approach is that all reported surface releases have occurred on the mesa top (and in many instances on paved surfaces). Therefore, it is reasonable to assume that a majority of releases would have washed off of the surface and flowed down into the drainages and then through the outfalls. Only massive spills of solvents are likely to have dissolved and migrated downward though the surface and into or through the asphalt. It is assumed that only these large solvent spills would have left contaminants in or beneath the asphalt paving. Therefore samples into and beneath asphalt pavements will be limited to areas of visible staining that have no exposure to a flushing mechanism or pronounced drainage path.

Outfalls associated with the PRSs in this aggregate will be investigated in Subsection 5.4. No outfalls will be sampled for this surface release aggregate.

The sixteen PRSs in the surface release aggregate have been categorized into three groups requiring similar sample collection techniques. The categories are delineated in Table 5-3-7.

Table 5-3-8 is a summary of all site surveys and sample analyses in the surface release aggregate.

5.3.4.2 PRS Sampling Summaries

5.3.4.2.1 Hand Augered Sampling

Sampling at **SWMU 46-006(a)**, a concrete and asphalt drum storage area located at the north end of the parking lot between TA-46-1 and TA-46-42, will consist of the collection of three hand-augered samples. The augered core holes will be located in the unpaved drainage ditch that collects runoff from the SWMU (Fig. 5-3-6). Data from Outfall P, described in Subsection 5.4, will also be used to make the decision for this SWMU.

Sampling at **SWMU 46-008(g)**, a former unpaved storage area south of TA-46-76, will consist of the boring of three hand-augered samples. The augered core holes will be located in the drainage swale that receives runoff from the SWMU (Fig. 5-3-7). These samples will be collected with hand-augered soil sampler equipment to a depth of 18 in. or bedrock, which ever is encountered first. Specimens (0.2 ft in length minimum) will be collected at the top, middle, and bottom of the sample. Sample collection will be procedurally controlled through the use of LANL-ER-SOP-06.10, Hand Auger and Thin-Wall Tube Sampler. Data from samples at Outfall BB, described in Subsection 5.4, will also be used to make the decision for this SWMU.

TABLE 5-3-7

SAMPLE COLLECTION CATEGORIES FOR SURFACE RELEASES

PRS	SAMPLING TECHNIQUE
PRS Requiring Hand-Augered Samples	
46-006(a)	Hand-auger soil/sediment samples
46-008(g)	Hand-auger soil/sediment samples
PRS Requiring Surface/Near-surface Sampling	
46-003(f)	Surface soil samples
46-003(h)	Surface soil samples
46-006(b)	Surface pavement/soil sample
46-006(c)	Surface soil samples
46-006(d)	Surface soil samples
46-006(f)	Surface soil samples
46-006(g)	Surface pavement/soil sample
46-007	Surface soil samples
46-008(a)	Surface soil samples
46-008(b)	Surface soil samples
46-008(e)	Surface soil samples
46-008(f)	Surface soil samples
46-010(d)	Surface soil samples
46-008(d)	No samples/sampled in Subsection 5.4, Outfalls Aggregate

5.3.4.2.2 Surface Sampling

Procedural control of surface soil sample collection will be though the use of LANL-ER-SOP-06.11, Stainless Steel Surface Soil Sampler or LANL-ER-SOP-06.09, Spade and Scoop Method of Collection Soil Samples. Procedural control of the collection of near-surface samples will be according to LANL-ER-SOP Collection of Near-surface Soil Samples Beneath Pavements (in preparation). A near-surface sample is defined in this aggregate as a sample that begins immediately beneath the surface of the asphalt or concrete pavement and extends 6 in. beneath the bottom surface of the pavement. These near-surface samples will be drilled with a small, portable diamond-coring unit.

Table 5-3-8

Summary of OU 1140 TA-46 Surface Releases Site Surveys, Sampling and Analysis

Structure Sample Total 0
Surface Sample Total 32
Subsurface Sample Total 21

					Field Surveys			Samples				Field Screening						Field Lab.						Laboratory Analyses																
	PRS	Outfall Field ID	PRS Type Outfall Type	Phase 1 Approach	Land Survey	Geophysics	Radiation	Sampled Media	Structure	Surface	Subsurface	Gross Alpha	Gross Gamma/Beta	Organic Vapor	Combustible gas/oxygen	X-Ray Fluorescence	Lithologic Logging	Gross Alpha	Tritium	Soil Moisture	Gamma Spectroscopy	PCB	VOA	Gamma Spectroscopy	Isotopic Americium	Total Uranium	Isotopic Uranium	Isotopic Plutonium	Isotopic Thorium	Isotopic Cesium	VOA (SW 8240)	Semivolatiles (SW 8270)	TCLP	Metals (SW 6010)	PCB (SW 8080)	Asbestos	Mercury	Herbicides	Pesticides	Aggregate
(1)	46-003-f		Sand filter	Reconn	1		1	Soil	0	3	0	1	1	1		1	1	1			1	1	1	1			1				1	1		1	1		1			5.3
(2)	46-003-h		Sink Drain	Reconn	1		1	Soil	0	3	0	1	1	1		1							1								1	1		1						5.3
(3)	46-006-a		Drum Storage	Reconn	1		1	Soil	0	0	9	1	1	1		1		1				1	1	1	1		1			1	1	1		1	1				1	5.3
(4)	46-006-b		General Storage	Reconn	1		1	Soil/Paving	0	0	1	1	1	1		1		1				1		1			1					1		1	1					5.3
(5)	46-006-c		Drum Storage	Reconn	1		1	Soil	0	2	0	1	1	1		1						1										1		1	1					5.3
(6)	46-006-d		Surface Disposal	Reconn	1		1	Soil	0	5	0	1	1	1		1		1				1	1	1			1	1		1	1	1		1	1					5.3
(7)	46-006-f		General Storage	Reconn	1		1	Soil	0	3	0	1	1	1		1		1				1	1	1			1				1	1		1	1	1	1			5.3
(8)	46-006-g		Surface Release	Reconn	1		1	Paving	0	0	2	1	1	1				1					1	1			1				1	1								5.3
(9)	46-007		Surface Disposal	Reconn	1		1	Soil	0	2	0	1	1	1		1		1					1	1			1				1	1		1†			1			5.3
(10)	46-008-a		Drum Storage	Reconn	1		1	Soil	0	2	0	1	1	1		1																1		1						5.3
(11)	46-008-b		Drum Storage	Reconn	1		1	Soil	0	3	0	1	1	1								1										1			1					5.3
(12)	46-008-d		Drum Storage	Reconn	1		1	Soil	0	2	0	1	1	1		1		1				1	1	1			1				1	1		1	1					5.3
(13)	46-008-e		Drum Storage	Reconn	1		1	Soil	0	4	0	1	1	1		1		1					1	1			1				1	1		1	1					5.3
(14)	46-008-f		Drum Storage	Reconn	1		1	Soil	0	1	0	1	1	1		1		1					1	1			1				1	1		1						5.3
(15)	46-008-g		Drum Storage	Reconn	1		1	Soil	0	0	9	1	1	1								1	1								1	1			1					5.3
(16)	46-010-d		General Storage	Reconn	1		1	Soil	0	2	0	1	1	1		1						1									1	1		1	1	1				5.3

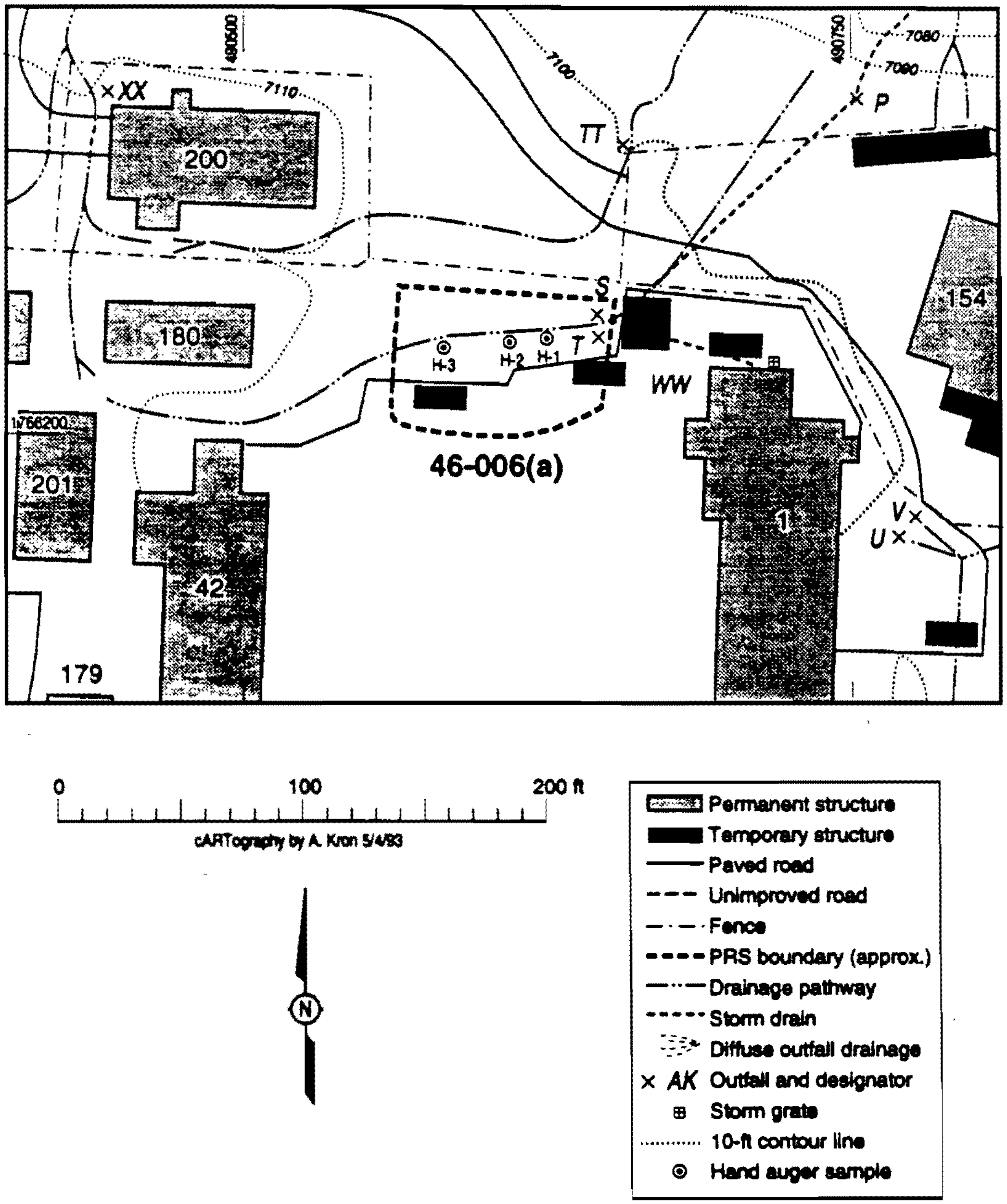


Fig. 5-3-6. Sampling locations at PRS 46-006(a).

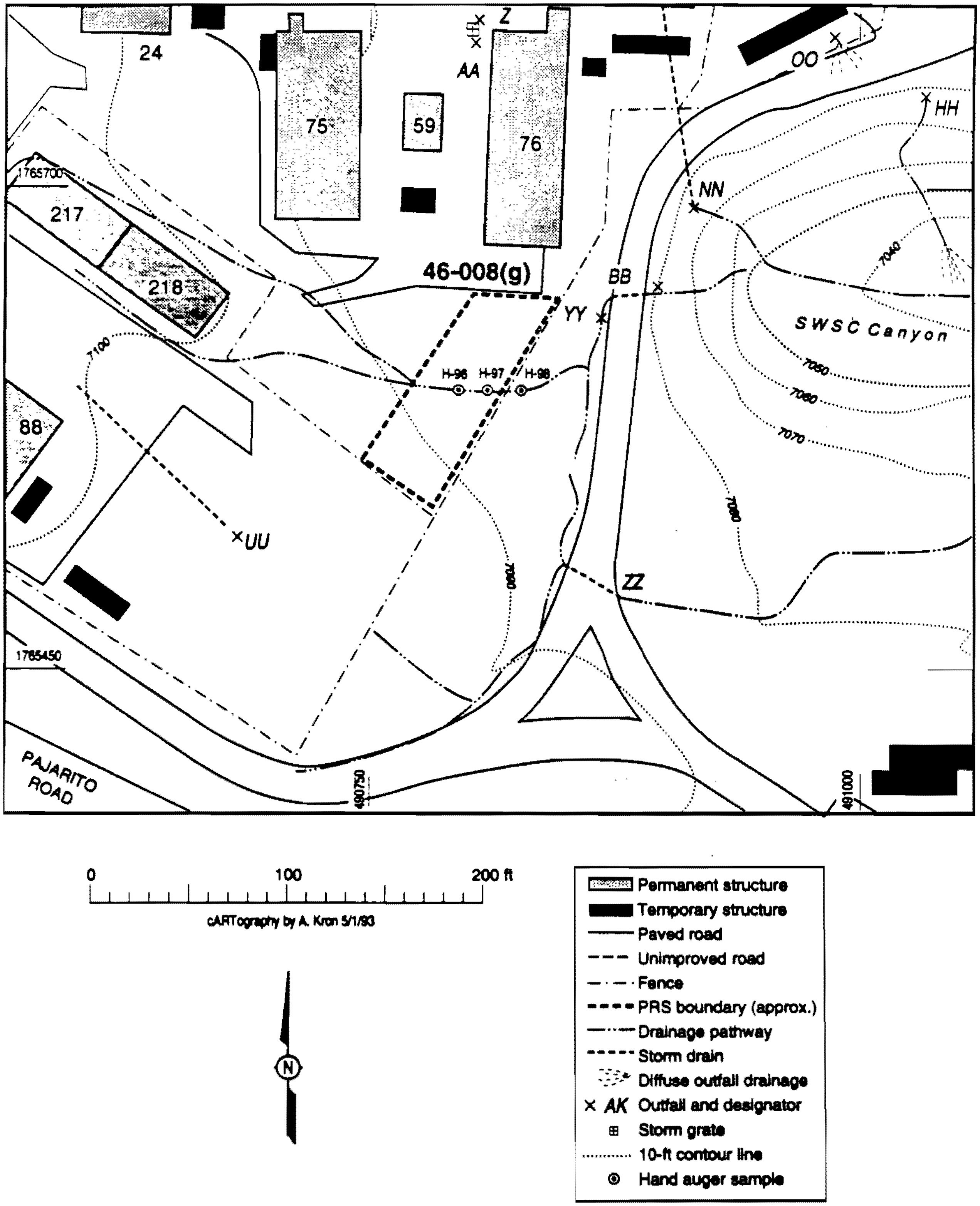


Fig. 5-3-7. Sampling locations at PRS 46-008(g).

Sampling at **SWMU 46-003(f)**, a sand filter, will consist of three surface soil samples. Locations will be determined by field screening (Fig. 5-3-8). Data from samples at Outfall FF, described in Subsection 5.4, will also be used to make the decision for this SWMU.

Sampling at **SWMU 46-003(h)** beneath a small outfall (GG) from TA-46-77 will consist of surface soil samples. Two will be taken directly beneath the pipe; a third 5 ft downslope from the outfall (Fig. 5-3-9).

Sampling at **SWMU 46-006(b)**, former storage shed TA-46-197 located 40 ft north of TA-46-41, will include drilling one near-surface borehole. The pavement borehole will be located at the indentation in the asphalt at the southeast corner of the former shed area (Fig. 5-3-10). Data from samples at Outfall QQ, described in Subsection 5.4, will also be used to make the decision for this SWMU.

Sampling at **SWMU 46-006(c)**, stained, sloping asphalt pavement east of TA-46-158, will consist of the collection of two surface soil samples from soil at the point where runoff from the SWMU exits a culvert. This area is northeast and downgradient of the asphalt area and feeds into surface runoff Outfall PP (Fig. 5-3-11). Data from samples at Outfall PP, described in Subsection 5.4, will also be used to make the decision for this SWMU.

Data from these samples will be used to confirm the NFA recommendation for SWMU 46-010(f) described in Subsection 6.2.2.

Sampling at **SWMU 46-006(d)**, a disposal area north of TA-46-31, will consist of the collection of five surface soil samples in the area immediately north and downgradient of the asphalt area (Fig. 5-3-12). Data from samples at Outfall AG, AH, and AI, described in Subsection 5.4, will also be used to make the decision for this SWMU.

Sampling at **SWMU 46-006(f)**, a group of active storage sheds east of Building TA-46-1, will consist of the collection of three surface soil samples. The samples will be gathered from the east and north side of the three structures in a swale that receives runoff from areas around the sheds (Fig. 5-3-13). Data from samples at Outfall M, described in Subsection 5.4, will also be used to make the decision for this SWMU.

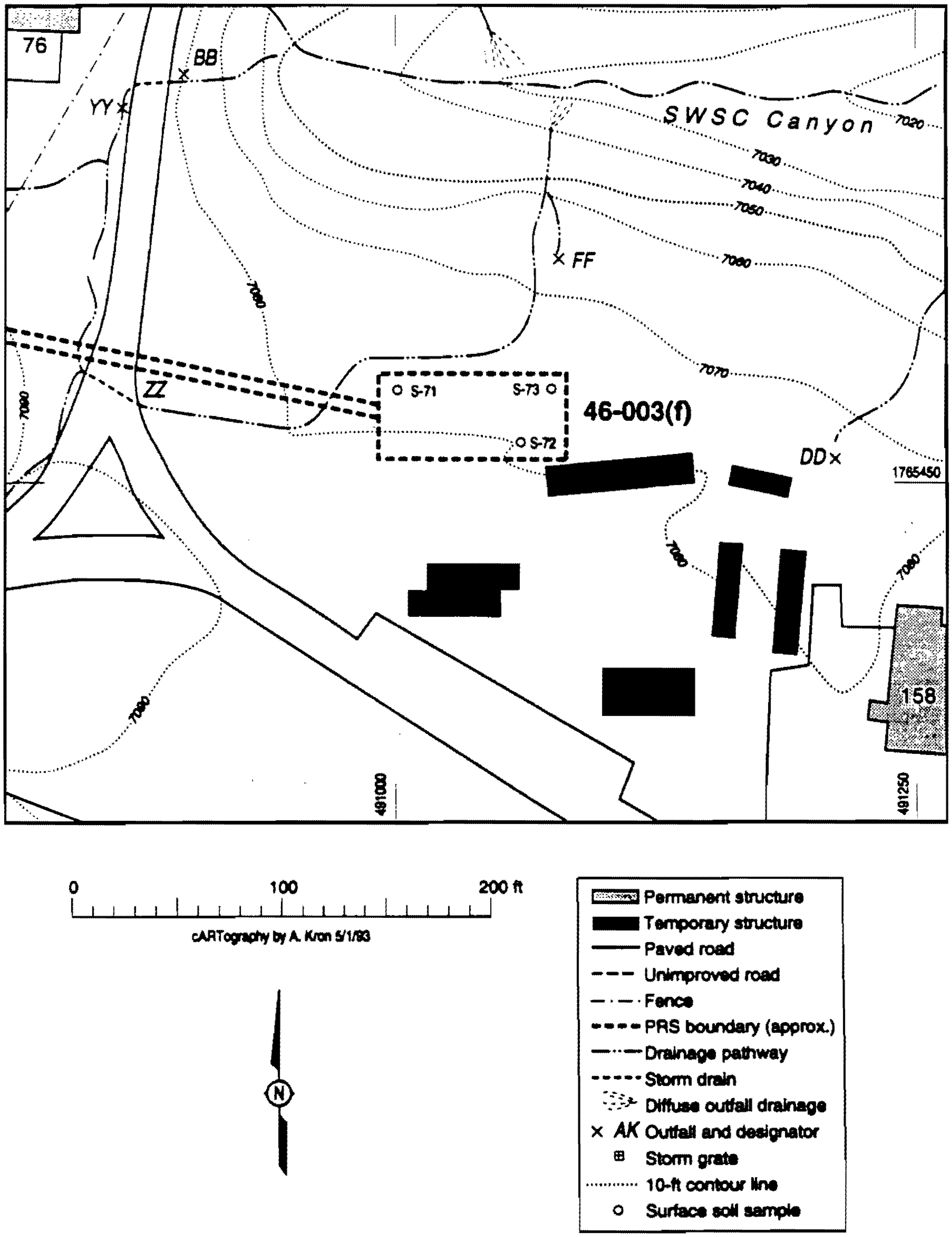


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Fig. 5-3-8. Sampling locations at PRS 46-003(f).

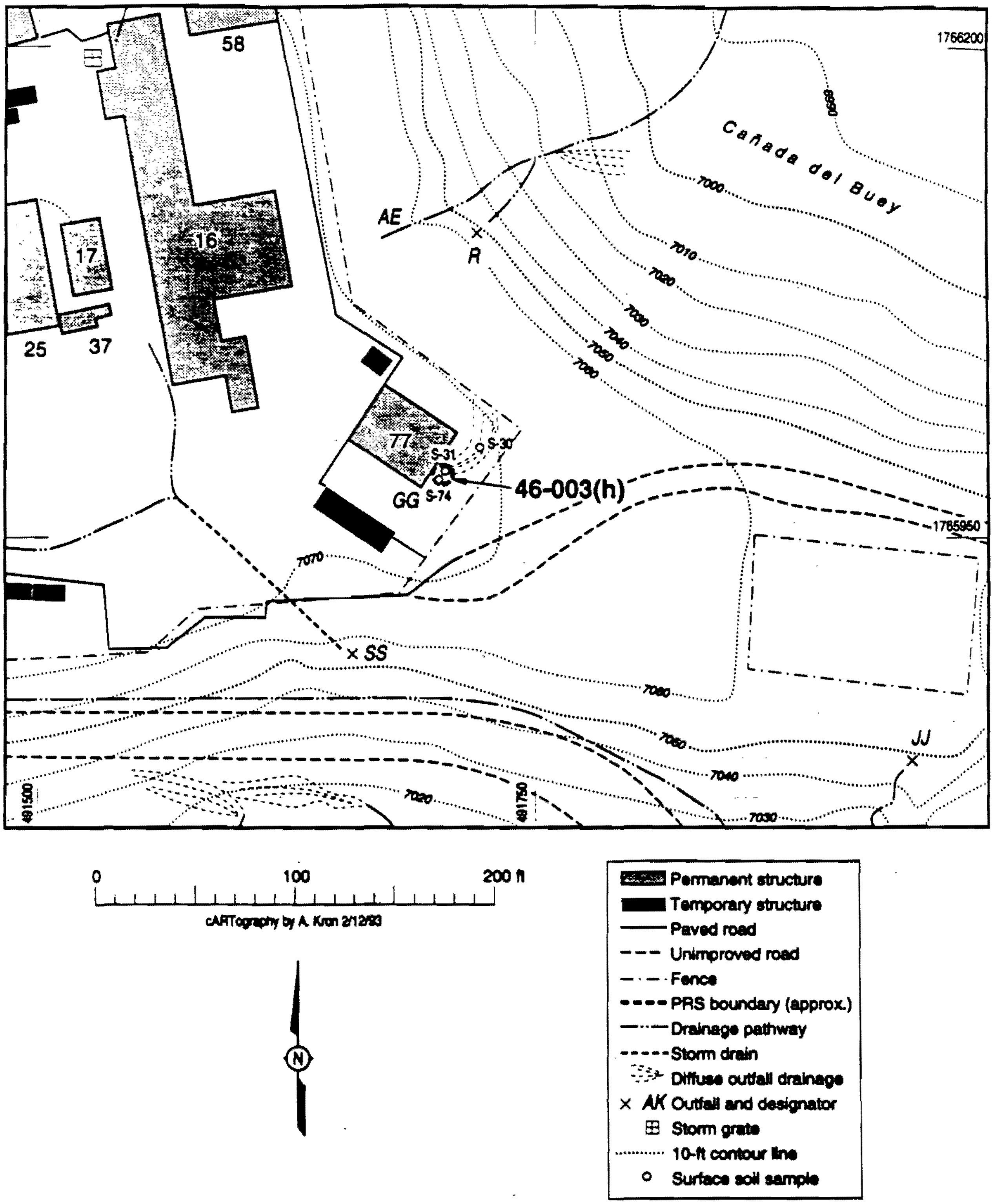

Fig. 5-3-9. **Sampling locations at PRS 46-003(h).**

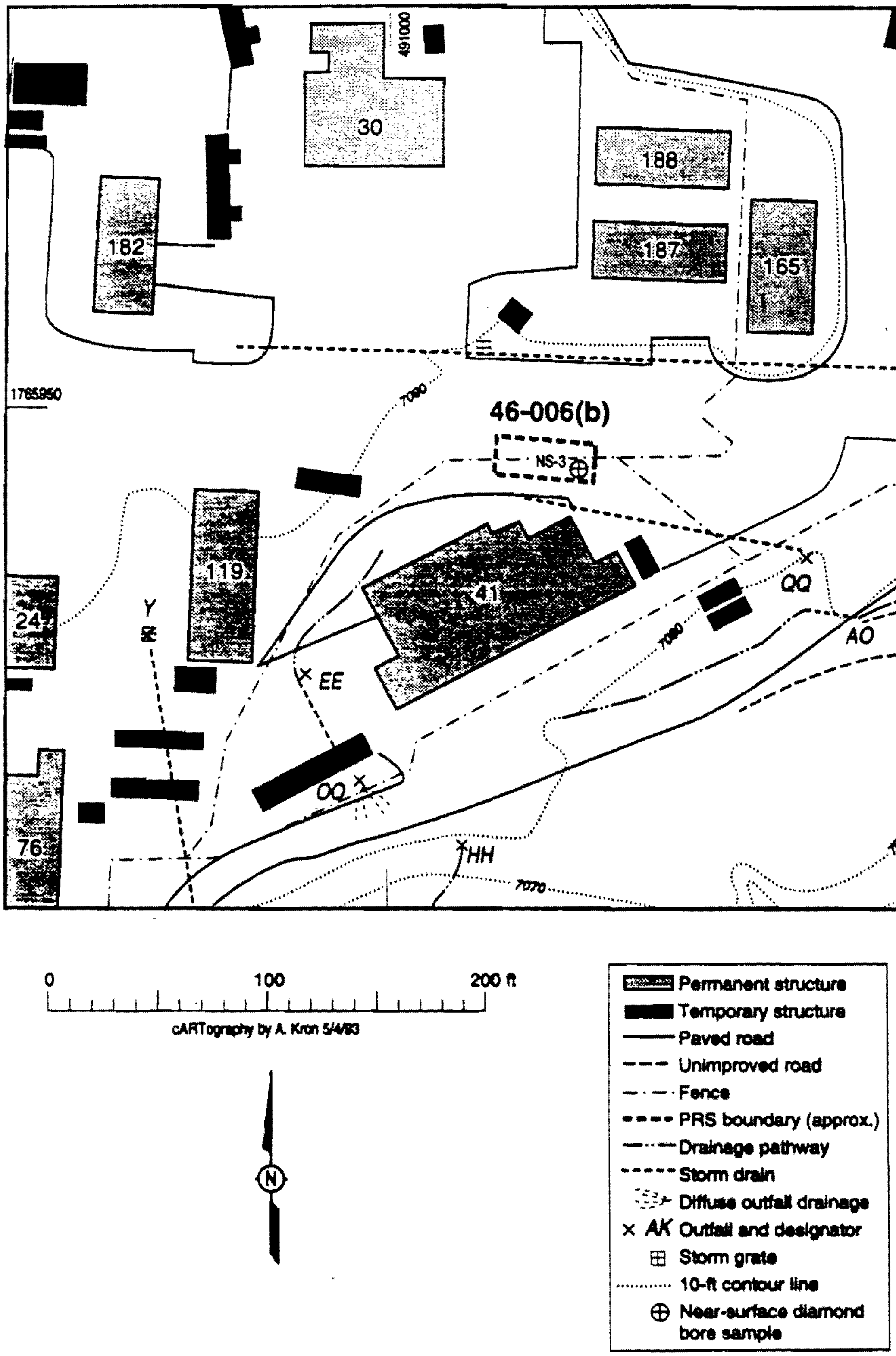

Fig. 5-3-10. Sampling locations at PRS 46-006(b).

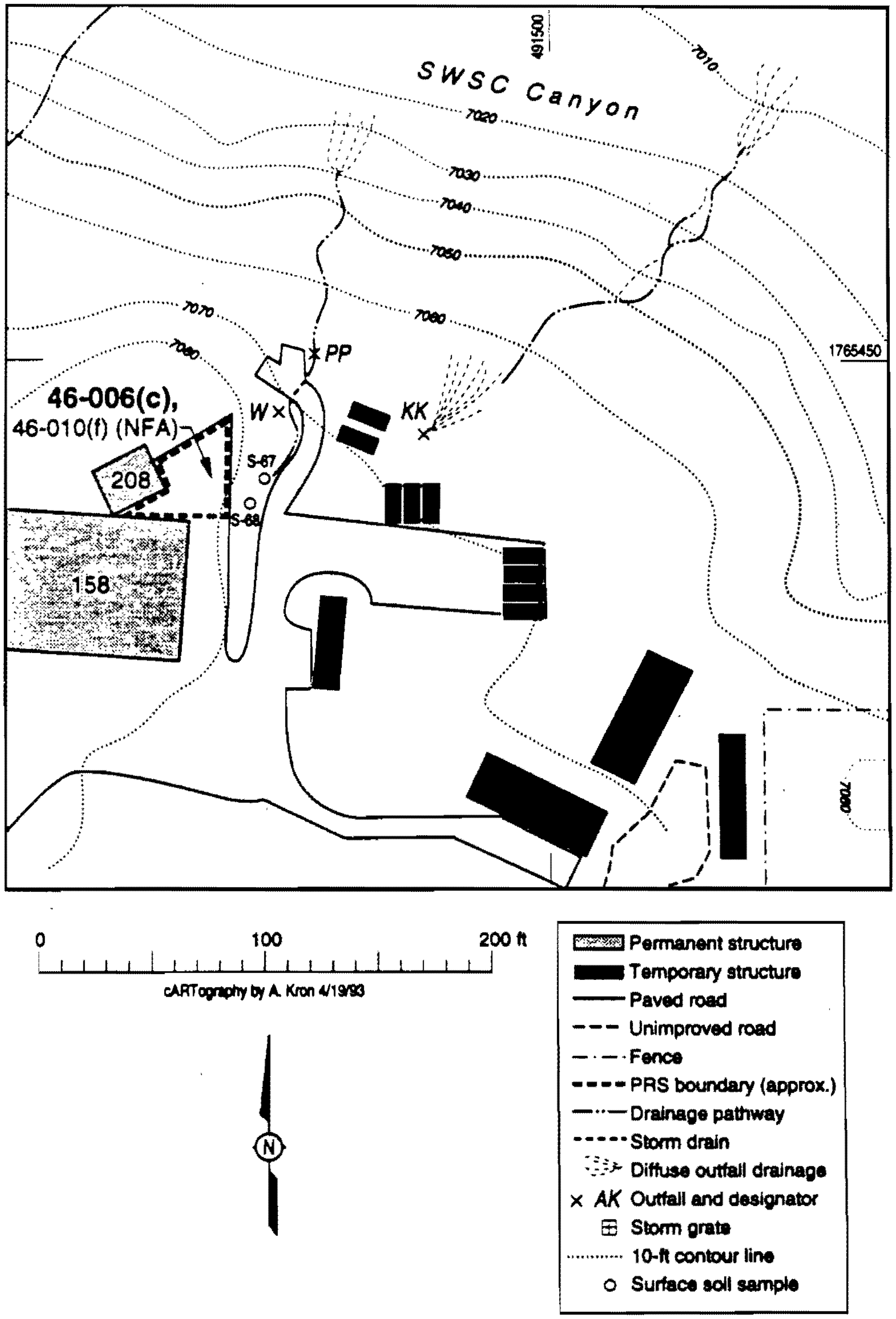

Fig. 5-3-11. Sampling locations at PRS 46-006(c).

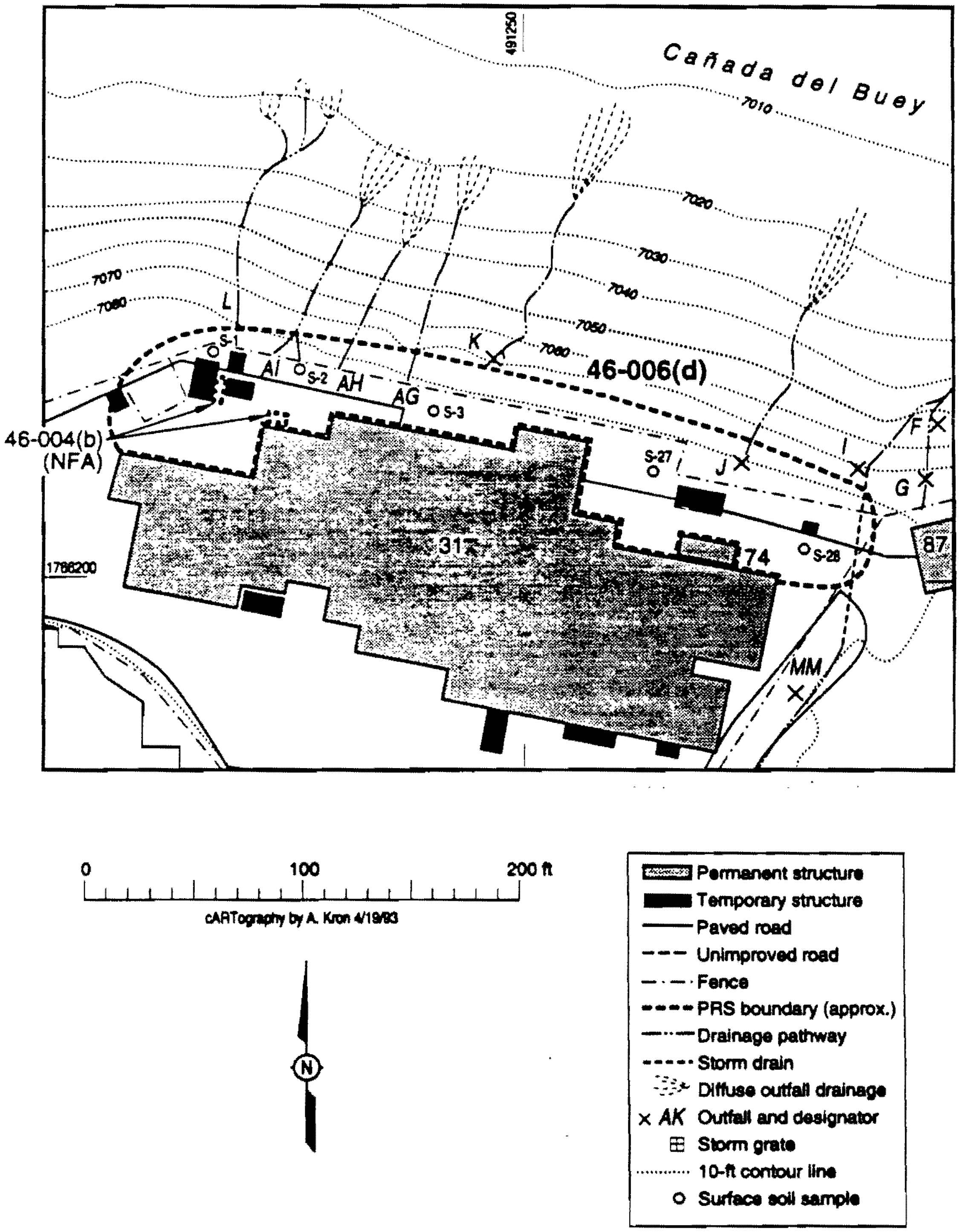

Fig. 5-3-12. Sampling locations at PRS 46-006(d).

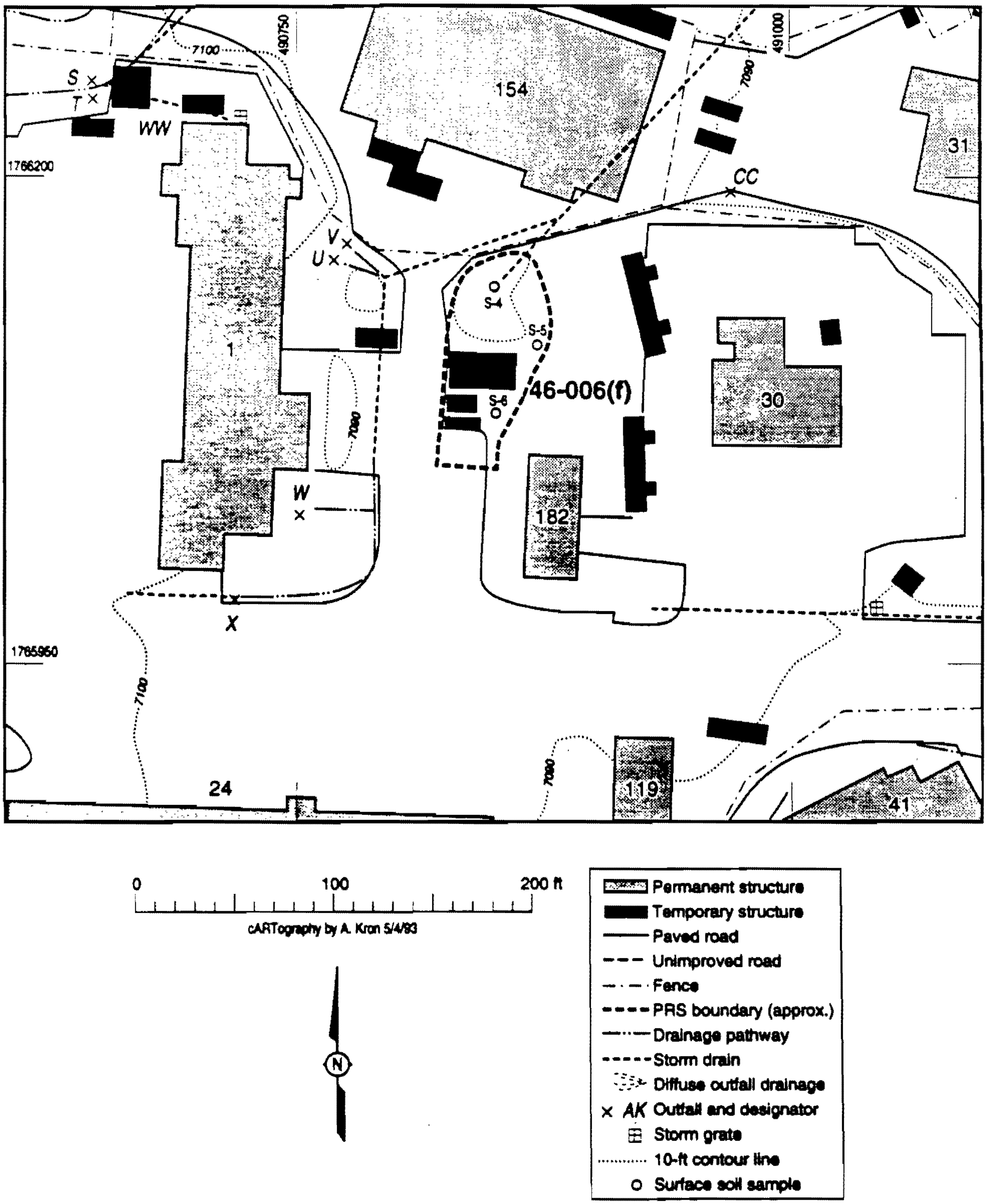

Fig. 5-3-13. Sampling locations at PRS 46-006(f).

Sampling in **SWMU 46-006(g)**, a shed attached to the west end of Building TA-46-31, will consist of the drilling of two near-surface boreholes into the pavement. The samples will be collected at the oil stains near the entrance door and toward the east end of the shed adjacent to the raised concrete slab (Fig. 5-3-14). Data from samples at Outfall AG and AI, described in Subsection 5.4, will also be used to make the decision for this SWMU.

The **SWMU 46-007** disposal ditch will be sampled by the collection of two surface soil samples equally distributed along the lowest point in the ditch south of TA-46-1 (Fig. 5-3-15). Data from samples at Outfall M, described in Subsection 5.4, will also be used to make the decision for this SWMU.

Data from these samples will be used to confirm the NFA recommendation for SWMU 46-010(a) described in Subsection 6.2.2.

Sampling at **SWMU 46-008(a)**, a former drum storage area east of TA-46-88, will consist of the collection of two surface soil samples, one located south and one northeast of the asphalt pavement. These points receive runoff from the paved SWMU surface (Fig. 5-3-16). Data from samples at Outfall ZZ, described in Subsection 5.4, will also be used to make the decision for this SWMU.

Data from these samples will be used to confirm the NFA recommendation for SWMU 46-001 described in Subsection 6.2.2.

Sampling at **SWMU 46-008(b)**, the inactive, unpaved storage area east of TA-46-1, will include the collection of three surface soil samples (Fig. 5-3-17). Data from samples at Outfall M, described in Subsection 5.4, will also be used to make the decision for this SWMU.

Sampling at **SWMU 46-008(d)**, a 100 x 200 ft storage area south of Building TA-46-24, will consist of the collection of two surface soil samples at the southwest end (Fig. 5-3-18). Data from these samples will be used to confirm the NFA recommendation for SWMU 46-010(b) described in Subsection 6.2.2.

Sampling at **SWMU 46-008(e)**, the former drum storage area south of TA-46-187, will consist of the collection of four surface soil samples at points distributed across this unpaved SWMU (Fig. 5-3-19). Data from

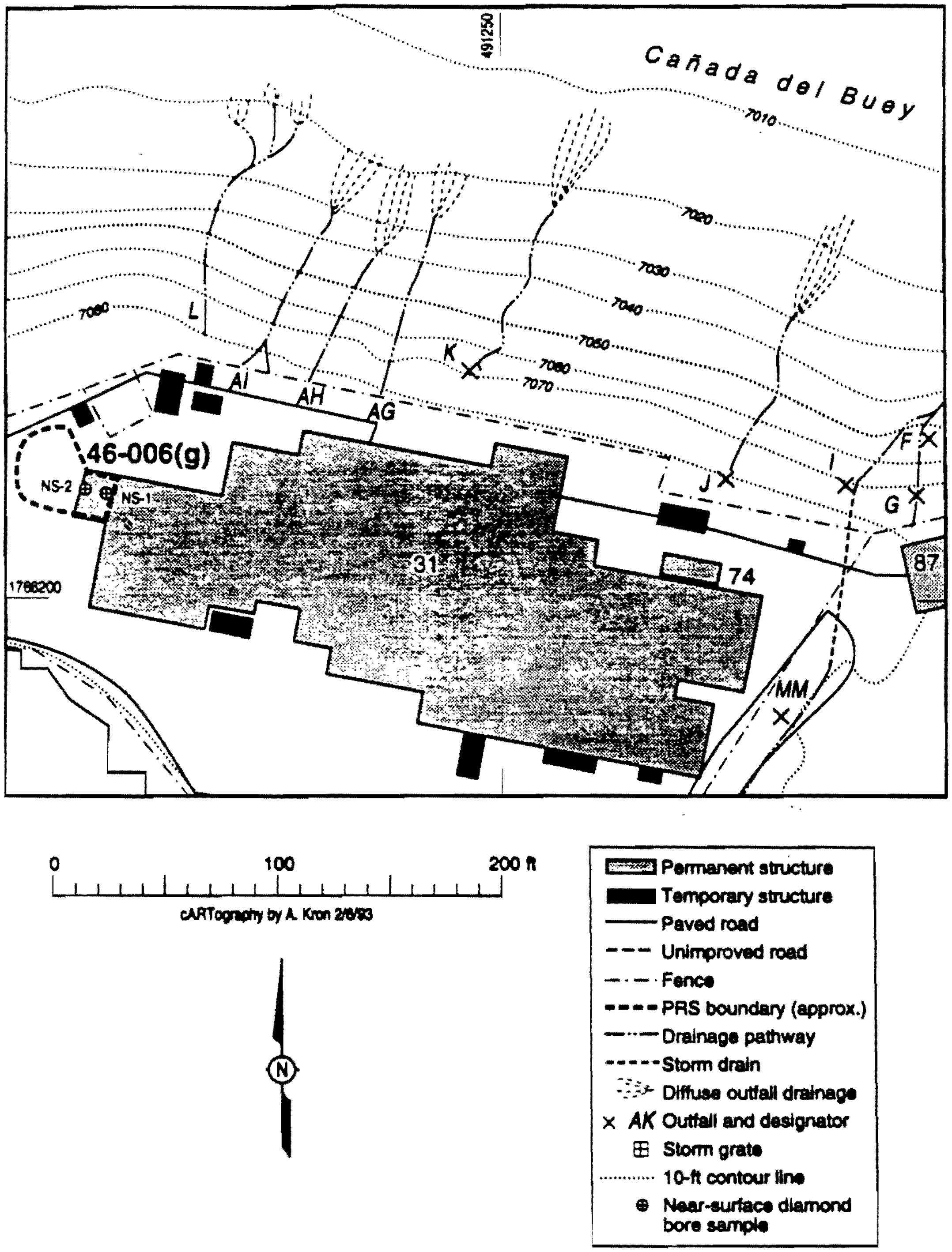

Fig. 5-3-14. Sampling locations at PRS 46-006(g).

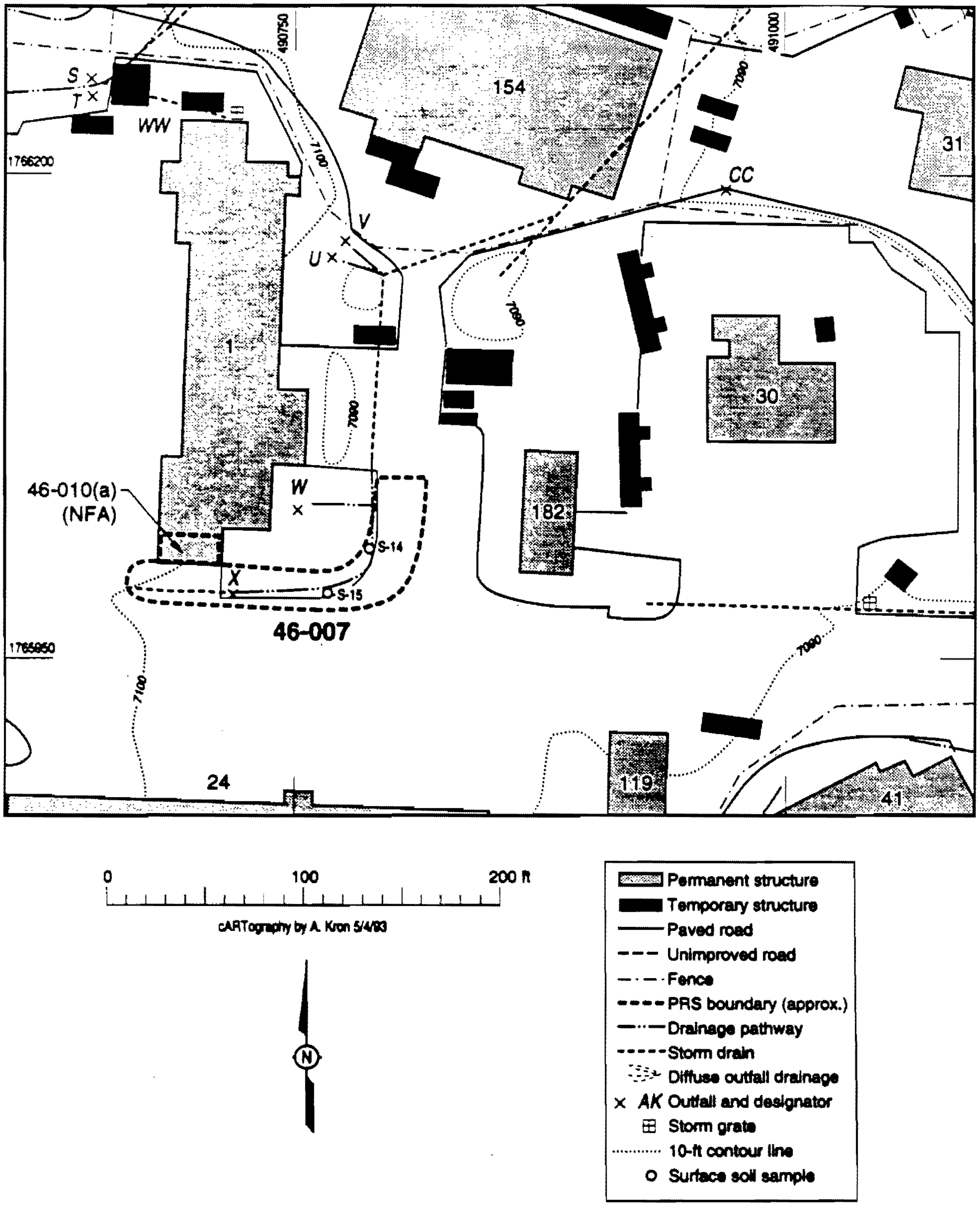

Fig. 5-3-15. Sampling locations at PRS 46-007.

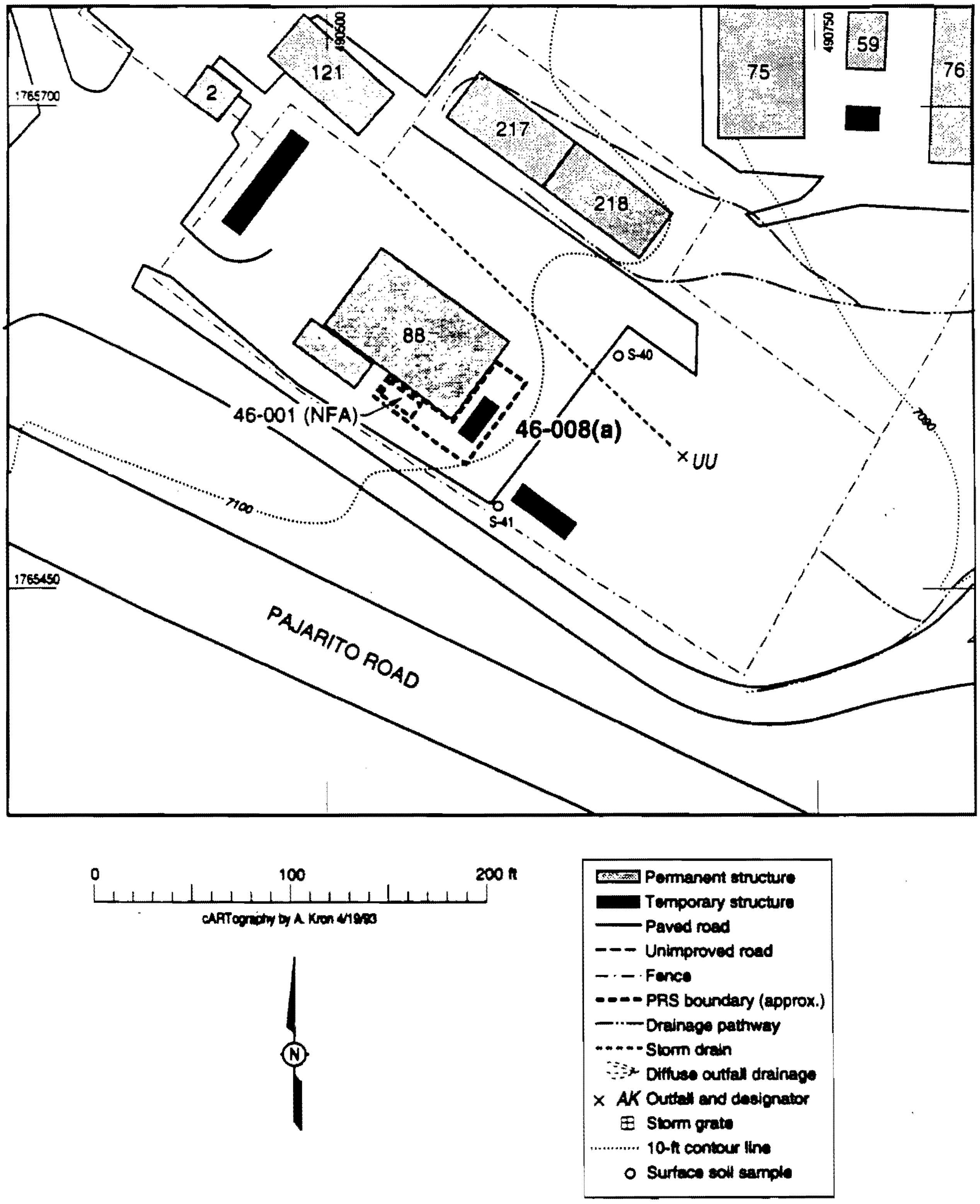

Fig. 5-3-16. **Sampling locations at PRS 46-008(a).**

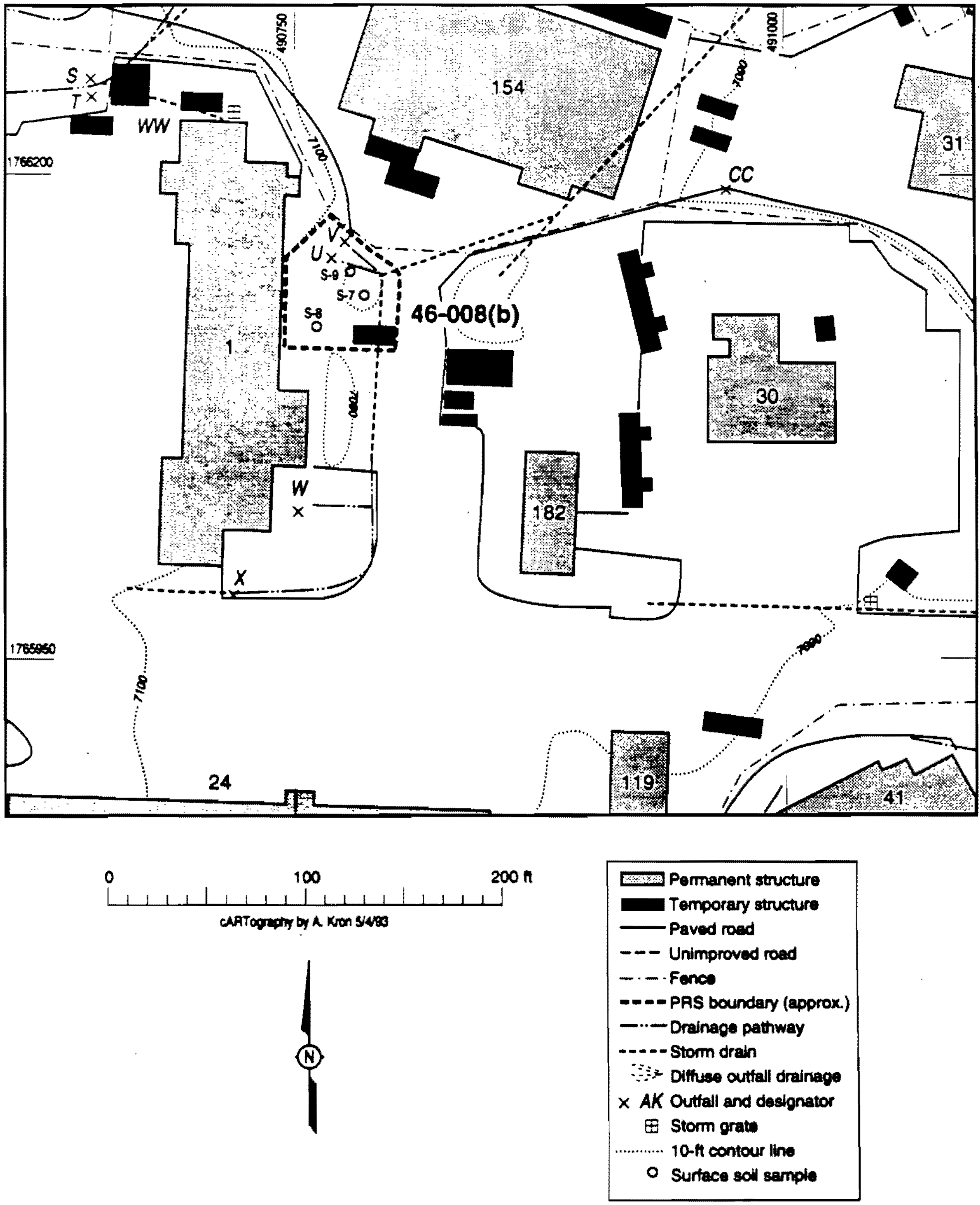

Fig. 5-3-17. Sampling locations at PRS 46-008(b).

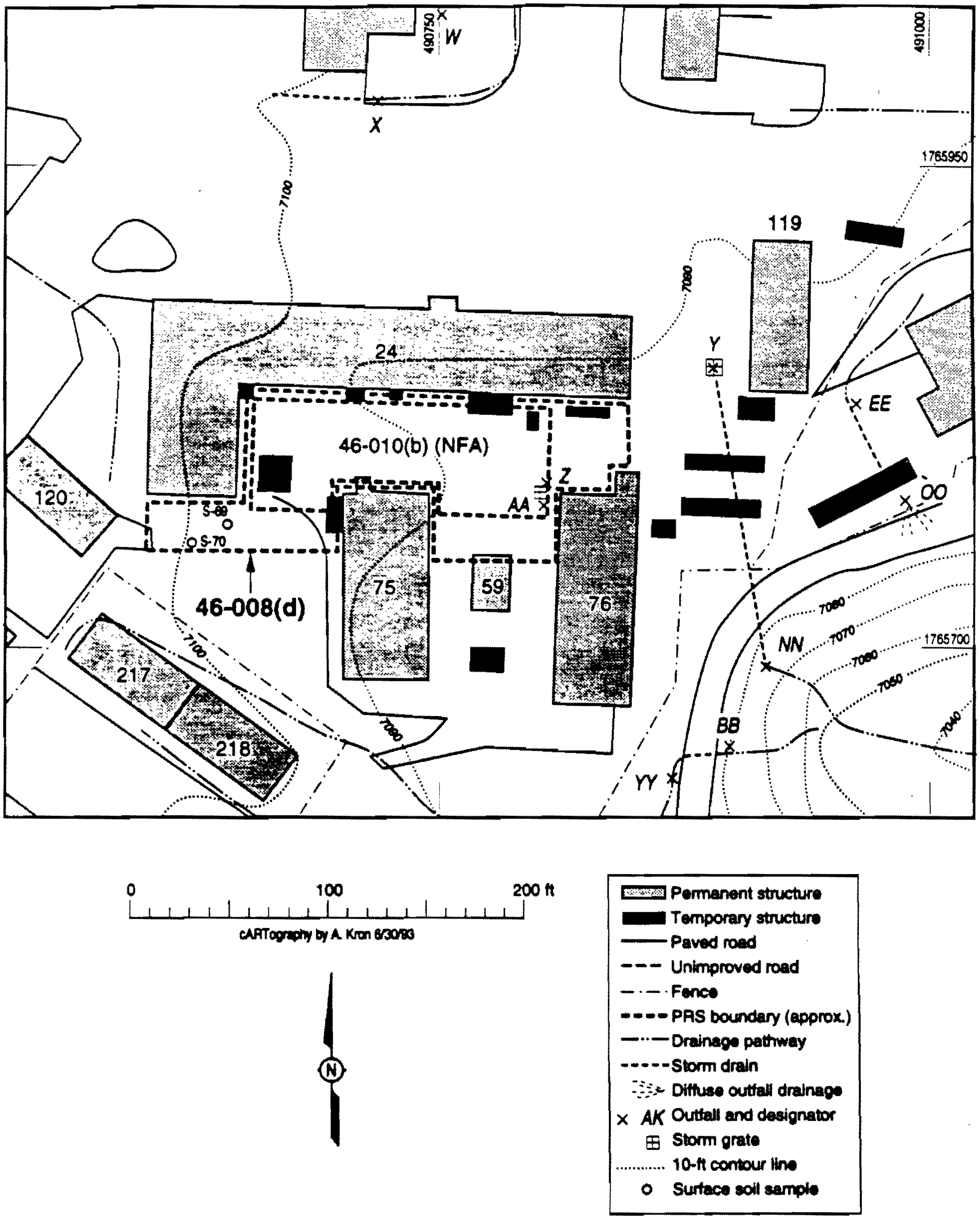

Fig. 5-3-18. Sampling locations at PRS 46-008(d).

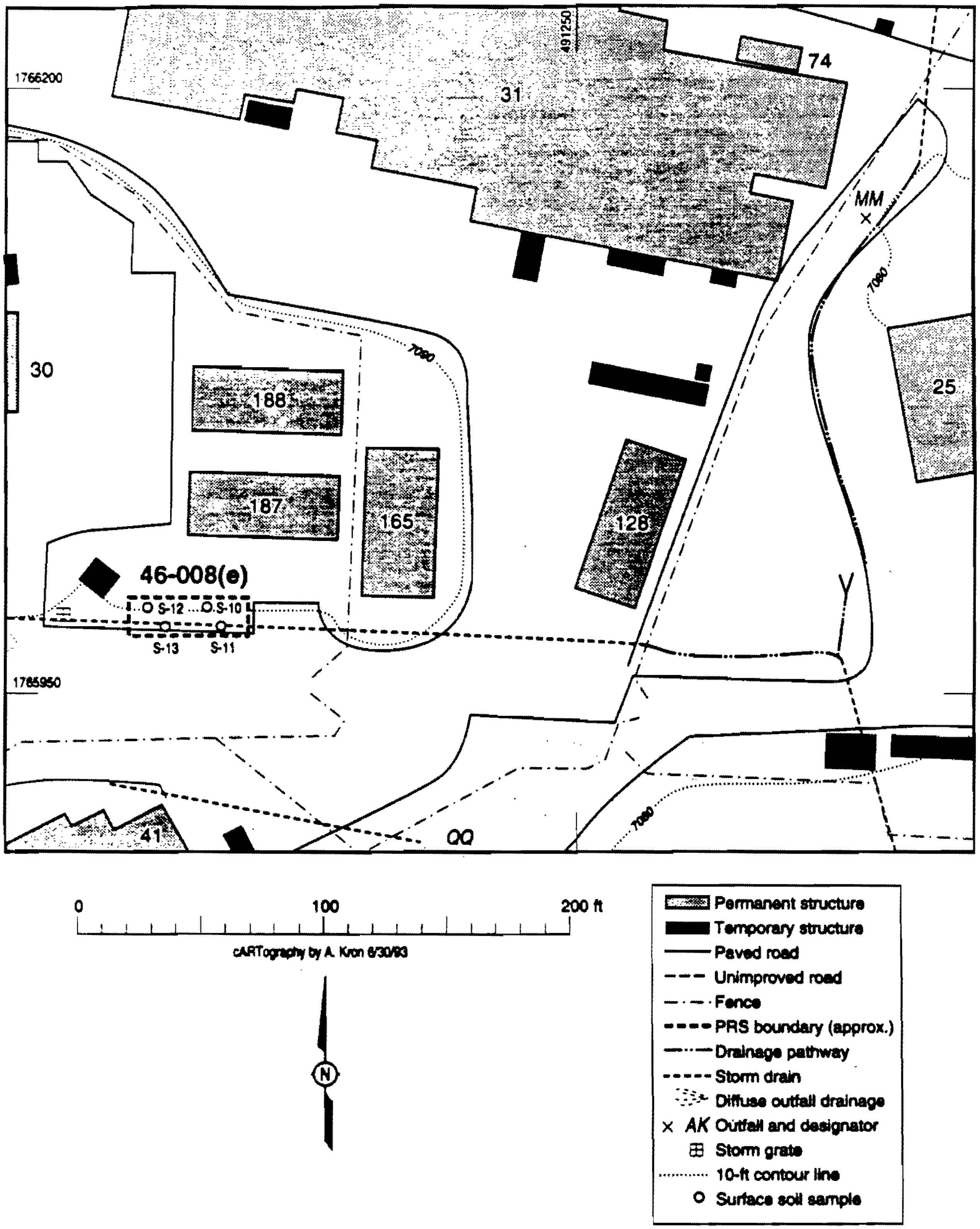

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Fig. 5-3-19. Sampling locations at PRS 46-008(e).

samples at Outfall RR, described in Subsection 5.4, will also be used to make the decision for this SWMU.

Sampling at **SWMU 46-008(f)**, the former drum storage location on the southeast side of TA-46-31, will consist of the collection of one surface sample on a soil area that may have received runoff from the paved area (Fig. 5-3-20). Data from samples at Outfall RR, described in Subsection 5.4, will also be used to make the decision for this SWMU.

Data from these samples will be used to confirm the NFA recommendation for SWMU 46-010(c) described in Subsection 6.2.2.

Sampling at **SWMU 46-010(d)**, the unpaved satellite accumulation area located on the south side of TA-46-41, will consist of the collection of two surface soil samples within the SWMU (Fig. 5-3-21). Data from samples at Outfall AO, described in Subsection 5.4, will also be used to make the decision for this SWMU.

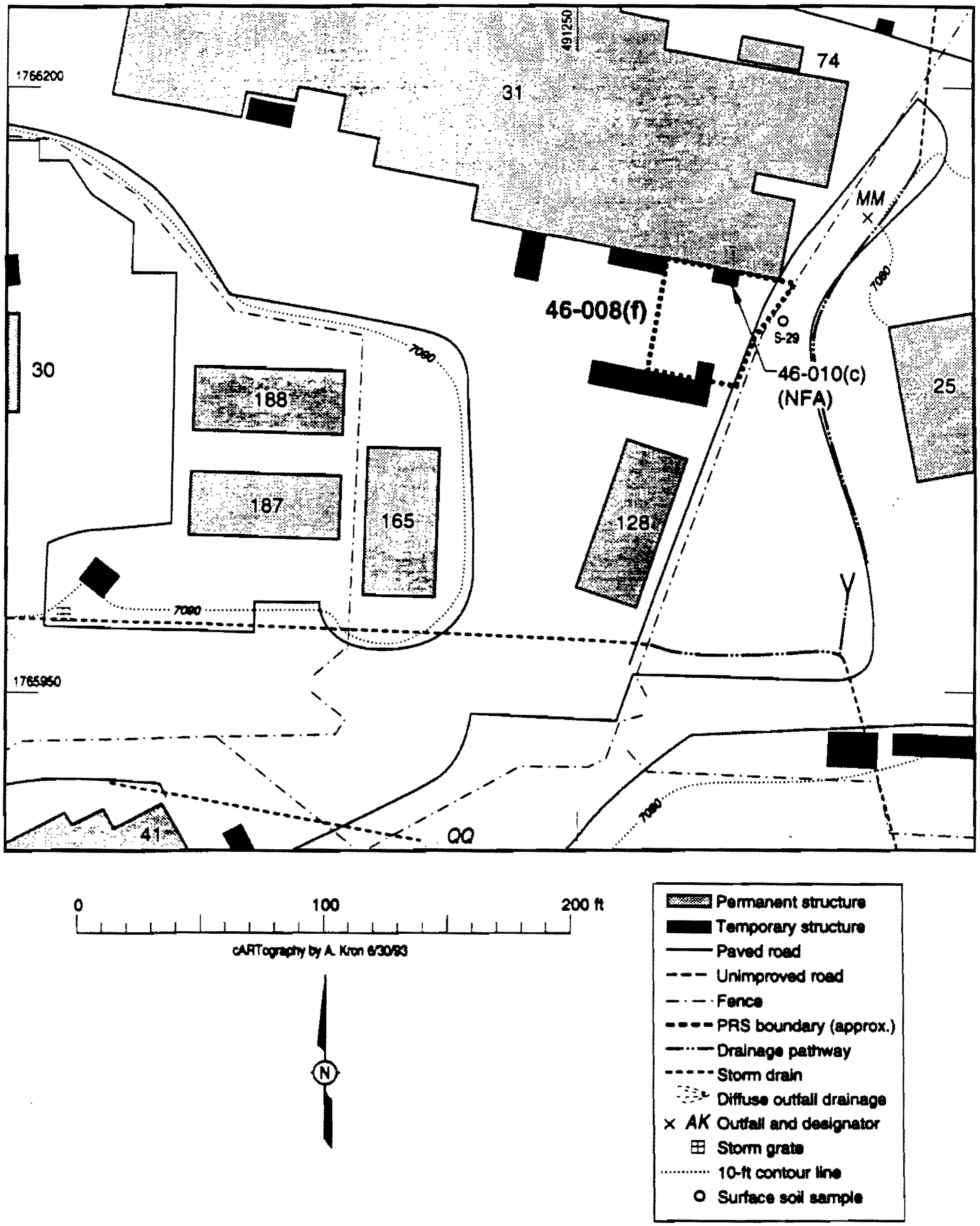

Fig. 5-3-20. Sampling locations at PRS 46-008(f).

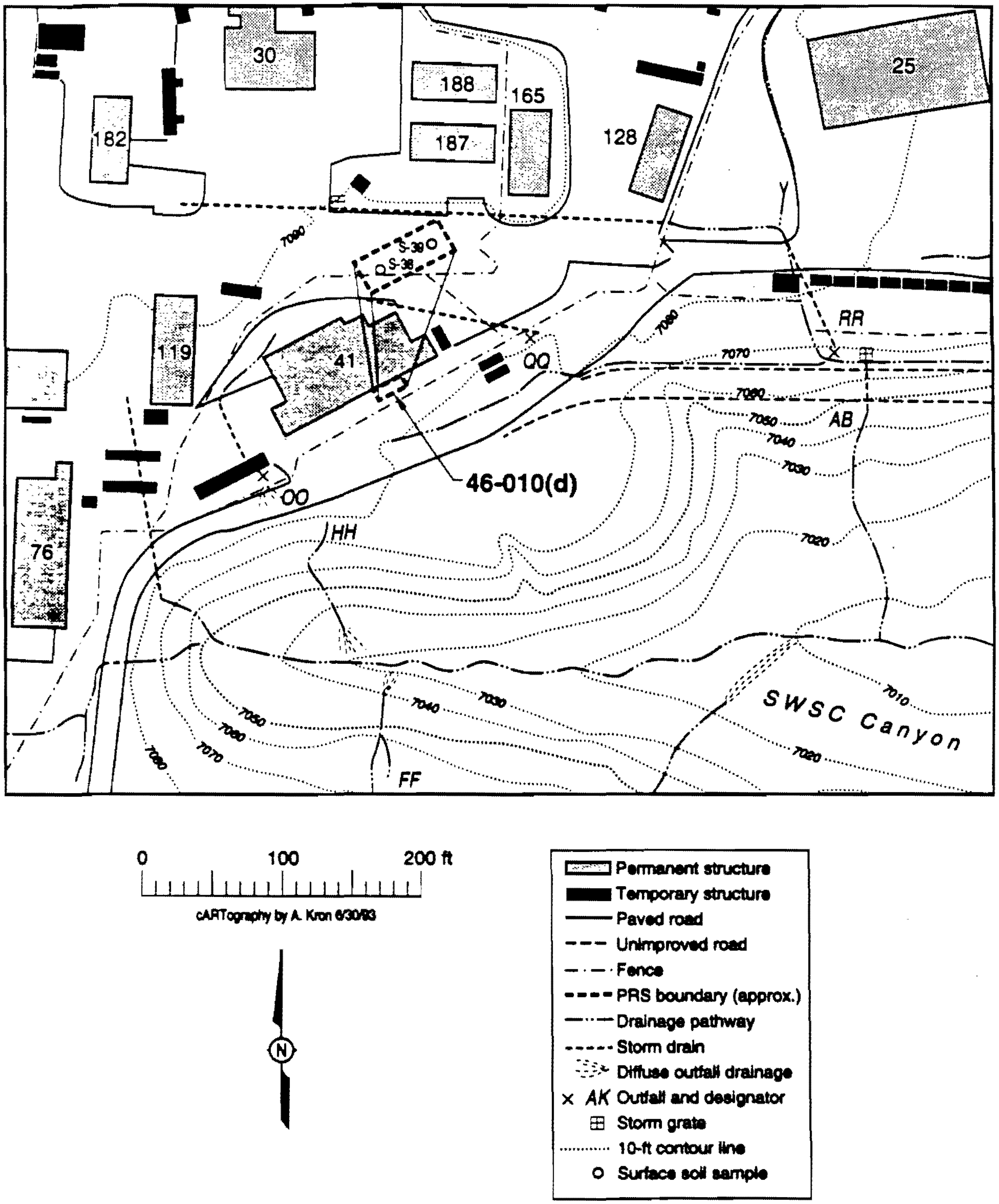

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Fig. 5-3-21. Sampling locations at PRS 46-010(d).

5.4 Outfalls

5.4.1 Background

A 1992 field survey at TA-46 identified 35 outfalls at TA-46 (McCulla 1992, 11-203). Additional outfalls were located by ICF Kaiser Engineering personnel, bringing the total to 66 (ICF Kaiser Engineers 1992, 11-214). Only 15 of these outfalls were designated as PRSs in the SWMU Report (LANL 1990, 0145). However, field investigation reveals complex interconnections of outfall effluent streams requiring more global considerations in the design of sampling plans. Subsection 5.4 attempts to address those issues.

This RFI divides outfalls into the following categories: outfalls that are PRSs (Subsection 5.4.1.1.1), outfalls that may have received effluent from other PRSs (Subsection 5.4.1.1.2), and outfall PRSs proposed for NFA (Subsection 6.2.3). Outfall VV is regulated under the Clean Water Act. No sampling is proposed for several outfalls that are neither PRSs nor subject to potential contamination. While AOC C-46-001 is not an outfall, it is included in this subsection because the effects of a mercury spill will be investigated as an outfall problem.

Sampling plans for outfalls at TA-46 focus on individual outfalls rather than PRSs. Table 5-4-0 is a summary of tables in Section 5.4 that, taken together, relate field identifiers of outfalls to appropriate information concerning PRSs. Also included are relevant tables in Appendix E, entitled Sample Data Base, which describes the entire OU 1140 data base system. Table 5-4-1 lists PCOCs at each PRS outfall discussed in Subsection 5.4.

Outfalls not proposed for NFA are aggregated in Subsection 5.4 on the basis of similar physical characteristics, sampling strategies, and risk assessment concerns. All outfalls are identified by an alpha designator assigned during field surveys. Figures 5-4-1 and 5-4-2 show the location of outfalls, storm drain systems, canyon drainage channels, and sediment catchments.

5.4.1.1 Description and History

Outfalls at TA-46 consist of pipes of various diameters protruding from the steep walls of Cañada del Buey or SWSC Canyon, and of storm drains and

TABLE 5-4-0

SUMMARY OF TABLES IN SUBSECTION 5.4 AND APPENDIX E

TABLE	TITLE	CONTENTS
5-4-1	PCOCs of Outfall PRSs	PCOCs, locations, and descriptions of all PRS outfalls
5-4-2	PRS Outfalls at TA-46	Source building and outfall ID
5-4-3	Non-PRS Outfalls Associated with PRSs	Descriptions and subsection reference
5-4-4	Outfall Highlights	Outfall ID; associated PRS, if any; subsection reference; style and type; and source description
5-4-5	NPDES-Permitted Outfalls at TA-46	Source building, SWMU, status, and subsection reference
5-4-6	Exposure Mechanisms and Receptors for Outfalls	Release mechanisms and current and future receptors
5-4-7	DQO Summary for Outfalls	DQO steps and rationales
5-4-8	Engineering Surveys for Outfalls	Survey types and references to Appendix D
5-4-9	Summary of OU 1140 TA-46 Outfalls Site Surveys, Sampling and Analysis	Specific analyses at each outfall
5-4-10	Outfall Cross-Correlation Table	Each field ID correlated with primary PRS and overlapping PRSs
E-2	OU 1140 Sample Locations	Each sample designator correlated with overlapping PRSs and outfall field IDs.
E-3	PRS Sample Locations Summary	Correlation of each PRS with all relevant sampling points
E-4	Sample Location Surveys and Analyses	For each sample point, gives applicable PRSs and all analyses proposed for that sampling point

TABLE 5-4-1

PCOCs OF OUTFALL PRSs

PRS	LOCATION	DESCRIPTION	PCOCs
46-002	East end of TA-46	Sanitary lagoon	Metals; uranium-235, -238; SVOCs, VOCs; mercury; PCBs
46-003(a)	Southwest of TA-46-41	Septic system	Metals; uranium-235, -238; thorium; SVOCs, VOCs; mercury; PCBs
46-003(f)	Southeast of TA-46-76	Septic system	Metals; uranium-235, -238; SVOCs, VOCs; PCBs, mercury
46-003(g)	East of TA-46-158	Septic system	Metals, activation products, SVOCs, VOCs, PCBs
46-004(a2)	East of 46-31	Industrial drains	Metals; uranium-235, -238; SVOCs, VOCs; mercury; thorium; PCBs
46-004(b2)	East of TA-46-1	Floor drains	Metals; uranium-235, -238; SVOCs, VOCs; mercury; thorium
46-004(c2)	Northwest of TA-46-1	Floor drains	Metals; uranium-235, -238; SVOCs, VOCs; mercury; thorium
46-004(f)	East of TA-46-24	Industrial drain	Metals; uranium-235, -238; SVOCs, VOCs; mercury; PCBs
46-004(g)	North of TA-46-1	Industrial drains	Metals; uranium-235, -238; SVOCs, VOCs; thorium
46-004(h)	North of TA-46-16	Industrial drains	Metals; uranium-235, -238; SVOCs, VOCs; mercury
46-004(m)	North of TA-46-30	Floor drains	Metals; uranium-235, -238; SVOCs; mercury
46-004(q)	North of TA-46-58	Unknown source	Metals; uranium-235, -238; VOCs, SVOCs
46-004(r)	South of TA-46-24	Industrial drain	Metals; uranium-235, -238; SVOCs, VOCs; mercury; PCBs
46-004(s)	South of TA-46-1	Floor drains	Metals; uranium-235, -238; SVOCs, VOCs; mercury
46-004(t)	West end of SWSC Canyon	Industrial drain	VOCs
46-004(u)	North of TA-46-87	Overflow from well	Metals, SVOCs, VOCs
46-004(v)	North of TA-46-87	Industrial drain	SVOCs
46-004(w)	East of TA-46-59	Sink drain	Oils, VOCs, SVOCs, PCBs
46-004(x)	Northeast of TA-46-31	Industrial drains	Metals; uranium-235, -238; SVOCs, VOCs; thorium; mercury; PCBs
46-004(y)	North of TA-46-31	Industrial drains	Metals; uranium-235, -238; SVOCs, VOCs; thorium; mercury; PCBs
46-004(z)	North of TA-46-31	Floor drains	Metals; uranium-235, -238; SVOCs, VOCs; thorium; mercury; PCBs
46-005	East of TA-46-158	Sanitary lagoons	Metals; uranium-235, -238; SVOCs, VOCs; PCBs
C-46-001	South of TA-46-24	Mercury spill	Mercury

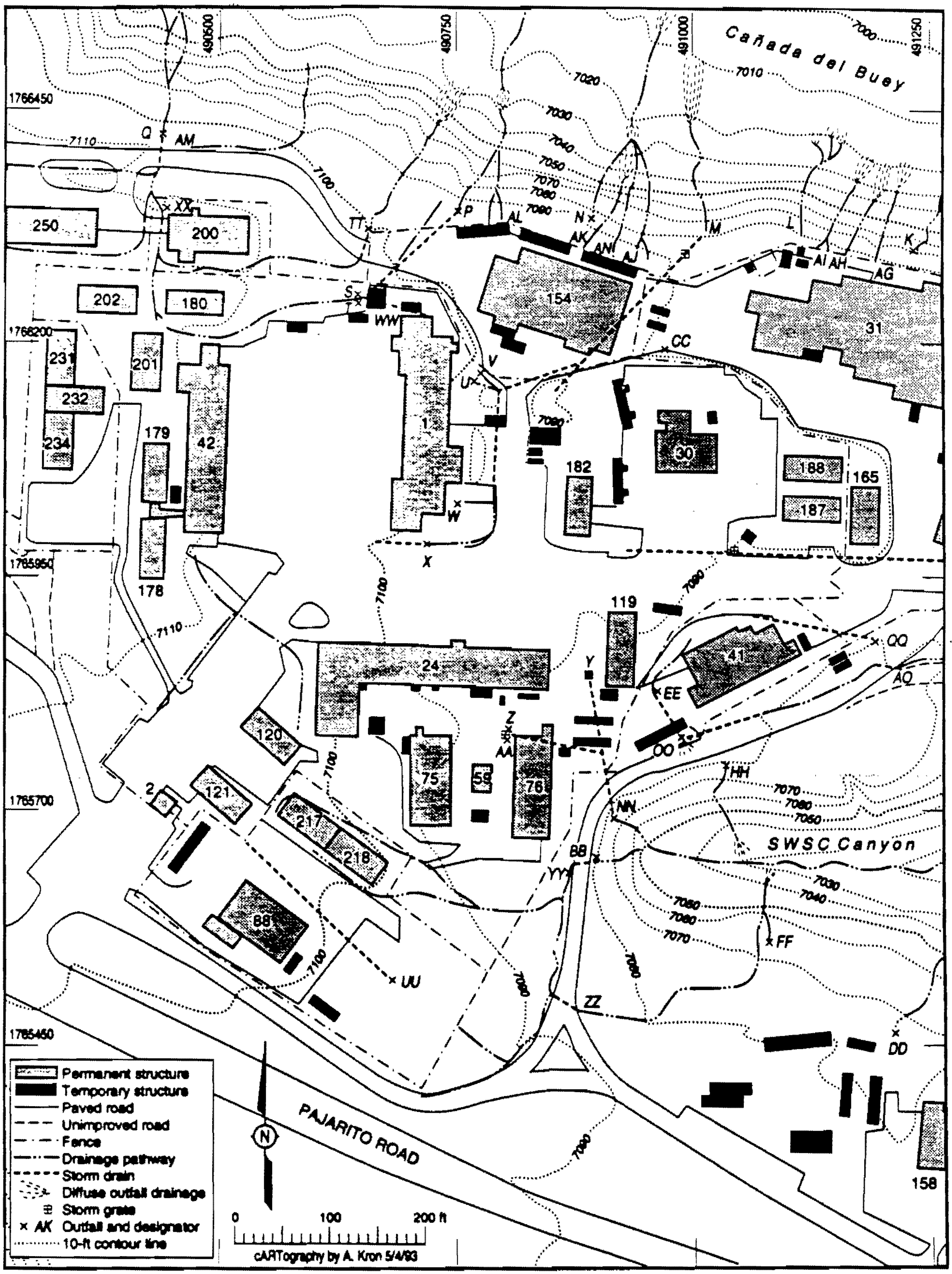


Fig. 5-4-1. Outfall locations at TA-46 (western half).

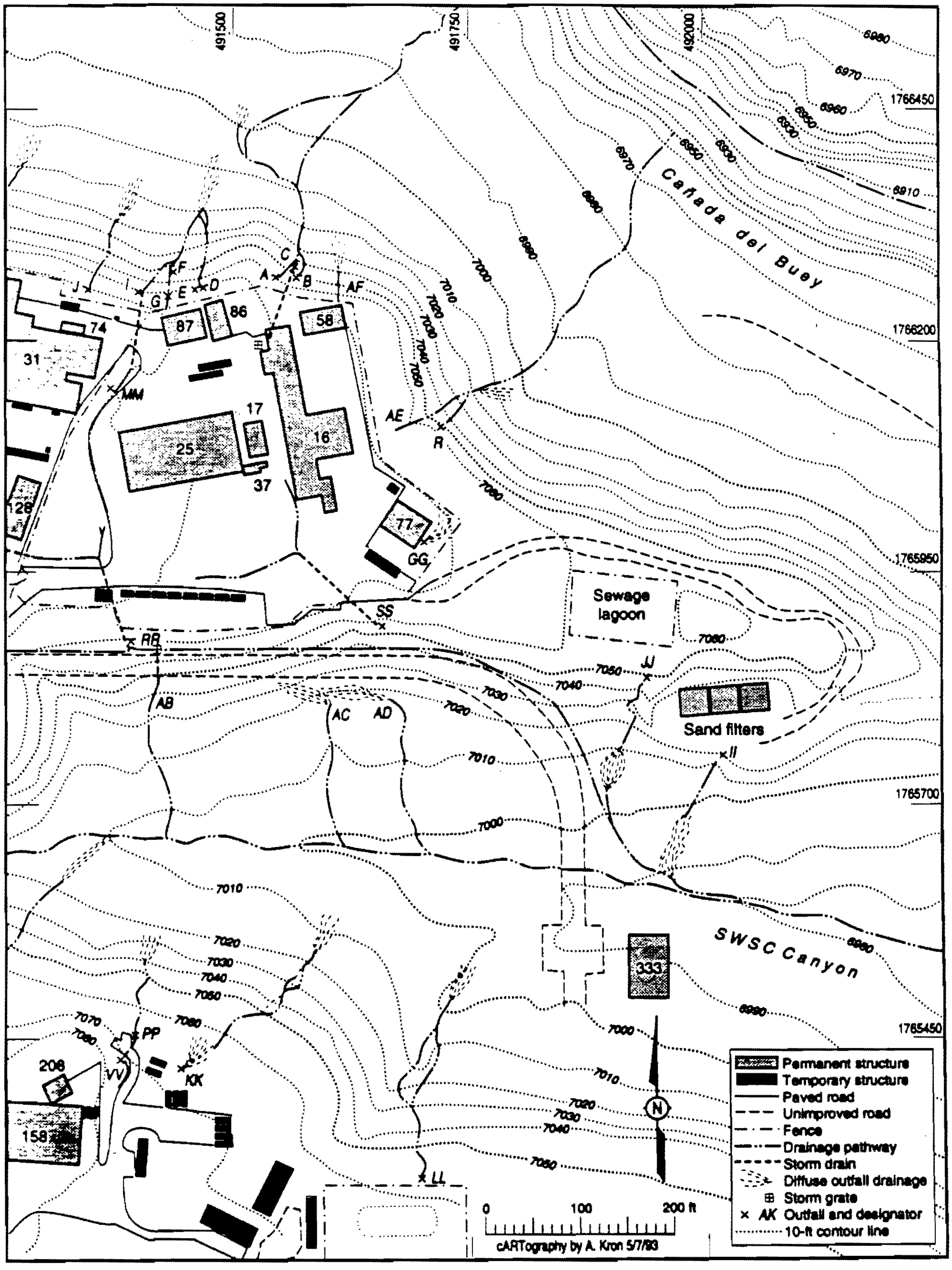


Fig. 5-4-2. Outfall locations at TA-46 (eastern half).

storm runoff points. There are two types of outfalls; industrial drains (ID) characterized by intermittent, low-volume flows, and storm runoff (SR) characterized by short-term, high-volume flows. Runoff from both types has eroded drainage channels, varying in width from 0.5 to 3 ft, down the canyon sides to the canyon floor. Historic flow rates and volumes are unknown. Thick stands of brush separate the channels and stabilize the slopes, much of which is fill material from initial leveling of the TA-46 site.

5.4.1.1.1 PRS Outfalls

Outfalls that have been designated as PRSs, and are not proposed for NFA, are listed in Table 5-4-2.

TABLE 5-4-2

PRS OUTFALLS AT TA-46

PRS	SOURCE	FIELD ID	NPDES ID
46-004(f)	TA-46-24 industrial drain	Y	04A018
46-004(g)	TA-46-1 industrial drain	N	None
46-004(h)	TA-46-16 industrial drain	A	None
46-004(m)	TA-46-30 industrial drain	CC	04A013
46-004(q)	Unknown	B	None
46-004(r)	TA-46-24 industrial drain	Z	None
46-004(s)	TA-46-1 industrial drain	X	None
46-004(t)	TA-46-88 industrial drain	YY	04A014
46-004(u)	TA-46-87 west wet well	F	None
46-004(v)	TA-46-87 industrial drain	G	None
46-004(w)	TA-46-59 industrial drain	AA	None
46-004(x)	TA-46-31 industrial drain	J	None
46-004(y)	TA-46-31 industrial drain	K	03A043
46-004(z)	TA-46-31 industrial drain	L	None
46-004(a2)	TA-46-31 industrial drain	MM	None
46-004(b2)	TA-46-1 industrial drain	V	None
46-004(c2)	TA-46-1 industrial drain	T	None

SWMU 46-004(f) (Outfall Y) is the outfall from the industrial drain that services Rooms 101 through 134 of TA-46-24. The outfall is a 6-in.-diameter vitrified clay (VC) pipe that discharges to a storm drain east of the building. This storm drain is part of a network that discharges to SWSC Canyon at NPDES 04A018 (ICF Kaiser Engineers 1992, 11-214). Figure 5-4-1 shows this storm drain network and its outfall location labeled NN.

Engineering drawing ENG-C 22720 indicates that roof drains originally were tied into this drain system. Engineering drawing ENG-C 21233 shows that in 1958, a sump and an acid sink in Rooms B-22 and B-30, respectively, were plumbed into this system. The acid sink was used for cleaning operations using hydrochloric and nitric acids (Hyatt 1958, 11-010). Engineering drawing ENG 4914, dated 1961, indicates that several nonsanitary floor and sinks drains were also plumbed to the industrial drain. The addition of the west wing in 1964 resulted in additional connections to the industrial drain, as shown in Engineering drawing ENG-C 31620. The cooling water system permitted under NPDES 04A018 is one of several sources for this outfall (McCulla 1992, 11-203).

There is a lack of historical information regarding activities and/or processes that have taken place in TA-46-24. Based on what is known concerning historical activities and processes in the building, PCOCs may include VOCs, SVOCs, mercury, PCBs, metals, and uranium.

SWMU 46-004(g) (Outfall N) is the outfall associated with the industrial drain in Building TA-46-1. The drain is a 12-in.-diameter vitrified clay pipe that intersects manhole TA-46-15 and daylights at Cañada del Buey northeast of the building as shown in Fig. 5-4-1. Engineering drawing ENG-C 18111 indicates that all roof and floor drains within the central portion of the building are plumbed into the industrial drain. Laboratory sinks also tie into this drain system (McCulla 1992, 11-203).

TA-46-1 was used for Rover experiments. In 1965, an approved disposal practice involved the discharge of radioactive liquid waste containing uranium-235 to a drain in Room 8. It is not known what other activities and processes took place in this building. PCOCs include mercury, other metals, VOCs, SVOCs, uranium, and thorium. Portions of SWMU 46-004(g), described as ducts and drains of TA-46-1, are further discussed in Subsections 5.6.1, 6.1.1, and 6.2.1.

SWMU 46-004(h) (Outfall A) is the outfall from the industrial drain in TA-46-16. The outfall is a 6-in.-diameter cast iron (CI) pipe located north of the building as shown in Fig. 5-4-2. Engineering drawing ENG-C 14983 indicates that floor drains and possibly roof drains are plumbed to this drain. Floor drain connections to this outfall were verified in the field (McCulla 1992, 11-203).

Experiments with uranium-loaded graphite were conducted in the test cells in TA-46-16 under the Rover Program. Based on historical information, depleted uranium was used and there were plans to use enriched uranium (Welty 1958, 11-007). PCOCs include metals, VOCs, SVOCs, and uranium. Portions of SWMU 46-004(h), described as ducts and drains of TA-46-16, are further discussed *in* Subsections 5.6.1 and 6.1.1.

SWMU 46-004(m) (Outfall CC) is the outfall from a noncontact cooling water system in Building TA-46-30. The outfall, NPDES 04A013 located north of the building, protrudes from a 10 ft-deep bank cut. Effluent flows through a ditch at the foot of the bank into a storm drain located east of Building TA-46-154. This storm drain is part of a network that discharges to Cañada del Buey. Figure 5-4-1 shows this storm drain network and its outfall location labeled M.

The pipe labeled NPDES 04A013 is the outfall from the industrial drain in Building TA-46-30. A noncontact cooling-water system is one of several sources for this outfall. The 1990 NPDES permit application indicates that the noncontact cooling water system is associated with a compressor. Engineering drawing ENG-C 22732 indicates that the compressor room floor drains are plumbed to the industrial drain. In addition, roof drains and laboratory sinks, with the exception of the north wall sink, are also plumbed to the industrial drain (ICF Kaiser Engineers 1992, 11-214). Building TA-46-30 was built in 1967 as a hydraulics laboratory. Engineering drawing ENG-C 22732 shows the presence of two compressed air lines as well as oil-return and supply building lines. PCOCs include mercury, other metals, SVOCs, and uranium from laboratory processes.

SWMU 46-004(q) (Outfall B) is a 6-in.-diameter cast iron pipe that discharges to Cañada del Buey north of Building TA-46-58 as shown in Fig. 5-4-2. The source is unknown, so the outfall will be treated as an industrial drain. It will be sampled for uranium, SVOCs, VOCs, and metals.

SWMU 46-004(r) (Outfall Z) is the outfall from the industrial drain that services the west wing of TA-46-24, constructed in 1964. Engineering drawing ENG-C 22720 indicates that roof drains and possibly sink drains are plumbed to this drain. The outfall is a 4-in.-diameter cast iron pipe that discharges to a storm drain south of TA-46-24 between TA-46-59 and TA-46-76 as part of a storm drain network that discharges to SWSC Canyon (ICF Kaiser Engineers 1992, 11-214). Figure 5-4-1 shows this storm drain network and its canyon outfall location, Outfall NN. Activities and processes that were conducted in the west wing of TA-46-24 are not known; however, based on general process knowledge of Building TA-46-24, PCOCs include uranium, mercury, other metals, VOCs, SVOCs, and PCBs.

SWMU 46-004(s) (Outfall X) is the outfall of a 4-in.-diameter cast iron pipe located about 25 ft south of TA-46-1. Engineering drawing ENG-C 3369 indicates that the floor and roof drains in the south high bay discharge via this outfall. The effluent flows to a ditch, SWMU 46-007, that is part of a storm drain network that discharges to Cañada del Buey as shown in Fig. 5-4-1. The outfall for this storm drain network is designated Outfall M. Activities and processes that were conducted in the south addition of TA-46-1 are not known; however, based on general process knowledge of Building TA-46-1, PCOCs include mercury, other metals, VOCs, SVOCs, and uranium.

Engineering drawing ENG-C 1811, sheet 43, indicates that some floor drains in the south high bay connect to a pipe that exits to the east. This outfall has not been confirmed in the field. Outfall W, located in this area, may serve these floor drains or may be the outfall for roof drains. [The east outfall is included in SWMU 46-004(s) in this work plan.]

SWMU 46-004(t) (Outfall YY) is the outfall from the industrial drain in TA-46-88. The outfall is NPDES 04A014, a 4-in.-diameter vitrified clay pipe located northeast of TA-46-88 on the west side of the SWSC road. The effluent flows through a storm drain under the road then discharges to SWSC Canyon. Figure 5-4-1 shows the location of this storm drain and its outfall designated BB.

Engineering drawing ENG-C 31549 indicates that all laboratory sinks, floor drains, and roof drains in Building TA-46-88 are plumbed to this outfall. Based on this information, the outfall pipe labeled NPDES 04A014 is the outfall for the industrial drain in Building TA-46-88. A noncontact cooling water system is one of several sources for this outfall (ICF Kaiser Engineers 1992, 11-214). In the late 1960s and 1970s, Building TA-46-88 was the N-7 structural test laboratory used to test pressure vessels associated with the Rover Program. In the mid-1970s, Isotope and Nuclear Chemistry (INC) Division acquired the building for its ICON program which isolated nonradioactive isotopes of carbon, oxygen, and nitrogen.

Process chemistry did take place under this program. PCOCs include VOCs (ICF Kaiser Engineers 1992, 11-214).

SWMU 46-004(u) (Outfall F) is an outfall from an overflow pipe for the west concrete wet well in TA-46-87. The outfall, located north of TA-46-86, is an 8-in.-diameter cast iron pipe that discharges to Cañada del Buey as shown in Fig. 5-4-2.

Engineering drawing ENG-C 32302 indicates that the west well, a deionized-water holding pit, was originally part of a closed-loop cooling-water system that serviced Buildings TA-46-16, -25, and -31. This process system was a secondary system that operated in conjunction with the primary, open, recirculating, cooling-tower system, TA-46-86 discussed under SWMU 46-004(i) in Subsection 6.2.3. The cooling tower system is believed to have been in operation only six months after its construction in 1968 (ICF Kaiser Engineers 1992, 11-214). Based on discussions with ENG-6 personnel and inspection of Engineering drawing ENG-C 32300, the wet well is currently used to store industrial waste from TA-46-25. The industrial drain is connected to two sink drains; there are no floor drains in the building. Industrial waste from TA-46-25 is routed to the wet well through an old cooling-water supply line associated with the original cooling water system (ICF Kaiser Engineers 1992, 11-214). Historically, chemical processing activities have not taken place in Building TA-46-25. During the time of the Rover Program, this building was used as a battery storage building and for selective small-scale painting activities. PCOCs include VOCs, SVOCs, and metals (ICF Kaiser Engineers 1992, 11-214).

SWMU 46-004(v) (Outfall G) is the outfall for the industrial drain from TA-46-87. The outfall is a 6-in.-diameter cast iron pipe located northwest of TA-46-87 and discharges to Cañada del Buey as shown in Fig. 5-4-2. Engineering drawing ENG-C 32305 suggests that floor and roof drains are connected to this drain. Building TA-46-87 is the pump house for the associated cooling tower, TA-46-86. It houses two wet well systems and mechanical equipment associated with the cooling tower. Chemical processing activities have never taken place in this building. Currently, the pump house is used to store nonhazardous cooling tower chemicals. PCOCs may include SVOCs (ICF Kaiser Engineers 1992, 11-214).

SWMU 46-004(w) (Outfall AA) is the outfall from the sink drain in TA-46-59. Engineering drawing ENG-C 23346 indicates that the outfall is a 2-in. cast iron pipe that discharges to a storm drain located between TA-46-59 and TA-46-76. This is the same storm drain network described under SWMU 46-004(r) as discharging to SWSC Canyon (ICF Kaiser Engineers 1992, 11-214). Figure 5-4-1 shows the location of this storm drain network and its canyon outfall designated NN. Under the Rover Program, TA-46-59 was used for hydraulic and structural testing of Rover components. Therefore, PCOCs may include SVOCs, VOCs, and constituents of oils including PCBs.

SWMU 46-004(x) (Outfall J) may be the outfall from floor and/or roof drains in TA-46-31. The outfall is a 6-in.-diameter cast iron pipe, located northeast of TA-46-31, that discharges to Cañada del Buey as shown in Fig. 5-4-2. McCulla identified three industrial drain systems for TA-46-31. Based on discussions with ENG-6 personnel, this outfall is probably another industrial drain that services floor and/or sink drains in TA-46-31 (ICF Kaiser Engineers 1992, 11-214). Historical information indicates that fissionable materials were used in several rooms in Building TA-46-31 (Ehrenkranz 1964, 11-043). Based on general activity and process information, other PCOCs may include mercury, other metals, VOCs, SVOCs, uranium, and thorium.

SWMU 46-004(y) (Outfall K) is the blowdown outfall from the cooling tower that serves TA-46-31. The outfall is a 6-in.-diameter cast iron pipe labeled NPDES 03A043 and located north of TA-46-31. It discharges to Cañada del Buey as shown in Fig. 5-4-1. Engineering drawing ENG-C 22752 indicates that floor and roof drains, laboratory sinks, and fume hoods in TA-46-31 are also plumbed to this outfall, which constitutes one of three industrial drain outfalls from TA-46-31 (McCulla 1992, 11-203).

Based on the SWMU Report, chromates may be a contaminant of concern at Laboratory cooling tower blowdown outfalls; however, no chromates were used at TA-46 (Radzinski 1992, 11-188). Cooling tower treatment chemicals currently used at the Laboratory, Garratt-Callahan Formula 227-L and 314-T, are EPA-approved products. In addition, historical information indicates that fissionable materials were used in several rooms in Building TA-46-31 (Ehrenkranz 1964, 11-043). Based on general activity and process information, PCOCs may include mercury, other metals, VOCs, SVOCs, uranium, and thorium.

SWMU 46-004(z) (Outfall L) is the outfall from a second industrial drain servicing Rooms 160 through 172 in TA-46-31. The outfall is a 6-in.-diameter cast iron pipe, located northwest of building, that discharges to Cañada del Buey as shown in Fig. 5-4-1. Engineering drawing ENG-C 26332 indicates that the floor and roof drains associated with Rooms 160 through 172 constitute one of three industrial drain systems for this building (McCulla 1992, 11-203). Historical information indicates that fissionable materials were used in several rooms in Building TA-46-31 (Ehrenkranz 1964, 11-043). Based on general activity and process information, other PCOCs may include mercury, other metals, SVOCs, VOCs, uranium, and thorium.

SWMU 46-004(a2) (Outfall MM) is the outfall from a third industrial drain servicing Rooms 101, 103, and 105 in TA-46-31. Engineering drawing ENG-C 25879 indicates that sinks and drains from these rooms are plumbed to this industrial drain. The outfall is a 6-in.-diameter pipe, located southeast of TA-46-31 and northwest of TA-46-25, discharging to a ditch located between the two buildings. The ditch is part of a storm drain network that discharges to Cañada del Buey (ICF Kaiser Engineers 1992, 11-214). Figure 5-4-2 shows this storm drain network and its outfall designated I. Historical information indicates that fissionable materials were used in several rooms in Building TA-46-31 (Ehrenkranz 1964, 11-043). Based on general activity and process information, PCOCs may include mercury, other metals, VOCs, SVOCs, uranium, thorium, and PCBs.

SWMU 46-004(b2) (Outfall U) is the outfall for an additional industrial drain in the north high bay in TA-46-1. The outfall is a 4-in.-diameter vitrified clay pipe located east of TA-46-1. Engineering drawing ENG-C 18111 indicates that the floor drains along the east wall of the north high bay are plumbed to this drain. The effluent from this outfall discharges to a ditch, SWMU 46-007, that is part of a storm drain network discharging to Cañada del Buey (ICF Kaiser Engineers 1992, 11-214). Figure 5-4-1 shows this storm drain network and its outfall designated M.

Activities and processes that were conducted in the north high bay are not known; however, based on overall process knowledge of Building TA-46-1, PCOCs may include mercury, other metals, VOCs, SVOCs, uranium, and thorium.

SWMU 46-004(c2) (Outfall S) is the outfall from an industrial drain from Building TA-46-1. The outfall is a 4-in.-diameter cast iron pipe, located northwest of the building, that drains into Cañada del Buey as shown in Fig. 5-4-1. Engineering drawing ENG-C 18111 indicates that the floor drains in the north equipment room are plumbed to this drain. Building TA-46-1 was used for Rover experiments. It is not known what activities and processes took place in the north high bay. PCOCs include mercury, other metals, VOCs, SVOCs, uranium, and thorium.

5.4.1.1.2 Non-PRS Outfalls Receiving Effluent from PRSs

Non-PRS outfalls that may have received effluent from other PRSs are listed in Table 5-4-3. In all cases, the outfall constitutes the overflow or drainage component for the associated PRS (i.e., septic systems, lagoon). Table 5-4-3 also lists the location of the more complete discussion of each PRS.

SWMU 46-002 (Outfall II) is NPDES Outfall SSS07S associated with the sanitary lagoon and sand filters described in Subsection 5.2.1.1. The outfall consists of a sluice box with two 6-in. vitrified clay pipes that drain the three sand filters. Outfall SSS07S has been deleted from the Laboratory NPDES Permit Part I-I I as a result of hookup of waste water lines to the SWSC plant (Sneesby 1992, 11-217). PCOCs associated with the lagoon from past

TABLE 5-4-3

NON-PRS OUTFALLS ASSOCIATED WITH PRSs

OUTFALL	ASSOCIATED PRS	DESCRIPTION	NPDES ID	SUBSECTION
II	46-002	TA-46-149 lagoon	SSS07S	5.2.1.1
JJ	46-002	TA-46-149 lagoon	None	5.2.1.1
HH	46-003(a)	TA-46-1,TA-46-30 septic system	None	5.1.1.1
FF	46-003(f)	Sand filter	None	5.1.1.1, 5.3.1.1
KK	46-003(g)	TA-46-158 septic system	None	5.1.1.1
LL	46-005	TA-46-170 lagoon	SSS12S	5.2.1.1
BB, NN	C-46-001	Mercury spill	None	5.4.1.1.2

operations may be mercury, other metals, uranium, SVOCs, VOCs, and PCBs.

SWMU 46-002 (Outfall JJ) is also an outfall associated with SWMU 46-002. It is located about 30 ft off the northwest corner of the sand filters as shown in Fig. 5-4-2. The outfall pipe is a 12-in. corrugated metal (CM) pipe that serves as an overflow drain for the sanitary lagoon. PCOCs are identical to those in Outfall II.

SWMU 46-003(a) outfall component **(Outfall HH)** is a 4-in.-vitrified clay pipe south of the road adjacent to TA-46-41 as shown in Fig. 5-4-1. Engineering drawing ENG-PL 974 indicates that this drain pipe is associated with SWMU 46-003(a), an inactive septic system that consists of three elements: septic tank TA-46-8, distribution boxes TA-46-9 and TA-46-10, and the associated drain field (McCulla 1992, 11-203). A discussion in Subsection 5.1.1.1 includes the operation and waste stream history for SWMU 46-003(a); PCOCs include mercury, other metals, uranium, SVOCs, VOCs, and PCBs.

SWMU 46-003(f) outfall component **(Outfall FF)** is a 4-in.-vitrified clay pipe located approximately 30 ft northeast of the inactive, excavated sand filter as shown in Fig. 5-4-1. Engineering drawing ENG-C 34339 indicates that this drain pipe is associated with SWMU 46-003(f), an inactive septic system that consists of four elements: septic tank TA-46-94, manhole TA-46-95, distribution box TA-46-97, and the associated drain field (sand filter). SWMU 46-003(f) is located southwest of Building TA-46-76 (McCulla 1992, 11-203). A discussion in Subsection 5.1.1.1 includes the history for SWMU 46-003(f), PCOCs include mercury, other metals, uranium, SVOCs, VOCs, and PCBs. Subsection 5.3.1.1 includes a description of the abandoned sand filter.

SWMU 46-003(g) outfall component **(Outfall KK)** is a 4-in.-polyvinyl chloride (PVC) pipe located approximately 50 ft northeast of TA-46-158 as shown in Fig. 5-4-2 (McCulla 1992, 11-203). SWMU 46-003(g) is a septic system consisting of a septic tank and seepage pit; ENG-6 personnel question the presence of a seepage pit (ICF Kaiser Engineers 1992, 11-214). The system appears to be active; the tank requires pumping periodically. Engineering drawings do not show a daylighted pipe associated with this system. However, the proximity of the outfall to the septic system suggests the association (McCulla 1992, 11-203). Subsection 5.1.1.1 includes a discussion of the operation and waste stream history for SWMU 46-003(g); PCOCs include metals, various radionuclides, SVOCs, VOCs, and PCBs.

SWMU 46-005 outfall component **(Outfall LL)** is a 6-in.-PVC pipe labeled NPDES SSS12S. SWMU 46-005 is a sanitary lagoon system located east of TA-46-158 as shown in Fig. 5-4-2. A discussion in Subsection 5.2.1 includes operation and waste stream history for SWMU 46-005; PCOCs include metals, radionuclides, SVOCs, and VOCs. Outfall SSS12S has been deleted from the Laboratory NPDES Permit Part I-I I as a result of hookup of waste water lines to the SWSC system (Sneesby 1992, 11-217).

AOC C-46-001 is described as a spill of 0.55 to 1.1 lb of mercury near TA-46-75 on July 22, 1975. Cleanup of all visible mercury was ordered at the time (Ahlquist 1975, 11-080). No precise location was given for the spill. Aerial photos and the term "scraped up" indicate that the area was paved. From the existing information, runoff from the site would be directed toward Outfall BB or possibly the storm drain Outfall NN as shown in Fig. 5-4-1. Both outfalls will be tested for mercury as investigation of AOC C-46-001.

Table 5-4-4, Outfall Highlights, illustrates the relationship of each identified outfall with a PRS number (if applicable). The table includes all outfalls at TA-46 whether they will be sampled or not. The table is further described in Subsection 5.4.4. If any additional outfalls are identified during the course

TABLE 5-4-4

OUTFALL HIGHLIGHTS

FIELD ID	PRS	SAMPLE?	SAMPLING JUSTIFICATION	CHAPTER OR SUB-SECTION	OUTFALL STYLE	DRAIN TYPE	SOURCE DESCRIPTION
II, JJ	46-002	Yes		5.2, 5.4	Industrial drain	II - 6" vitrified clay pipe, JJ - 12" corrugated metal pipe	Sanitary lagoon TA-46-149 (constructed in 1973) and associated sand filters, at east end of TA-46, receives waste from most drain lines at TA-46.
HH	46-003(a)	Yes	46-009(a)	5.1, 5.4	Industrial drain	4" vitrified clay pipe	Septic system south and west of TA-46-41 received waste from TA-46-1, TA-46-30, and TA-46-2. Possible vent or leachate collection outfall on north rim of SWSC Canyon.
FF	46-003(f)	Yes		5.1, 5.3, 5.4	Industrial drain	4" vitrified clay pipe	Septic system southeast of TA-46-76 received waste from TA-46-88 and from septic tank SWMUs 46-003(a,c). Outfall FF from sand filter component of this SWMU.
KK	46-003(g)	Yes	46-006(c)	5.1, 5.4	Industrial drain	4" PVC pipe	Septic system east of TA-46-158, received waste from TA-46-158, and later from office buildings, system has overflowed.
GG	46-003(h)	Yes**		5.3	Industrial drain	2" galvanized pipe	Outfall on east wall of TA-46-77, sink drains onto ground, first date of discharge unknown but prior to 1976. **(sampled as surface release)
Y	46-004(f)	Yes		5.4	Industrial drain	6" vitrified clay pipe	East of TA-46-24. Industrial drain, NPDES 04A018, from TA-46-24.
N	46-004(g)	Yes		5.4, 5.6, 6	Industrial drain	12" vitrified clay pipe	Ducts and drains of TA-46-1, sink drains, floor drains, and sanitary waste discharge to Cañada del Buey via outfall N. DC drain line - still active.
A	46-004(h)	Yes		5.4, 5.6, 6	Industrial drain	6" cast iron pipe	Ducts and drains of TA-46-16, floor drains discharge to Cañada del Buey. DC drain line - still active.
D, E	46-004(i)	No		6	Storm runoff	D- , 8" cast iron pipe, E- , 2" galvanized pipe	South rim of Cañada del Buey, north of TA46-87. D is cooling tower blow-down from TA-46-86, NPDES outfall 03A-44. E is dilute lithium hydroxide line. NFA- no threat.

TABLE 5-4-4 (continued)

OUTFALL HIGHLIGHTS

FIELD ID	PRS	SAMPLE?	SAMPLING JUSTIFICATION	CHAPTER OR SUB - SECTION	OUTFALL STYLE	DRAIN TYPE	SOURCE DESCRIPTION
T	46-004(j)	No		6	Industrial drain	12" corrugated metal pipe	Northwest of TA-46-1. Cooling tower blow-down from TA-46-1, NPDES Outfall 03A042 into Cañada del Buey. NFA- no threat.
DD	46-004(k)	No		6	Industrial drain	3" cast iron pipe	South rim of SWSC Canyon, northwest of TA-46-158. Cooling tower blow-down from TA-46-158, NPDES Outfall 03A124. NFA- no threat.
CC, AN	46-004(m)	Yes		5.4	Industrial drain	6" vitrified clay pipe	North of TA-46-30. Floor drains and non-contact cooling water from TA-46-30, discharge into Cañada del Buey, NPDES Outfall 04A013.
EE	46-004(n)	No		6	Industrial drain	2" galvanized pipe	West of TA-46-41. Non-contact cooling water from TA-46-41, NPDES Outfall 04A117, discharge into SWSC Canyon, unknown when first discharge occurred. NFA- no threat.
XX	46-004(o)	No		6	Industrial drain	2" cast iron pipe	Northeast of TA-46-200. Cooling tower blow-down from TA-46-200, NPDES Outfall 03A136 into Cañada del Buey. NFA- no threat.
B	46-004(q)	Yes		5.4	Industrial drain	6" cast iron pipe	North of TA-46-58, discharging to Cañada del Buey via Outfall N, unknown source.
Z	46-004(r)	Yes		5.4	Industrial drain	4" cast iron pipe	West of TA-46-76. Outfall is industrial waste line servicing west wing of TA-46-24, discharges into a grated storm drain network then into SWSC Canyon.
X	46-004(s)	Yes	46-007	5.4	Industrial drain	4" cast iron pipe	South of TA-46-1. Floor drains from the south high bay of TA-46-1.
YY	46-004(t)	Yes		5.4	Industrial drain	4" vitrified clay pipe	West end of SWSC Canyon. Outfall serves sinks and non-contact cooling water from TA-46-88, NPDES 04A014.
F	46-004(u)	Yes		5.4	Industrial drain	8" cast iron pipe	South rim of Cañada del Buey, north of TA-46-87. Serves as overflow from west wet well in TA-46-87. West wet well receives influent from floor drains in TA-46-25.

TABLE 5-4-4 (continued)

OUTFALL HIGHLIGHTS

FIELD ID	PRS	SAMPLE?	SAMPLING JUSTIFICATION	CHAPTER OR SUB-SECTION	OUTFALL STYLE	DRAIN TYPE	SOURCE DESCRIPTION
G	46-004(v)	Yes		5.4	Industrial drain	6" cast iron pipe	South rim of Cañada del Buey, north of TA-46-87. Serves as industrial waste line for TA-46-87, floor and roof drains are plumbed into this line.
AA	46-004(w)	Yes		5.4	Industrial drain	2" cast iron pipe	East of TA-46-59. Sink drain in TA-46-59 discharging into grated storm drain.
J	46-004(x)	Yes		5.4	Industrial drain	6" cast iron pipe	South rim of Cañada del Buey, northeast of TA-46-31. Floor drains and roof drains from TA-46-31 are plumbed to this line.
K	46-004(y)	Yes		5.4	Industrial drain	6" cast iron pipe	South rim of Cañada del Buey, north of TA-46-31. Cooling tower blow-down serving TA-46-31 (NPDES 03A043). Also floor, roof, laboratory sinks, and fume hood drains in TA-46-31 are plumbed to this line.
L	46-004(z)	Yes		5.4	Industrial drain	6" cast iron pipe	South rim of Cañada del Buey, north of TA-46-31. Floor and roof drains of TA-46-31 are plumbed to this line.
MM	46-004(a2)	Yes		5.4	Industrial drain	6" vitrified clay pipe	East of 46-31, discharges via storm drain into Cañada del Buey. Industrial waste line serving sink and floor drains TA-46-31.
U	46-004(b2)	Yes	46-007	5.4	Industrial drain	4" vitrified clay pipe	East of TA-46-1. Floor drains from north high bay of TA-46-1.
S	46-004(c2)	Yes	46-004(j)	5.4	Industrial drain	4" cast iron pipe	Northwest of TA-46-1. Floor drains in the north equipment room of TA-46-1.
LL	46-005	Yes		5.2, 5.4	Industrial drain	6" PVC	Sanitary lagoons located east of TA-46-158 received waste from TA-46-158 (laboratory), TA-46-226 (office trailer), Outfall LL - north of lagoons drains into SWSC Canyon, NPDES SSS12S.
C		Yes	Aggregate 5.6		Storm runoff	Corrugated metal pipe	South rim of Cañada del Buey, north of TA-46-16. Storm water runoff from area west of TA-46-16.

TABLE 5-4-4 (continued)

OUTFALL HIGHLIGHTS

FIELD ID	PRS	SAMPLE?	SAMPLING JUSTIFICATION	CHAPTER OR SUB-SECTION	OUTFALL STYLE	DRAIN TYPE	SOURCE DESCRIPTION
H		No					South rim of Cañada del Buey, north of TA-46-87 (not on map). Electrical conduit, no potential release.
I		Yes	46-004(a2), Aggregate 5.6		Storm runoff	Corrugated metal pipe	South rim of Cañada del Buey, northeast of TA-46-31. Contributing flows from PRSs and Outfall MM. Storm water runoff from southeast TA-46-31 and west side of TA-46-25.
M		Yes	46-004(m), 46-004(s), 46-004(b2), 46-006(f), 46-007, 46-008(b), Aggregate 5.6		Storm runoff	Corrugated metal pipe	South rim of Cañada del Buey, northeast of TA-46-154. Contributing flow from multiple PRSs. Storm water runoff from the east side of TA-46-1, west side of TA-46-31 and south and east sides of TA-46-154.
O		No					South rim of Cañada del Buey, east of TA-46-154 (not on map). Bollard (parking post), no potential release.
P		Yes	46-004(j), 46-004(c2), 46-006(a), Aggregate 5.6		Storm runoff	Corrugated metal pipe	South rim of Cañada del Buey, northwest of TA-46-154. This outfall is mislabeled as NPDES 04A117. (Outfall S should be permitted.) Contributing flow from multiple SWMUs. Storm water runoff from PRSs, parking area between TA-46-42, TA-46-1, and Outfall WW.
Q		Yes	46-004(o), Aggregate 5.6		Storm runoff	Corrugated metal pipe	South rim of Cañada del Buey, northwest of TA-46-200. Contributing flow from Outfall XX. Storm water runoff from area north of TA-46-200.
R		No			Industrial drain	2" cast iron pipe	South rim of Cañada del Buey, north of TA-46-77. Outfall (plugged) from a transformer-pad drain (labeled as non-PCB contaminated).
V		No			Industrial drain	4" vitrified clay pipe	East of TA-46-1. Roof drains from north high bay of TA-46-1.

TABLE 5-4-4 (continued)

OUTFALL HIGHLIGHTS

FIELD ID	PRS	SAMPLE?	SAMPLING JUSTIFICATION	CHAPTER OR SUB-SECTION	OUTFALL STYLE	DRAIN TYPE	SOURCE DESCRIPTION
W		No			Industrial drain	4" vitrified clay pipe	East of TA-46-1. Roof drains from south high bay of TA-46-1.
BB		Yes	46-004(t), 46-008(g), Aggregate 5.6, C-46-001		Storm runoff	Corrugated metal pipe	West end of SWSC Canyon, east of TA-46-76. Contributing flows include storm water runoff from multiple PRSs. Storm water runoff from the south sides of TA-46-59, TA-46-75, and TA-46-76, the area north of TA-46-88, and areas surrounding TA-46-217, TA-46-218, TA-46-120, and TA-46-121.
NN		Yes	46-004(f), 46-004(r) 46-00[illegible]([illegible]) 46-008(d), Aggregate 5.6, C-46-001		Storm runoff	Corrugated metal pipe	West end of SWSC Canyon, east of TA-46-76. Contributing flows from multiple PRSs. Storm water runoff from and areas around TA-46-24, TA-46-59, TA-46-75, TA-46-76, and TA-46-119.
OO		Yes	46-004(n), 46-006(b), Aggregate 5.6		Storm runoff	Corrugated metal pipe	Southwest of TA-46-41. Contributing flow from Outfall EE. Storm water runoff from PRSs and area southwest of TA-46-41.
PP		Yes	46-006(c), Aggregate 5.6		Storm runoff	Corrugated metal pipe	South rim of SWSC Canyon, northeast of TA-46-158. Storm water runoff from PRSs and area east of TA-46-158.
QQ		Yes	46-006(b), Aggregate 5.6		Storm runoff	Corrugated metal pipe	North rim of SWSC Canyon, east of TA-46-41. Contributing flow from PRSs. Storm water runoff from areas north and east of TA-46-41.
RR		Yes	46-00(e), 46-008(f), 46-010(c), Aggregate 5.6		Storm runoff	Corrugated metal pipe	North rim of SWSC Canyon, south of TA-46-25. Storm water runoff from PRSs and areas near TA-46-30, TA-46-128, TA-46-165, TA-46-187, and TA-46-188.
SS		No			Storm runoff	Corrugated metal pipe	North rim of SWSC Canyon, south of TA-46-77. Storm water runoff from south of TA-46-16 and TA-46-25.

TABLE 5-4-4 (continued)

OUTFALL HIGHLIGHTS

FIELD ID	PRS	SAMPLE?	SAMPLING JUSTIFICATION	CHAPTER OR SUB-SECTION	OUTFALL STYLE	DRAIN TYPE	SOURCE DESCRIPTION
TT		Yes	Aggregate 5.6		Storm runoff	Corrugated metal pipe	South rim of Cañada del Buey, east of TA-46-200. Storm water runoff from areas south and east of TA-46-200.
UU		No			Storm runoff	Corrugated metal pipe	South edge of technical area, east of TA-46-88. Storm water runoff from areas west of TA-46-88.
VV		No			Industrial drain	?	South rim of SWSC Canyon, north of TA-46-158. Outfall from sink drain located in TA-46-208.
WW		No			Industrial drain		South rim of Cañada del Buey, northwest of TA-46-1. Overflow drain from liquid nitrogen pad located on the west side of the north end of TA-46-1.
ZZ		Yes	46-008(a), 46-008(g), Aggregate 5.6		Storm runoff	Corrugated metal pipe	South edge of technical area, east of TA-46-88. Storm water runoff from PRSs and areas east of TA-46-88 and south of TA-46-76.
AB		Yes	46-008e, Aggregate 5.6		Storm runoff	Corrugated metal pipe	North bottom of SWSC Canyon, south of TA-46-25. Storm water runoff from SWMU 46-008e (Outfall RR) and runoff from road and mesa edge.
AC		No			Storm runoff	Surface	Bottom of SWSC Canyon, near north rim, south of TA-46-16. Storm water runoff from road and mesa edge.
AD		No			Storm runoff	Surface	Bottom of SWSC Canyon, near north rim, south of TA-46-77. Storm water runoff from road and mesa edge.
AE		Yes	Aggregate 5.6		Storm runoff	Surface	South rim of Cañada del Buey, east of TA-46-16. Storm water runoff from the area east of TA-46-16.
AF		Yes	Aggregate 5.6		Storm runoff	Surface	South rim of Cañada del Buey, north of TA-46-58. Storm water runoff from the area north and west of TA-46-58.

TABLE 5-4-4 (continued)

OUTFALL HIGHLIGHTS

FIELD ID	PRS	SAMPLE?	SAMPLING JUSTIFICATION	CHAPTER OR SUB-SECTION	OUTFALL STYLE	DRAIN TYPE	SOURCE DESCRIPTION
AG		Yes	46-006(d), 46-006(g), Aggregate 5.6		Storm runoff	Surface	South rim of Cañada del Buey, north of TA-46-31. Contributing flows: Storm water runoff from PRSs. Storm water runoff from the areas along the north and west side of TA-46-31.
AH		Yes	46-006(d) 46-006(g), Aggregate 5.6		Storm runoff	Surface	South rim of Cañada del Buey, north of TA-46-31. Contributing flows: Storm water runoff from the PRSs. Storm water runoff from the areas along the north and west side of TA-46-31.
AI		Yes	46-006(d), 46-006(g), Aggregate 5.6		Storm runoff	Surface	South rim of Cañada del Buey, north of TA-46-31. Contributing flows: Storm water runoff from PRSs. Storm water runoff, via two drainages, from the areas along the north and west side of TA-46-31.
AJ		No			Storm runoff	Surface	South rim of Cañada del Buey, north of the northeast corner of TA-46-154. Storm water runoff, via two drainages, from the north side of TA-46-154.
AK		No			Storm runoff	Surface	South rim of Cañada del Buey, north of TA-46-154. Storm water runoff from the north and west side of TA-46-154.
AL		Yes	46-007, Aggregate 5.6		Storm runoff	Surface	South rim of Cañada del Buey, northwest of TA-46-154. Storm water runoff via two drainages, from the west side of TA-46-154.
AM		No			Storm runoff	Corrugated metal pipe	South rim of Cañada del Buey, north of TA-46-200. Storm water runoff from the road and the mesa edge.
AN		Yes	46-007, Aggregate 5.6		Storm runoff	Surface	South rim of Cañada del Buey, north of TA-46-154. Storm water runoff from the north and west side of TA-46-154.
AO		No			Storm runoff	Corrugated metal pipe	North rim of SWSC Canyon, east of TA-46-41. Storm water runoff from Outfall QQ, Outfall OO, and areas south of TA-46-41.

of the investigation, they will be documented and sampled as necessary. A listing of all NPDES-permitted outfalls at TA-46 is presented in Table 5-4-5.

TABLE 5-4-5

NPDES-PERMITTED OUTFALLS AT TA-46

NPDES NO.	SOURCE	SWMU	STATUS	DISCUSSION
03A042	TA-46-1	46-006(a) 46-004(j)	Active Active	5.4.1.1.2 6.2.3
03A043	TA-46-31	46-004(y)	Active	5.4.1.1.1
03A044	TA-46-86	46-004(i)	Inactive	6.2.3
03A124	TA-46-158	46-004(k)	Active	6.2.3
03A136	TA-46-200	46-004(o)	Active	6.2.3
04A013	TA-46-30	46-004(m)	Active	5.4.1.1.1
04A014	TA-46-88	46-004(t)	Active	5.4.1.1.1
04A018	TA-46-24	46-004(f)	Active	5.4.1.1.1
04A117	TA-46-41	46-004(n)	Active	6.2.3
SSS07S	TA-46-149	46-002	Inactive	5.4.1.1.2
SSS12S	TA-46-170	46-005	Inactive	5.4.1.1.2

5.4.1.2 Conceptual Exposure Model

5.4.1.2.1 Existing Information on Nature and Extent of Contamination.

All NPDES-permitted outfalls are sampled as part of the permitting process. Sampling and analysis is performed only on effluent water; no soil samples are taken. Analyses, which include physical characteristics such as pH, biological and chemical oxygen demand, etc., are not relevant to the Environmental Restoration Program. These data are not discussed here.

No soil data exist on PRSs introduced in Subsection 5.4.1.1. Other soil data concerning associated PRSs are discussed in relevant sections as listed in Table 5-4-3. Because of the varied activities at TA-46, outfall PCOCs may include metals, radionuclides, VOCs, SVOCs, and PCBs. Concentrations of contaminants are expected to be low.

5.4.1.2.2 Potential Pathways and Exposure Routes

Table 5-4-6 is a summary of exposure mechanisms and human receptors relevant to all outfalls at OU 1140.

TABLE 5-4-6

EXPOSURE MECHANISMS AND RECEPTORS FOR OUTFALLS

POTENTIAL AREA OF CONTAMINATION	RELEASE MECHANISMS	CURRENT POTENTIAL RECEPTORS	FUTURE POTENTIAL RECEPTORS
Surface soil around outfall, on shelf, and on canyon floor	• Erosion, resulting in wind dispersion • Surface water runoff and infiltration • Volatilization • External irradiation	• On-site workers • Recreational users • Construction workers	• Recreational users (i.e., hikers and joggers) • On-site workers • Construction workers
Sediments in catchment basins in drainage channels	• Wind dispersion • Runoff	• Recreational users • On-site workers • Construction workers	• Recreational users • On-site workers • Construction workers
Subsurface soil at outfall and canyon floor	• Excavation or erosion, resulting in surface release mechanisms	• None	• Recreational users • On-site workers • Construction workers

Figure 5-4-3 illustrates the conceptual exposure model for outfalls at TA-46. Refer to Subsection 4.3 for a detailed discussion of migration pathways, conversion mechanisms, human receptors, and exposure routes.

At many outfalls located outside controlled areas at TA-46, contaminants may accumulate in sedimentation traps in the drainage channels. Some contaminants may reach the canyon bench or may eventually reach the inner stream channel of Cañada del Buey. Not enough water is available in OU 1140 to support a constant supply of game fish or to be used for swimming. Currently, land on the canyon bench is used for utilities maintenance and occasional recreational activities, such as hiking and jogging.

5.4.2 Remediation Decisions and Investigation Objectives

Problem Statement (DQO Step 1). The outfalls at TA-46 are divided into two categories: ID outfalls and SR outfalls. The industrial outfalls are

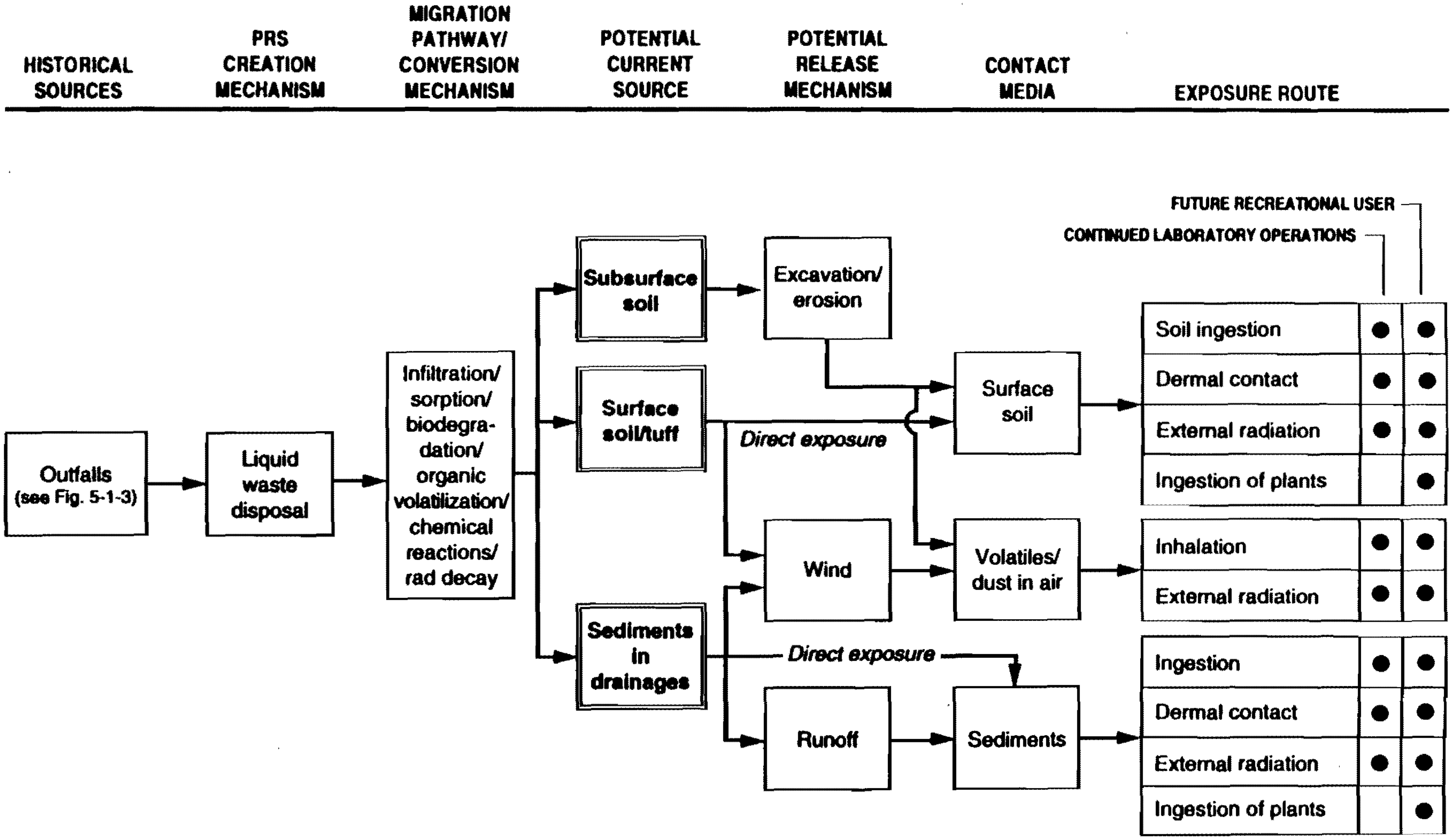


Fig. 5-4-3. Conceptual exposure model for the outfall aggregate at TA-46.

characterized as outfalls that release effluent in modest amounts on an occasional basis from buildings. Storm outfalls on the other hand frequently carry large amounts of water during periods of intense rainfall.

Each outfall has its own effluent source as documented in Subsection 5.4.1.1. The original source of potentially hazardous effluent is from the laboratory activities at TA-46. Because of the variety of laboratory activities, no PCOC can be ruled out. Since the laboratories of TA-46 were not known to use large quantities of any hazardous substance, concentration levels are expected to be below SALs. The Phase I problem for outfalls is to determine if any constituent is present in the drainage channels at concentrations above SALs. Some PCOCs could be categorized as resulting from urban runoff and, therefore, not subject to investigation under this work plan. However, any COC will be treated as a site-related contaminant, because urban-runoff contaminants at TA-46 could not be distinguished from laboratory-related PCOCs.

Decision Process (DQO Step 2). The Phase I investigation will determine if PCOCs exist above SALs in the drainage channels and collection points associated with each outfall. If the concentrations are found to be below SALs for a particular outfall, there will be no further investigation. If the concentration of any PCOC in any sample is above SAL, there will be additional investigation aimed at conducting a baseline risk assessment, including a Phase II sampling plan if required. Detecting contaminants above SALs from the outfalls may prompt the need for further investigation of PRSs in the other aggregates (e.g., surface releases, stack emissions) even if reconnaissance screening in those areas failed to detect contamination above SALs. Detection of contamination at outfalls will be followed by additional efforts to determine the nature, extent, and source of contamination. Phase II sampling may be required in channels, collection points, and contributing drain lines.

The options for remediating outfalls include the removal of contaminated soils and the placement of barriers to contain the spread of contaminated sediments.

which may have been the source of contamination detect
separate decision will be made for each outfall. The
outfalls is illustrated in Fig. 5-4-4.

The SWMU Report calls out SWMUs 46-004(g) and 46-
drains of TA-46-1 and TA-46-16, as well as outfalls. Bo
sampled. Contributing drain lines are proposed for def
Subsection 6.1.1). If COCs are detected above SALs

dividual outfall is
s in the drainage
, a baseline risk
e performed. In
other aggregates
d in the outfall. A
decision logic for

004(h) to include
h outfalls will be
rred action (see
t either of these

5.4.3 Data Needs and Data Quality Objectives

Inputs (DQO Step 3). The data required from the Phase
are concentrations of each PCOC in each sample at eac

Boundaries (DQO Step 4). In the case of industrial outfa
potential contamination include the surface and subsu
following areas: the point of release to the environme
channel from the point of release down the canyon walls,
points on the canyon shelf and the canyon floor. The re
contamination for the storm outfalls are the collection poi
shelf and floor. Because of the intense flow of effluen
outfalls, the canyon walls are not considered as regi
contamination. In both cases, the boundaries extend to
interface.

Potential regions of contamination will be investigated by
augered holes. From each hole at least one, and up
specimens will be removed. These specimens will be
exposure scenarios for this aggregate (e.g., erosion, win

The potential ultimate destination of effluent released fr
the inner canyon of Cañada del Buey. However, tha
investigated as part of the RFI for Operable Unit 1049 (c

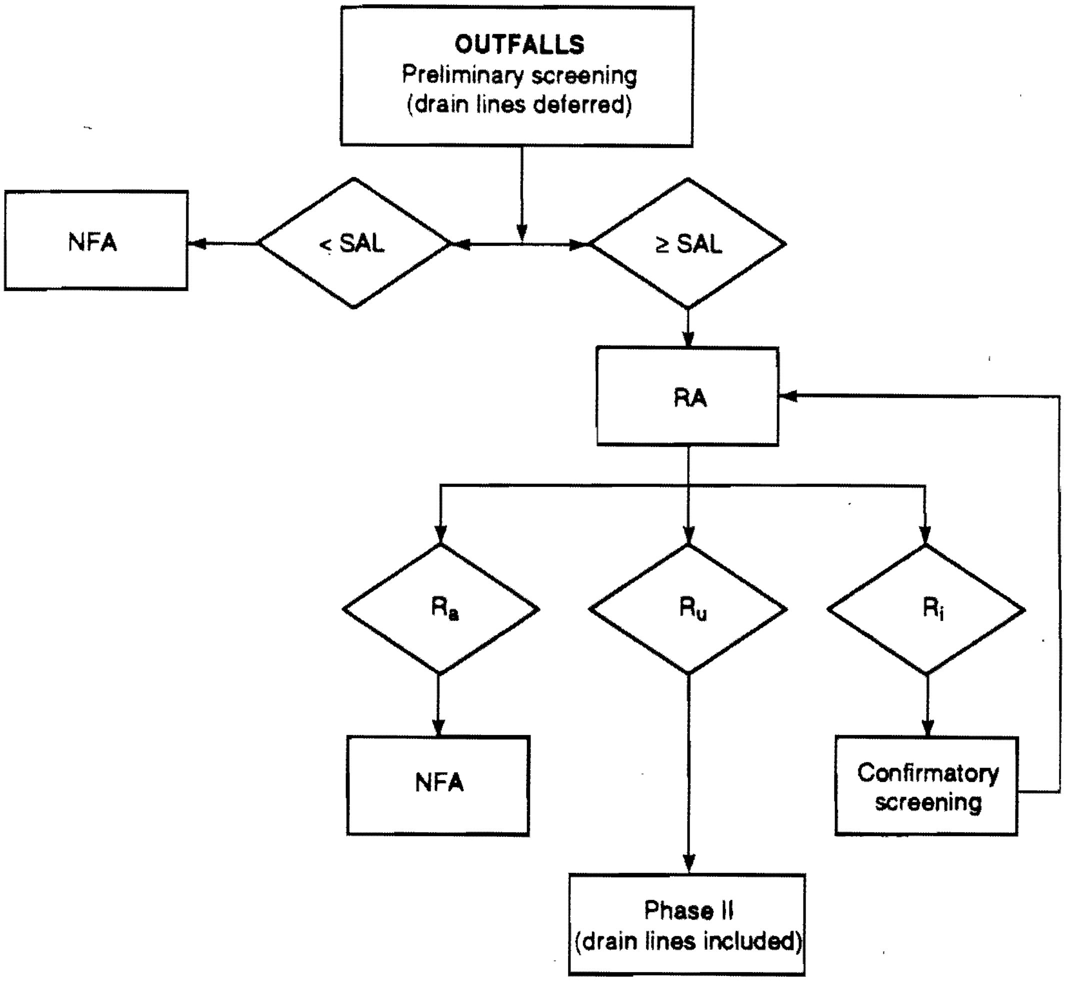
Decision Logic (DQO Step 5). The decision rule for an in
to propose NFA if concentrations of all PCOCs in all sampl
channel and collection points are below SALs. Otherwis
assessment including possible Phase II sampling will
addition, there will be further investigation of PRSs in

l sampling plans
PRS.

ls, the regions of
face soils in the
nt, the drainage
nd the collection
ions of potential
ts on the canyon
from the storm
ons of potential
the soil-bedrock

means of hand-
to three, 0.2 ft
dicative of likely
d dispersion).

m the outfalls is
t region will be
anyons).



NFA – No further action
SAL – Screening action levels for potential contaminants of concern
RA – Baseline risk assessment
R_a – Risk acceptable
R_u – Risk unacceptable
R_i – Risk indeterminate

Fig. 5-4-4. Decision logic for outfalls (preliminary screening).

outfalls, the decision to defer investigation of the associated drain lines will be reversed, and they may be included in Phase II sampling.

Design Criteria (DQO Step 6). Reconnaissance sampling will be designed to meet the following criteria: along the drainage channels the goal will be to detect contamination above SALs when the fraction of the contaminated catch basins is more than 30%. For runoff collection points the goal will be to detect contamination above SALs when the fraction of the contaminated region is more than 50%. In both cases the required probability of detection is 90%. (The rationale for the 50% figure is that any contamination in canyon shelf or floor collection points is expected to be highly homogeneous due to the effects of erosion and other release mechanisms. Since contamination within drainage channels is expected to be somewhat more heterogeneous, the 30% figure is a more appropriate criterion in that case.) These criteria will be enhanced by the use of judgmental sampling to identify the likeliest contamination points, such as catchment basins and runoff collection points.

Table 5-4-7 is a summary of the DQOs developed for outfalls.

TABLE 5-4-7

DQO SUMMARY FOR OUTFALLS

DQO STEP	RATIONALE
Problem statement	Establish presence or absence of PCOCs
Phase I decision	• Reconnaissance screening • Compare SALs
Inputs	• Concentration of constituents in surface and subsurface soil
Boundaries	• For industrial outfalls: points of release; drainage channels; canyon collection points • For storm outfalls: canyon collection points • All boundaries extend to bedrock
Decision logic	• Compare maximum sample concentration to SAL • If SAL exceeded, continue investigation • Include drain lines in baseline risk assessment • Include potential sources in other aggregates, if appropriate
Design criteria	• Drainage channels: 90% probability of detecting contaminants when 30% of catch basins are contaminated above SALS • Collection points: 90% probability of detecting contaminants when 50% of area is contaminated above SALS • Enhance probability by judgmental sampling

5.4.4 Phase I Sampling and Analysis Plan

Phase I reconnaissance sampling will focus on determining the presence or absence of PCOCs or their by-products above SALs at TA-46 outfalls. PCOCs include VOCs, SVOCs, radionuclides, and metals.

A detailed data base has been created for the purposes of ensuring that all outfalls at TA-46 that could release PCOCs are investigated. Many additional outfalls have been discovered during the course of the preliminary investigation that do not require further investigation. For the purposes of tracking, each outfall has been assigned a unique alphabetic designation (A through AO).

Table 5-4-4 illustrates the relationship of each identified outfall with the PRS number (if applicable), any related PRS numbers, any samples that will be collected for other PRSs or aggregates (overlapping samples), drain type (industrial drain or surface runoff), the route (pipe or surface), a brief source description, and codes for sorting by outfall and PRS. The table contains all identified outfalls at TA-46 whether or not they are to be sampled. Therefore, the table includes a column indicating if sampling is planned. It should be noted that if any additional outfalls are identified during the course of the investigation, they will be documented and sampled as necessary.

Engineering Surveys. Engineering surveys listed in Table 5-4-8 will be performed to precisely locate the drain lines that outfall into Cañada del Buey and SWSC Canyons. Geophysical techniques will be used to locate or verify the unlocated outfall from floor drains in the south high bay of Building TA-46-1. Geomorphologic surveys will be performed to generate maps of the outfalls and associated drainages including the lower regions of the canyon to which effluent flows.

Field Screening. The Phase I investigation will be initiated with a field survey of the PRS aggregate for radiation and organic vapors. The radiation survey and organic vapor screening will be performed according to the methods found in the Laboratory's SOPs, which are in preparation.

Appropriate health and safety precautions will be undertaken as described according to the Laboratory's ER Program SOPs (LANL 1993, 0875). Any

TABLE 5-4-8

ENGINEERING SURVEYS FOR OUTFALLS

SURVEYS	REFERENCE
Geodetic mapping	Appendix D, 3.1.1
Geomorphologic mapping	Appendix D, 3.1.2
Geophysical survey	Appendix D, 3.2

accessible sediments or water at outfalls will be field screened for radioactivity.

Sample Control. All samples will be field screened for radioactivity, metals, and organic vapors to identify gross concentrations of contaminants using the methods found in the Laboratory's SOPs, which are in preparation.

All samples will initially be analyzed in the field analytical laboratory. Gamma spectrometry will be used to identify radionuclides present in surface soil samples. X-ray fluorescence will be used to detect gross concentrations of metals. Results of field laboratory analyses will guide the selection of samples to be submitted for analytical laboratory analysis. All analytical laboratory samples will be analyzed for all PCOCs, both hazardous and radioactive. Field quality-assessment samples will be collected according to guidance provided in the IWP (LANL 1992, 0768). Any duplicate samples planned to be collected are included in Table E-1, listing sample and analysis information. See Appendix D, Subsection 2.8, for a discussion of Laboratory quality control duplicates. Sample control activities in the field will be performed according to LANL-ER-SOPs 01.01 to 01.06.

For further information on field sampling at OU 1140, refer to Appendix D Field Investigation Approach and Methods, Appendix E Sample Data Base Summary, and Appendix H Maps.

5.4.4.1 Sampling

Sampling Rationale. Outfalls at TA-46 form two distinct sample-collection regions. The first includes the point of release to the environment and the drainage channel leading to the bottom of the canyon (the upstream region). Sediment traps are normally associated with the this region. The second region is made up of canyon collection points where effluent and runoff flow slowly and absorption occurs (the canyon region).

The design of this sampling and analysis plan requires a minimum of seven analytical samples collected in each upstream region (at the outfall exit and in the drainage channel) to meet the prescribed DQO design criteria (see Subsection 5.4.3 and Table 4-8). A minimum of four analytical samples will be gathered in each canyon region. The hand-auger sampling technique will be used for most samples in the outfall aggregate and will yield up to three analytical samples per sample hole location. Therefore, 9 analytical samples may be collected from each upstream region to meet the DQOs (3 analytical samples per sample location times 3 sample locations per upstream region equals 9, which meets the 7 required samples). Six analytical samples may be collected from each canyon region (3 analytical samples per sample location times 2 sample locations per canyon region equals 6, which meets the 4 required samples).

It should be noted that many of the drainage channels receive effluent from multiple outfalls and multiple PRSs. Therefore, the total number of analytical samples may not correlate directly with the total number of outfalls.

Table 5-4-9 is a summary of site surveys and analyses for the outfall aggregate. For storm-runoff outfalls, the analytes are somewhat generic, but also based upon contributing PRS flows. More precise analyte information is developed for each sample location as detailed in Appendix E.

5.4.4.2 Sample Collection

Samples will collected with a hand-auger and thin-wall tube sampler and will be advanced to the tuff bedrock. Analytical samples will be removed from each sample hole at three depths: at the surface, middle, and bottom of the hole. The analytical sample interval will be a minimum of 0.2 ft in length. If the sample hole cannot be driven to a depth of 6 in. (or less), then only one analytical sample will be analyzed from the sample hole. A minimum 6 in. of sample material must be collected for each sample submitted for analysis.

The selection of specific sample-collection points will be based on the results of the preliminary field surveys that have been completed as well as engineering survey and geomorphologic mapping activities. In general,

Table 5-4-9

Summary of OU 1140 TA-46 Outfalls
Site Surveys,
Sampling and Analysis

Structure Sample Total 0
Surface Sample Total 2
Subsurface Sample Total 423

					Field Surveys			Samples				Field Screening						Field Lab.						Laboratory Analyses																
	PRS	Outfall Field ID	PRS Type Outfall Type	Phase 1 Approach	Land Survey	Geophysics	Radiation	Sampled Media	Structure	Surface	Subsurface	Gross Alpha	Gross Gamma/Beta	Organic Vapor	Combustible gas/oxygen	X-Ray Fluorescence	Lithologic Logging	Gross Alpha	Tritium	Soil Moisture	Gamma Spectroscopy	PCB	VOA	Gamma Spectroscopy	Isotopic Americium	Total Uranium	Isotopic Uranium	Isotopic Plutonium	Isotopic Thorium	Isotopic Cesium	VOA (SW 8240)	Semivolatiles (SW 8270)	TCLP	Metals (SW 6010)	PCB (SW 8080)	Asbestos	Mercury	Herbicides	Pesticides	Aggregate
(1)	46-002	II JJ	Outfall-pipe	Reconn	1		1	Sediments	0	0	30	1	1	1		1	1	1			1	1	1	1			1	1	1		1∞	1		1	1		1			5.4
(2)	46-003-a	HH	Outfall-pipe	Reconn	1		1	Sediments	0	0	21	1	1	1		1	1	1			1	1	1	1			1		1		1∞	1		1	1		1			5.4
(3)	46-003-f	FF	Outfall-pipe	Reconn	1		1	Sediments	0	0	18	1	1	1		1	1	1			1	1	1	1			1				1∞	1		1	1		1			5.4
(4)	46-003-g	KK	Outfall-pipe	Reconn	1		1	Sediments	0	0	27	1	1	1		1	1	1			1	1	1	1							1∞	1		1	1					5.4
(5)	46-004-f	Y	Outfall-pipe	Reconn	1		1	Sludge/Sediments	0	1	0	1	1	1		1		1			1	1	1	1			1				1	1		1	1	1	1			5.4
(6)	46-004-g	N	Outfall-Surface	Reconn	1		1	Sediments	0	0	24	1	1	1		1	1	1			1		1	1			1		1		1∞	1		1			1			5.4
(7)	46-004-h	A	Outfall-pipe	Reconn	1		1	Sediments	0	0	9	1	1	1		1	1	1			1		1	1			1				1∞	1		1						5.4
(8)	46-004-m	CC	Outfall-pipe	Reconn	1		1	Sediments	0	0	9	1	1	1		1	1	1			1		1	1			1				1			1			1			5.4
(9)	46-004-q	B	Outfall-pipe	Reconn	1		1	Sediments	0	0	3	1	1	1		1	1	1			1		1	1			1				1∞	1		1						5.4
(10)	46-004-r	Z	Outfall-pipe	Reconn	1		1	Sediments	0	0	0																													5.4

Samples for 46-004(r) are same as those for 46-004(w) (Outfall AA). Analyte suite included in samples allocated to 46-004(w), see Table E-1 sample notes.

	PRS	Outfall Field ID	PRS Type Outfall Type	Phase 1 Approach	Land Survey	Geophysics	Radiation	Sampled Media	Structure	Surface	Subsurface	Gross Alpha	Gross Gamma/Beta	Organic Vapor	Combustible gas/oxygen	X-Ray Fluorescence	Lithologic Logging	Gross Alpha	Tritium	Soil Moisture	Gamma Spectroscopy	PCB	VOA	Gamma Spectroscopy	Isotopic Americium	Total Uranium	Isotopic Uranium	Isotopic Plutonium	Isotopic Thorium	Isotopic Cesium	VOA (SW 8240)	Semivolatiles (SW 8270)	TCLP	Metals (SW 6010)	PCB (SW 8080)	Asbestos	Mercury	Herbicides	Pesticides	Aggregate
(11)	46-004-s	X	Outfall-pipes	Reconn	1		1	Sediments	0	0	9	1	1	1		1	1	1			1	1	1	1			1				1∞	1		1	1		1			5.4
(12)	46-004-t	YY	Outfall-pipe	Reconn	1		1	Sediments	0	0	3	1	1	1			1				1		1	1							1									5.4
(13)	46-004-u	F	Outfall-pipe	Reconn	1		1	Sediments	0	0	3	1	1	1		1	1						1								1∞	1		1						5.4
(14)	46-004-v	G	Outfall-pipe	Reconn	1		1	Sediments	0	0	3	1	1	1			1															1								5.4
(15)	46-004-w	AA	Outfall-pipe	Reconn	1		1	Sediments	0	1	0	1	1	1		1		1				1	1			1					1	1		1			1			5.4
(16)	46-004-x	J	Outfall-pipe	Reconn	1		1	Sediments	0	0	21	1	1	1		1	1	1			1	1	1	1			1		1		1∞	1		1	1		1			5.4
(17)	46-004-y	K	Outfall-pipe	Reconn	1		1	Sediments	0	0	15	1	1	1		1	1	1			1	1	1	1			1		1		1∞	1		1	1		1			5.4
(18)	46-004-z	L	Outfall-pipe	Reconn	1		1	Sediments	0	0	24	1	1	1		1	1	1			1	1	1	1			1		1		1∞	1		1	1		1			5.4
(19)	46-004-a2	MM	Outfall-pipe	Reconn	1		1	Sediments	0	0	9	1	1	1		1	1	1			1	1	1	1			1		1		1∞	1		1	1		1			5.4
(20)	46-004-b2	U	Outfall-pipe	Reconn	1		1	Sediments	0	0	12	1	1	1		1	1	1			1		1	1			1		1		1∞	1		1			1			5.4
(21)	46-004-c2	S	Outfall-pipe	Reconn	1		1	Sediments	0	0	9	1	1	1		1	1	1			1		1	1			1		1		1∞	1		1			1			5.4
(22)	46-005	LL	Outfall-surface	Reconn	1		1	Sediments	0	0	15	1	1	1		1	1	1			1	1	1	1			1				1∞	1		1	1					5.4
(23)		I	Outfall-pipe	Reconn	1		1	Sediments	0	0	18	1	1	1		1	1	1			1	1	1	1			1		1		1	1		1						5.4
(24)		P	Outfall-pipe	Reconn	1		1	Sediments	0	0	24	1	1	1		1	1	1			1	1	1	1			1		1		1	1		1						5.4
(25)		NN	Outfall-pipe	Reconn	1		1	Sediments	0	0	9	1	1	1		1	1	1			1	1	1	1			1		1		1	1		1			1			5.4
(26)		BB	Outfall-pipe	Reconn	1		1	Sediments	0	0	6	1	1	1		1	1	1			1	1	1	1			1		1		1	1		1			1			5.4
(27)		AF	Outfall-surface	Reconn	1		1	Sediments	0	0	6	1	1	1		1	1	1			1	1	1	1			1		1		1	1		1						5.4
(28)		AE	Outfall-surface	Reconn	1		1	Sediments	0	0	6	1	1	1		1	1	1			1	1	1	1			1		1		1	1		1						5.4
(29)		M	Outfall-pipe	Reconn	1		1	Sediments	0	0	6	1	1	1		1	1	1			1	1	1	1			1		1		1	1		1						5.4
(30)		OO	Outfall-pipe	Reconn	1		1	Sediments	0	0	6	1	1	1		1	1	1			1	1	1	1			1				1	1		1						5.4
(31)		QQ	Outfall-pipe	Reconn	1		1	Sediments	0	0	6	1	1	1		1	1	1			1	1	1	1			1		1		1	1		1	1					5.4
(32)		AI	Outfall-surface	Reconn	1		1	Sediments	0	0	6	1	1	1		1	1	1			1	1	1	1			1	1	1		1	1		1			1			5.4
(33)		AH	Outfall-surface	Reconn	1		1	Sediments	0	0	6	1	1	1		1	1	1			1	1	1	1			1	1	1		1	1		1			1			5.4
(34)		AG	Outfall-surface	Reconn	1		1	Sediments	0	0	6	1	1	1		1	1	1			1	1	1	1			1	1	1		1	1		1			1			5.4
(35)		ZZ	Outfall-pipe	Reconn	1		1	Sediments	0	0	6	1	1	1		1	1	1			1	1	1	1			1		1		1	1		1						5.4
(36)		RR	Outfall-pipe	Reconn	1		1	Sediments	0	0	6	1	1	1		1	1	1			1	1	1	1			1		1		1	1		1						5.4
(37)		AB	Outfall-pipe	Reconn	1		1	Sediments	0	0	6	1	1	1		1	1	1			1	1	1	1			1		1		1	1		1						5.4
(38)		Q	Outfall-pipe	Reconn	1		1	Sediments	0	0	6	1	1	1		1	1	1			1	1	1	1			1		1		1	1		1						5.4

Summary of OU 1140 TA-46 Outfalls Site Surveys, Sampling and Analysis

Structure Sample Total 0
Surface Sample Total 2
Subsurface Sample Total 423

					Field Surveys			Samples				Field Screening						Field Lab.						Laboratory Analyses																
	PRS	Outfall Field ID	PRS Type Outfall Type	Phase 1 Approach	Land Survey	Geophysics	Radiation	Sampled Media	Structure	Surface	Subsurface	Gross Alpha	Gross Gamma/Beta	Organic Vapor	Combustible gas/oxygen	X-Ray Fluorescence	Lithologic Logging	Gross Alpha	Tritium	Soil Moisture	Gamma Spectroscopy	PCB	VOA	Gamma Spectroscopy	Isotopic Americium	Total Uranium	Isotopic Uranium	Isotopic Plutonium	Isotopic Thorium	Isotopic Cesium	VOA (SW 8240)	Semivolatiles (SW 8270)	TCLP	Metals (SW 6010)	PCB (SW 8080)	Asbestos	Mercury	Herbicides	Pesticides	Aggregate
(39)		TT	Outfall-pipe	Reconn	1		1	Sediments	0	0	6	1	1	1		1	1	1			1	1	1	1			1		1		1	1		1	1					5.4
(40)		C	Outfall-pipe	Reconn	1		1	Sediments	0	0	6	1	1	1		1	1	1			1	1	1	1			1		1		1	1		1						5.4
(41)		AN	Outfall-surface	Reconn	1		1	Sediments	0	0	6	1	1	1		1	1	1			1	1	1	1			1		1		1	1		1						5.4
(42)		AL	Outfall-surface	Reconn	1		1	Sediments	0	0	6	1	1	1		1	1	1			1	1	1	1			1		1		1	1		1						5.4
(43)	46-008-c	PP	Outfall-pipe	Reconn	1		1	Sediments	0	0	6	1	1	1		1	1	1			1		1	1			1		1		1	1		1	1					5.4

industrial outfall sample-collection points will be located directly beneath the outflow of the drain line, at DQO-prescribed locations of sedimentation traps in the drainage channel, and within the area where the effluent is absorbed into the soil in benches or canyon bottoms. Sediment traps will be sampled by two separate auger holes. One will be driven in the center of the trap, the other will be placed on the lateral border (not up or downslope) of the trap at the average high-water line. This second hole is designed to take advantage of the phenomenon of PCOCs being preferentially trapped on the sides of channel catchments (Hoard 1993, 11-226). Storm outfall sample-collection points will normally be located at collection points on the canyon floor or on topographic flats on the canyon shelves.

Two surface sediment samples will be collected at outfalls that flow into drainage grates on the top of the TA-46 mesa.

The collection of outfall samples will be procedurally controlled by Laboratory ER SOPs, which are in preparation. The geologist performing the geologic logging of the outfall samples will make a determination of soil type. A decision as to whether the soils are hydric is necessary for the determination of federally-defined wetlands status.

Sample-collection locations are illustrated in Figs. 5-4-5 through 5-4-14 and Map H-2. Table 5-4-9 is a summary of outfall sampling and analysis. Table 5-4-10 provides cross-correlations between outfall designators, associated SWMUs, and sampling location figures. A drain description is included in the table.

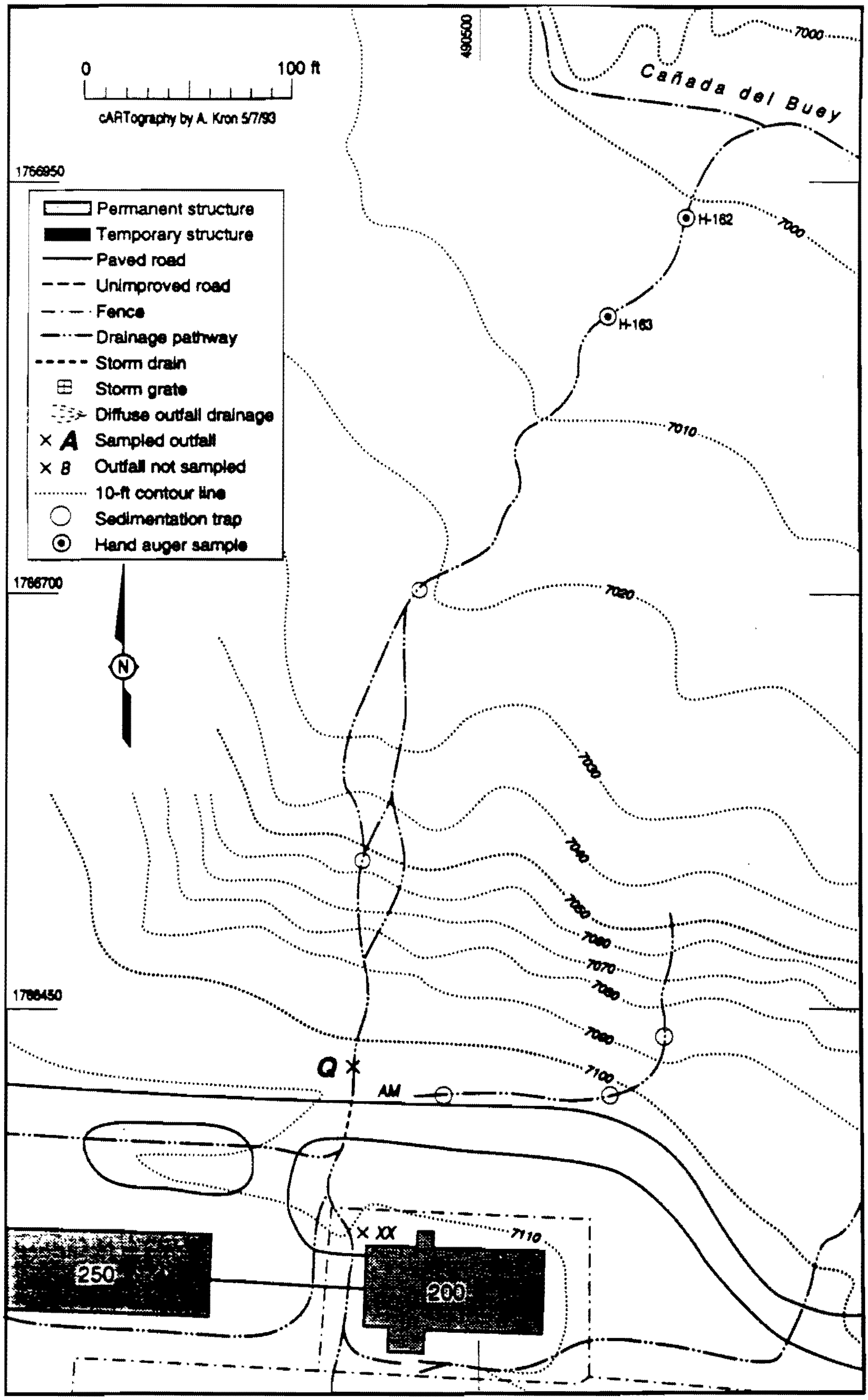
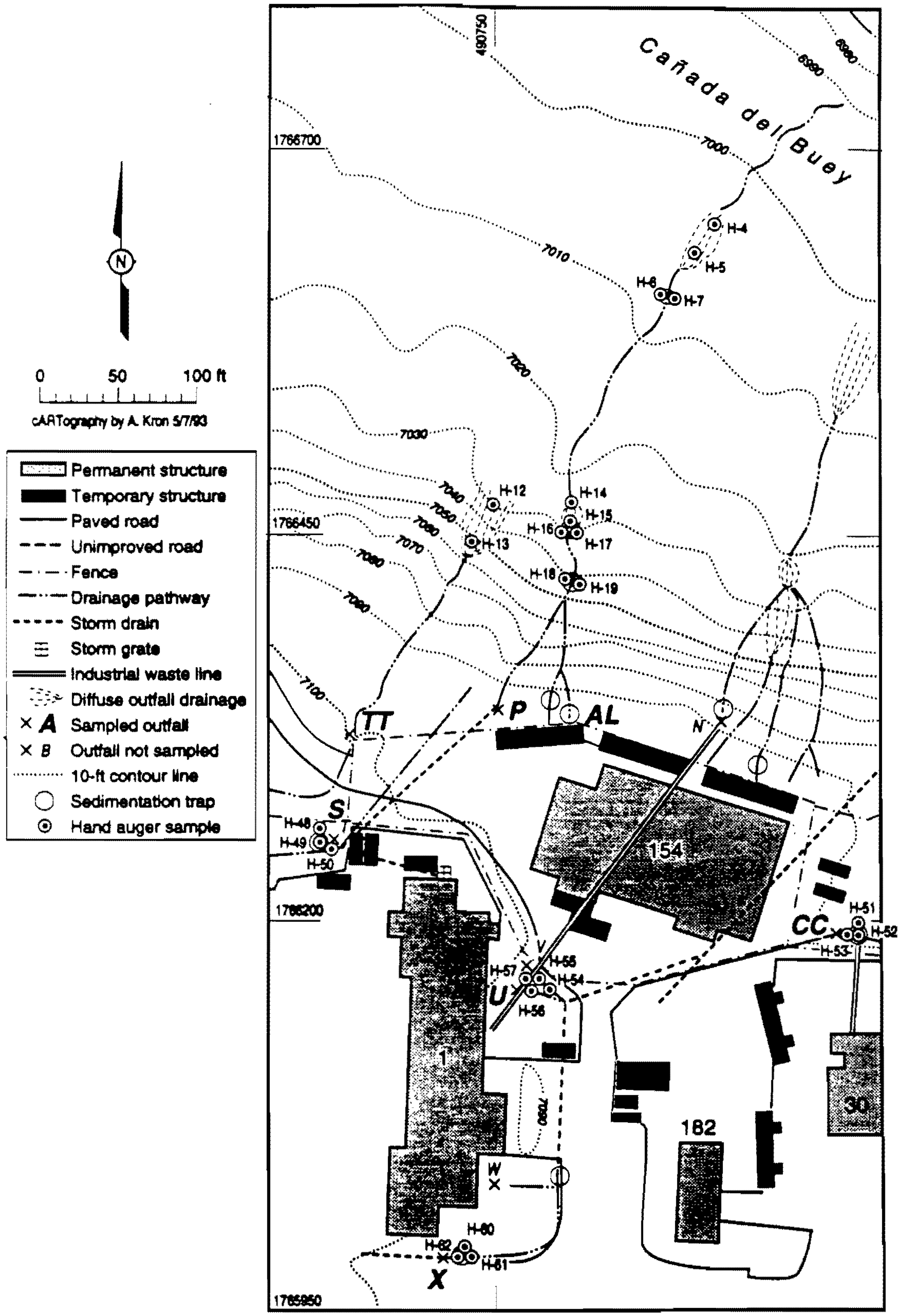


Fig. 5-4-5. Sampling locations at west TA-46: Outfall Q.



cARTography by A. Kron 5/7/93

Fig. 5-4-6. Sampling locations at northwest TA-46: Outfalls P, S, U, X, CC, TT, and AL.

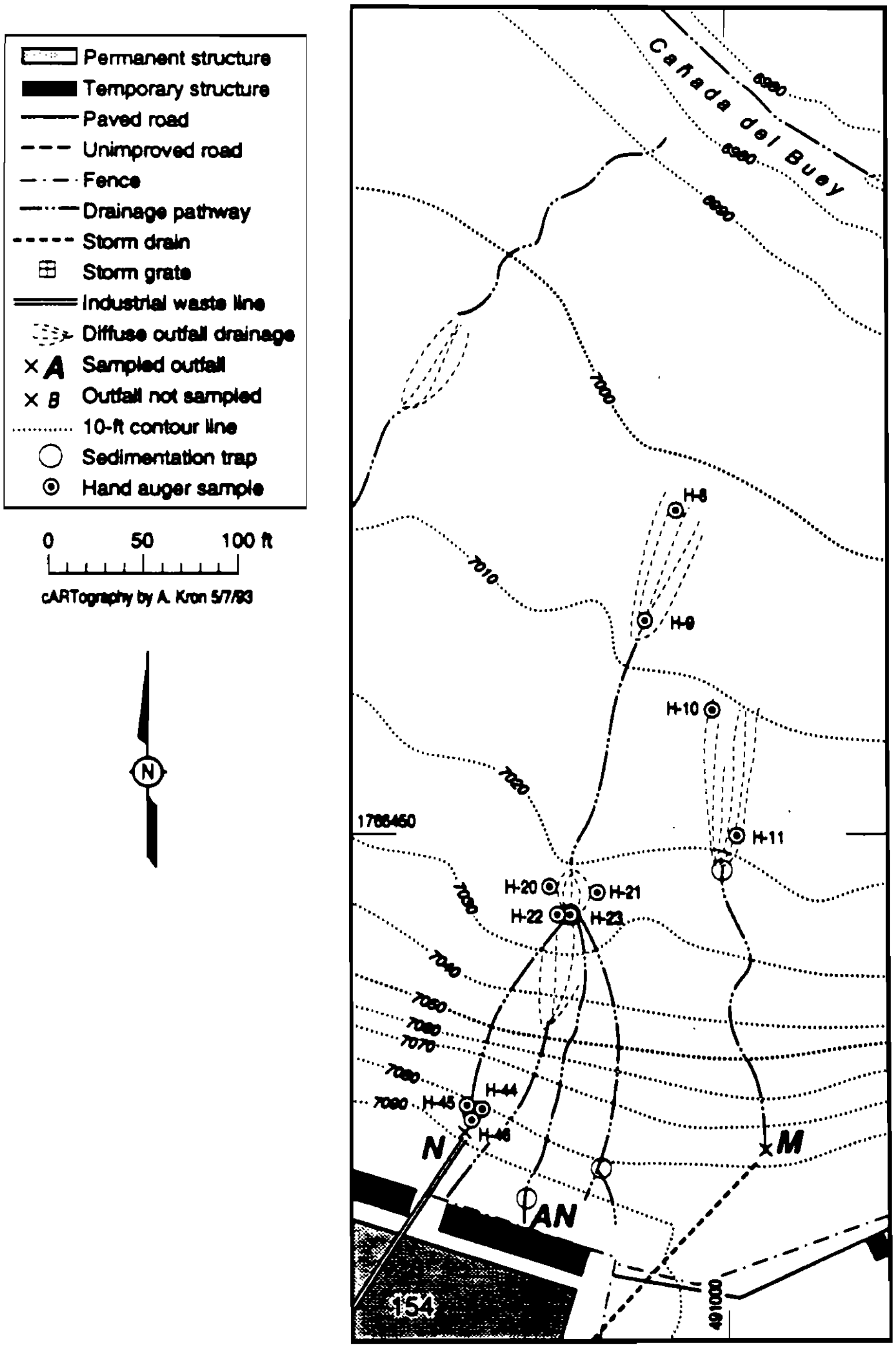
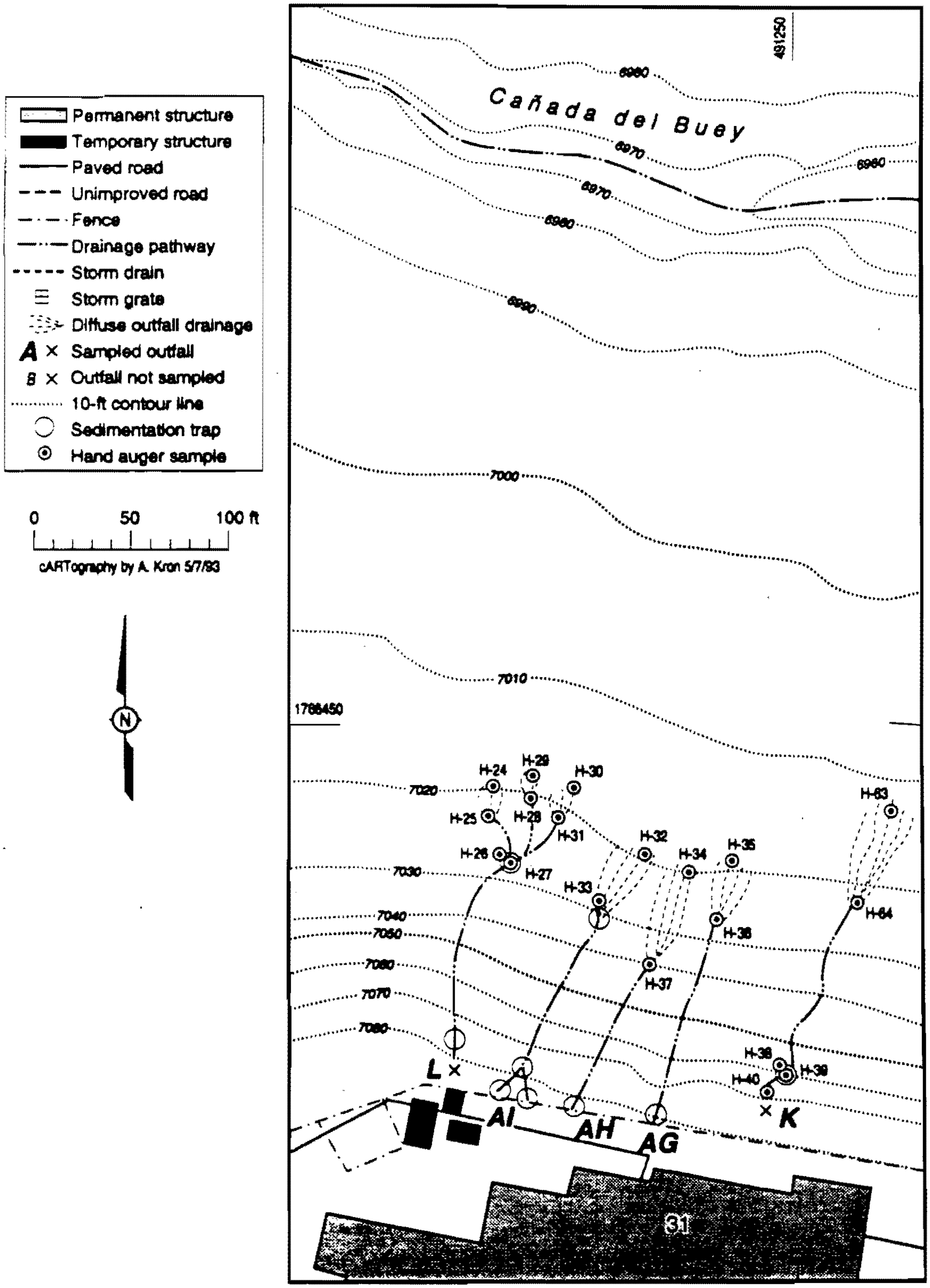


Fig. 5-4-7. Sampling locations at northwest central TA-46: Outfalls M, N, and AN.



cARTography by A. Kron 5/7/93

Fig. 5-4-8. Sampling locations at north central TA-46: Outfalls K, L, AG, AH, and AI.

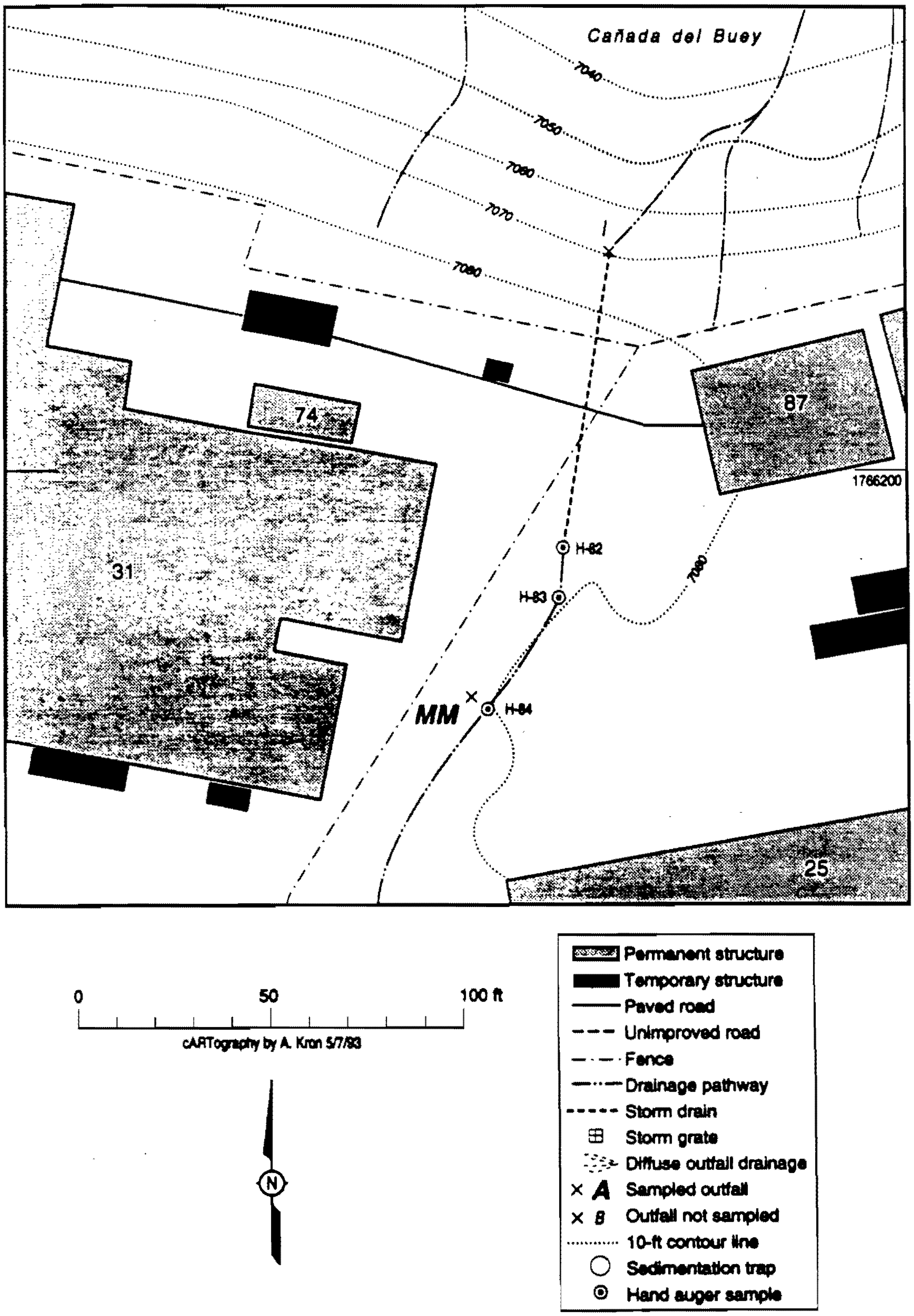


Fig. 5-4-9. Sampling locations at northeast central TA-46: Outfall MM.

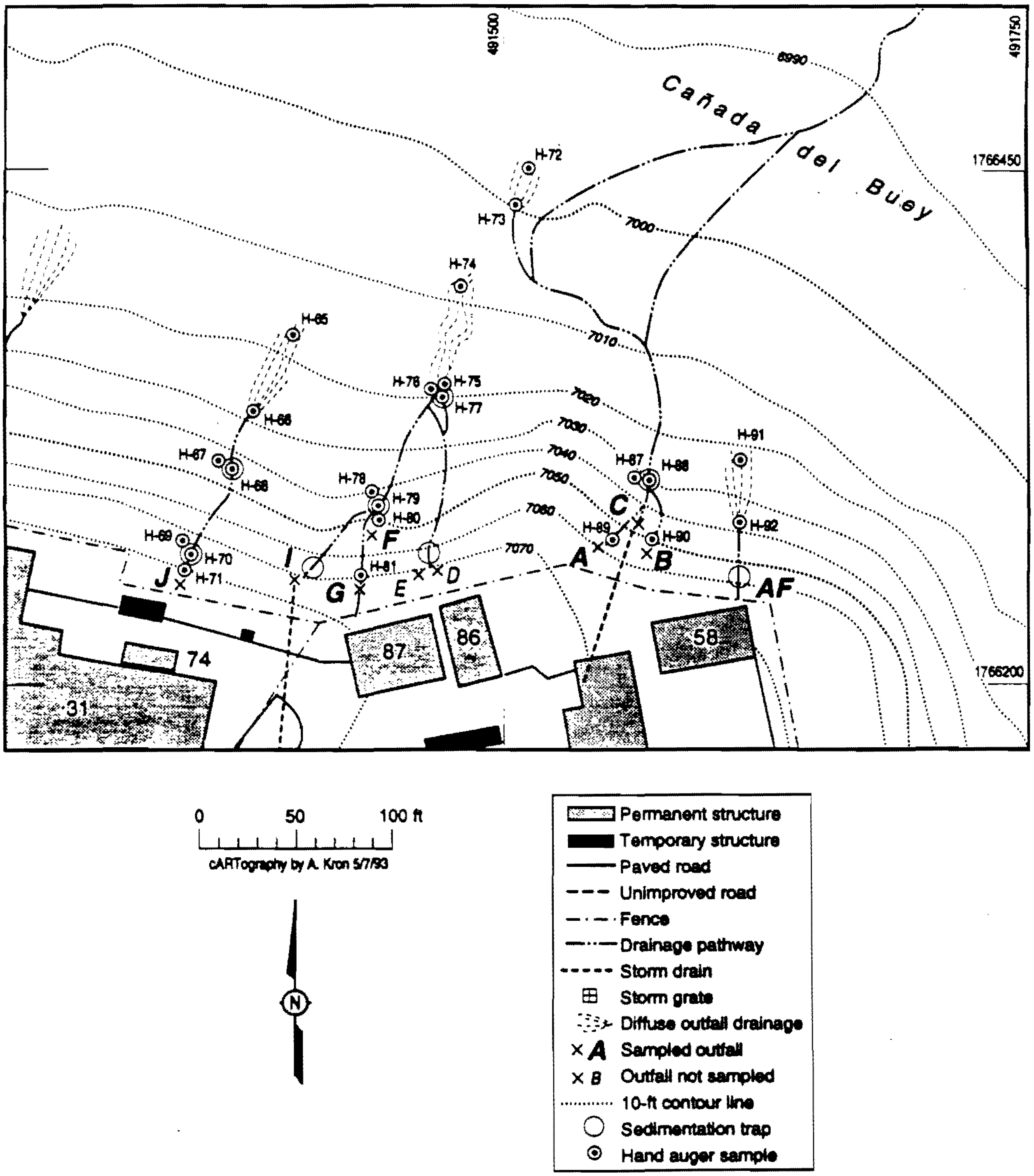


Fig. 5-4-10. Sampling locations at northeast TA-46: Outfalls A, B, C, F, G, I, J, and AF.

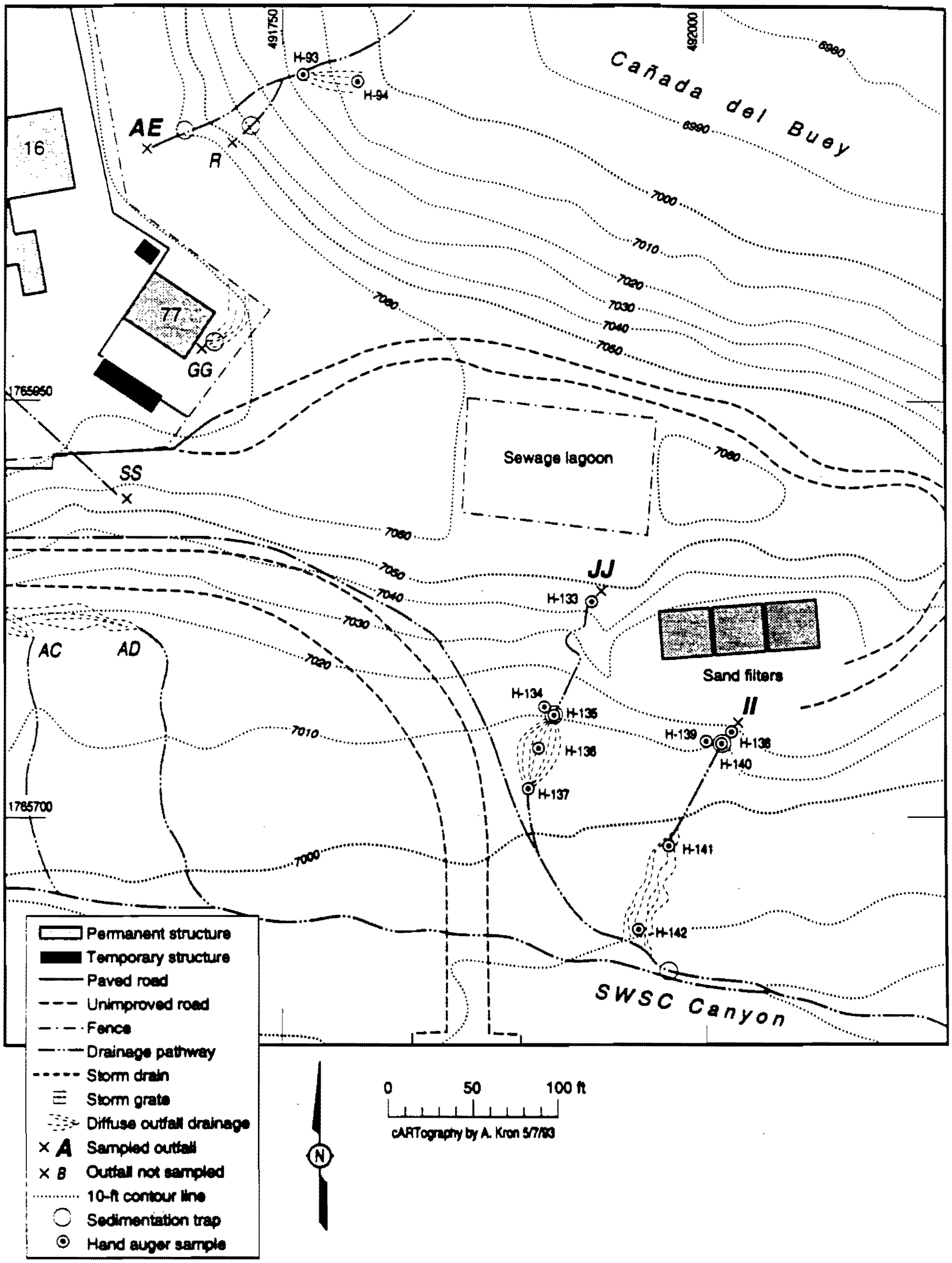


Fig. 5-4-11. Sampling locations at east TA-46: Outfalls II, JJ, and AE.

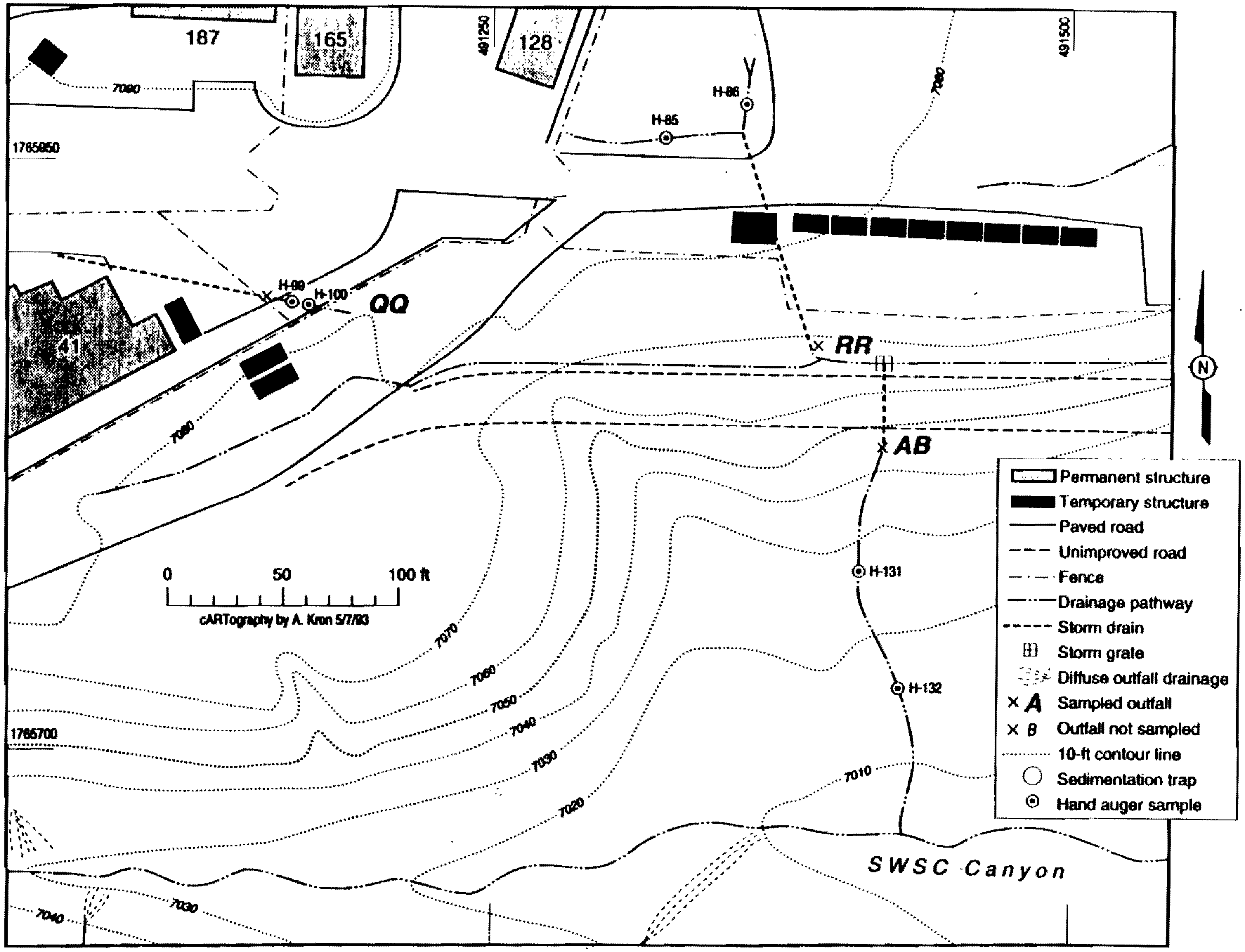
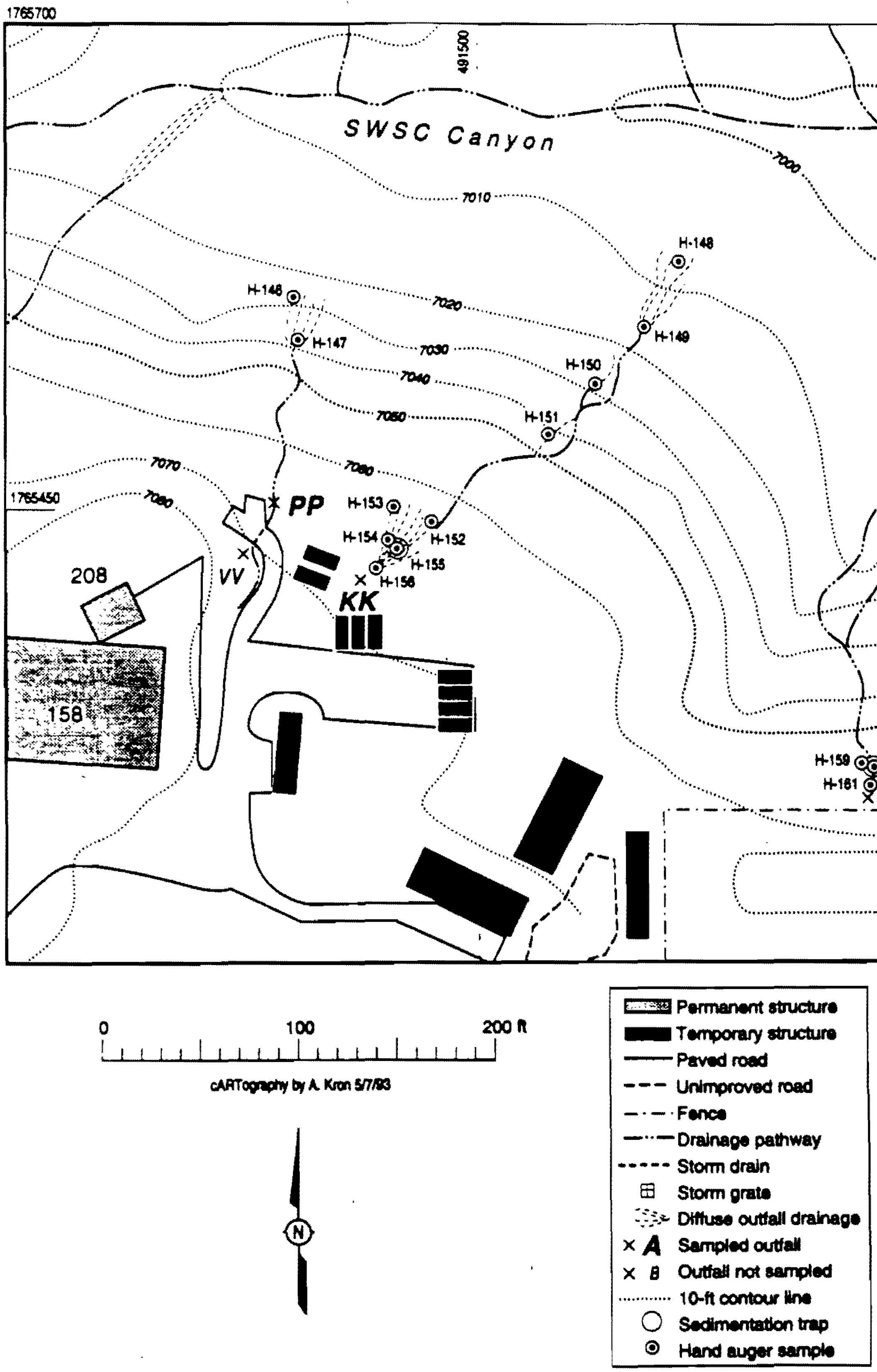


Fig. 5-4-12. Sampling locations at east central TA-46: Outfalls QQ, RR, and AB.



cARTography by A. Kron 5/7/93

Fig. 5-4-13. Sampling locations at southeast TA-46: Outfalls KK, LL, and PP.

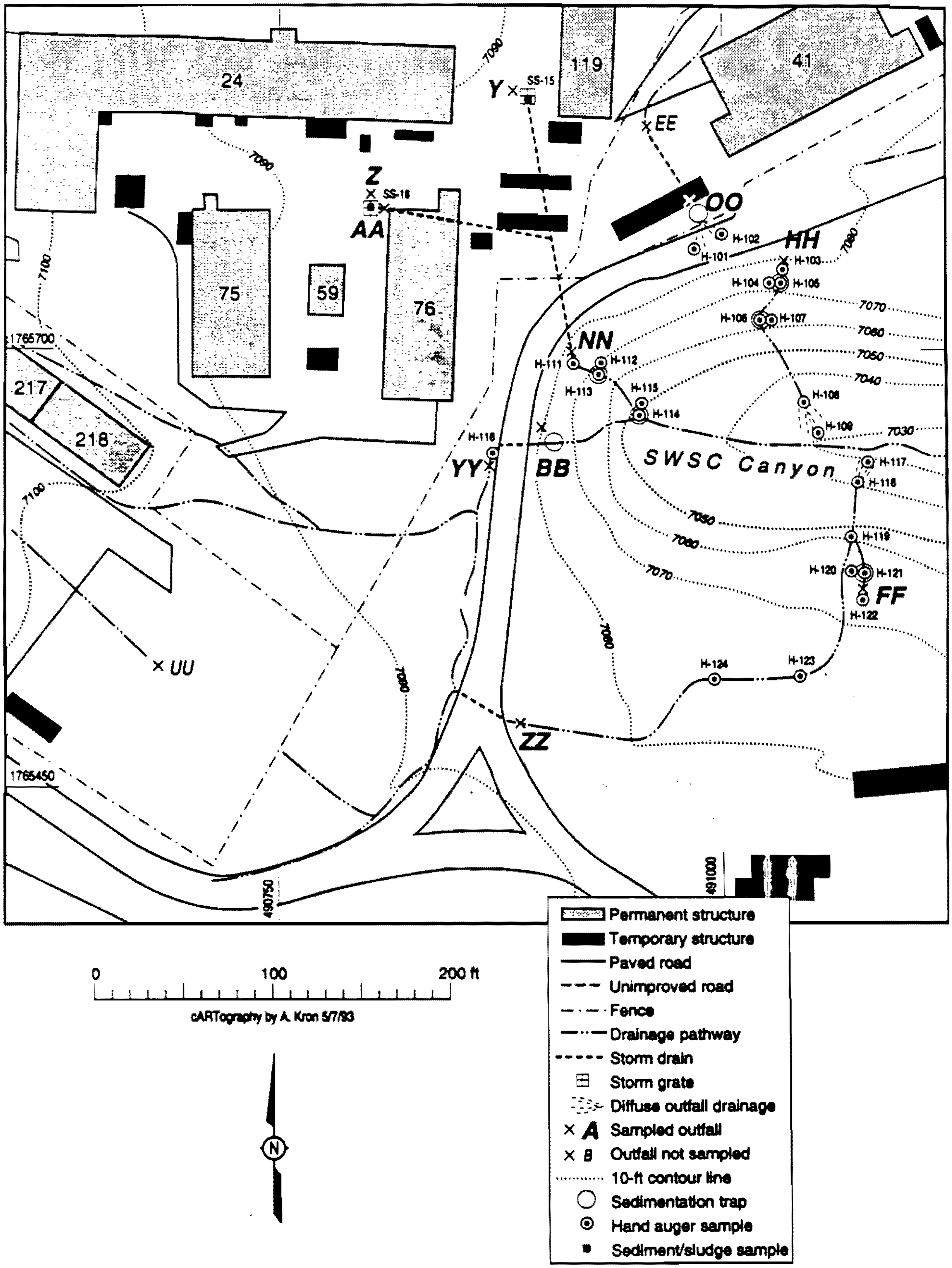


Fig. 5-4-14. Sampling locations at southwest TA-46: Outfalls Y, Z, AA, BB, FF, HH, NN, OO, YY, and ZZ.

TABLE 5-4-10

OUTFALL CROSS-CORRELATION TABLE

FIELD ID	FIGURE NUMBER	PRS	OVERLAPPING SAMPLES	OUTFALL STYLE	DRAIN TYPE
A	5-4-10	46-004(h)		Industrial drain	6" Cast iron pipe
B	5-4-10	46-004(q)		Industrial drain	6" Cast iron pipe
C	5-4-10		Aggregate 5.6	Storm runoff	Corrugated metal pipe
F	5-4-10	46-004(u)		Industrial drain	8" Cast iron pipe
G	5-4-10	46-004(v)		Industrial drain	6" Cast iron pipe
I	5-4-10		46-004(a2), 46-006(d), Aggregate 5.6	Storm runoff	Corrugated metal pipe
J	5-4-10	46-004(x)		Industrial drain	6" Cast iron pipe
K	5-4-8	46-004(y)		Industrial drain	6" Cast iron pipe
L	5-4-8	46-004(z)	46-006(d), 46-006(g)	Industrial drain	6" Cast iron pipe
M	5-4-7		46-004(m), 46-004(s), 46-004(b2), 46-006(f), 46-007, 46-008(b), Aggregate 5.6	Storm runoff	Corrugated metal pipe
N	5-4-7	46-004(g)		Industrial drain	12" Vitrified clay pipe
P	5-4-6		46-004(j), 46-004(c2), 46-006(a), Aggregate 5.6	Storm runoff	Corrugated metal pipe
Q	5-4-5		46-004(o), Aggregate 5.6	Storm runoff	Corrugated metal pipe
S	5-4-6	46-004(c2)	46-004(j), 46-006(a)	Industrial drain	4" Cast iron pipe
U	5-4-6	46-004(b2)	46-007	Industrial drain	4" Vitrified clay pipe
X	5-4-6	46-004(s)	46-007	Industrial drain	4" Cast iron pipe
Y	5-4-14	46-004(f)		Industrial drain	6" Vitrified clay pipe
Z	5-4-14	46-004(r)		Industrial drain	4" Cast iron pipe
AA	5-4-14	46-004(w)		Industrial drain	2" Cast iron pipe
BB	5-4-14		46-004(t), 46-008(g), Aggregate 5.6, C-46-001	Storm runoff	Corrugated metal pipe
CC	5-4-6	46-004(m)		Industrial drain	6" Vitrified clay pipe
FF	5-4-14	46-003(f)		Industrial drain	4" Vitrified clay pipe
GG		46-003(h)		Industrial drain	2" Galvanized pipe
HH	5-4-14	46-003(a)	46-009(a)	Industrial drain	4" Vitrified clay pipe
II, JJ	5-4-11	46-002		Industrial drain	II-, 6" Vitrified clay pipe, JJ-, 12" Corrugated metal pipe
KK	5-4-13	46-003(g)	46-006(c) Aggregate 5.6	Industrial drain	4" PVC pipe
LL	5-4-13	46-005		Industrial drain	6" PVC pipe
MM	5-4-9	46-004(a2)		Industrial drain	6" Vitrified clay pipe

Table 5-4-10 (continued)

OUTFALL CROSS-CORRELATION TABLE

FIELD ID	FIGURE NUMBER	PRS	OVERLAPPING SAMPLES	OUTFALL STYLE	DRAIN TYPE
NN	5-4-14		46-004(f), 46-004(r), 46-004(w) 46-008(d), Aggregate 5.6, C-46-001	Storm runoff	Corrugated metal pipe
OO	5-4-14		46-004(n), 46-006(b), Aggregate 5.6	Storm runoff	Corrugated metal pipe
PP	5-4-13		46-006(c), Aggregate 5.6	Storm runoff	Corrugated metal pipe
QQ	5-4-12		46-006(b), Aggregate 5.6	Storm runoff	Corrugated metal pipe
RR	5-4-12		46-008(e), 46-008(f), 46-010(c), Aggregate 5.6	Storm runoff	Corrugated metal pipe
TT	5-4-6		Aggregate 5.6	Storm runoff	Corrugated metal pipe
YY	5-4-14	46-004(t)	C-46-001	Industrial drain	4" Vitrified clay pipe
ZZ	5-4-14		46-008(a), 46-008(g), Aggregate 5.6	Storm runoff	Corrugated metal pipe
AB	5-4-12		46-008e, 46-008(f), Aggregate 5.6	Storm runoff	Corrugated metal pipe
AE	5-4-11		46-004(h), Aggregate 5.6	Storm runoff	Surface
AF	5-4-10		46-004(h), Aggregate 5.6	Storm runoff	Surface
AG	5-4-8		46-006(d), 46-006(g), Aggregate 5.6	Storm runoff	Surface
AH	5-4-8		46-006(d), 46-006(g), Aggregate 5.6	Storm runoff	Surface
AI	5-4-8		46-006(d), 46-006(g), Aggregate 5.6	Storm runoff	Surface
AL	5-4-6		46-007, Aggregate 5.6	Storm runoff	Surface
AN	5-4-7		46-007, Aggregate 5.6	Storm runoff	Surface

5.5 Landfills

5.5.1 Background

Table 5-5-1 lists the two PRSs in this aggregate:

TABLE 5-5-1

LANDFILLS AGGREGATE

PRS	DESCRIPTION	STATUS	PCOCs
46-009(a)	Landfill near building TA-46-41	Inactive	Metals; uranium-235, -238; plutonium-239, -240; thorium-230; cesium-137; VOCs; SVOCs; asbestos; PCBs
46-009(b)	Sand disposal area on east side of TA-46, near sanitary lagoon WA-149	Inactive	Metals; uranium-235, -238; plutonium-238, -239, -240; thorium; VOCs; SVOCs; asbestos; PCBs

Both PRSs are inactive landfills in TA-46. They are aggregated because they have similar conceptual models, potential contaminants of concern, and potential response actions.

See Fig. 5-5-1 for the location of these PRSs.

5.5.1.1 Description and History

PRS 46-009(a) is a steep landfill located at the head of SWSC Canyon, near the southeastern corner of TA-46. The landfill covers approximately 5 000 square yards and extends from the canyon rim to the floor of SWSC Canyon. The total landfill volume is unknown. The nearest structure is TA-46-41. The landfill contains a variety of materials, including soil, asphalt, concrete, plywood, pipe, and other construction materials. There are no precise records of the origin and age of these materials.

It is not clear when the use of this site as a landfill commenced, but it is possible that it predated TA-46. Convenient access from Pajarito Road would have made this PRS a potential disposal point for materials from other technical areas, both before and after the establishment of TA-46. Recent visitors to the site noted that the fill material included building rubble

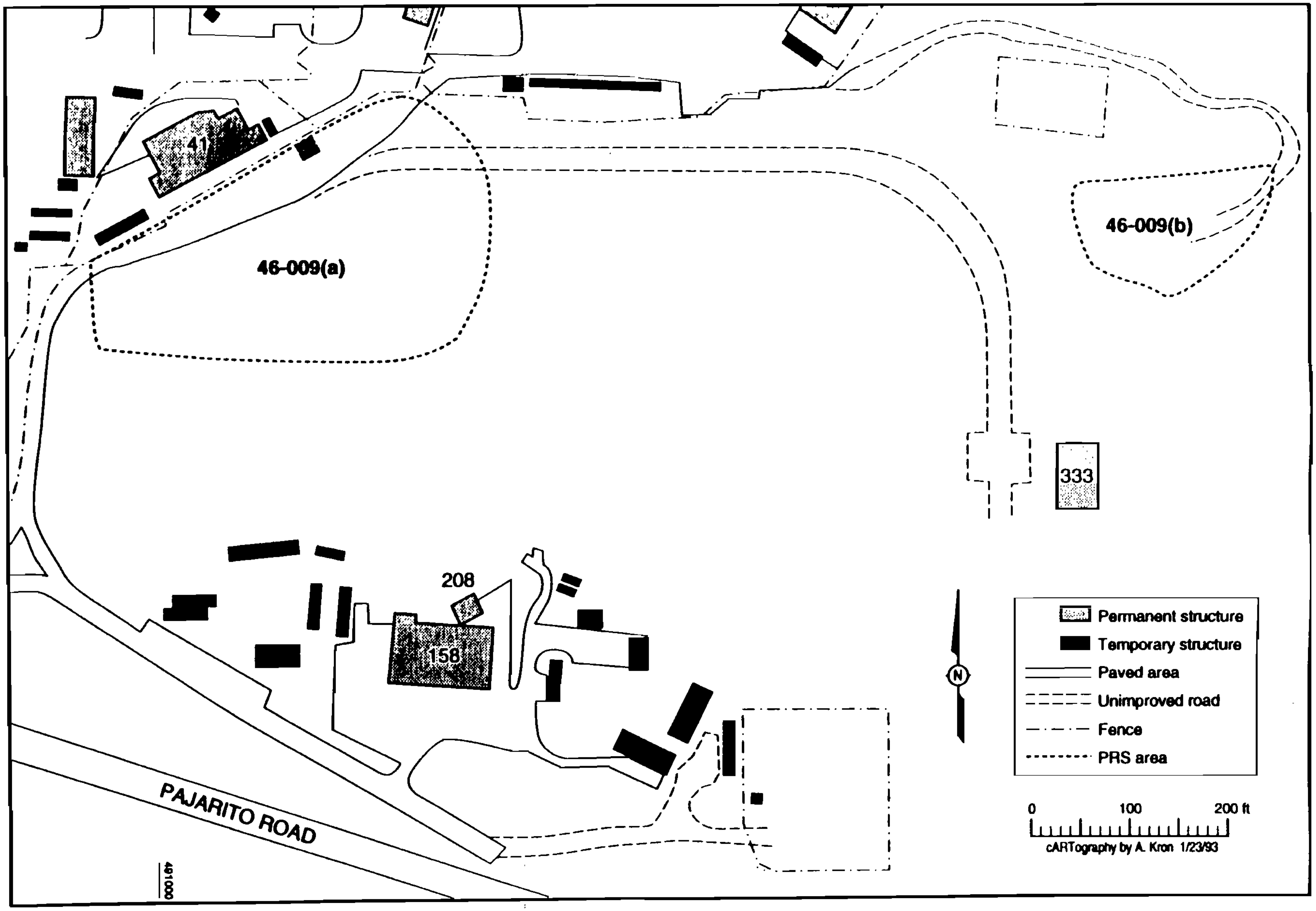


Fig. 5-5-1. **Location of PRSs in the landfill aggregate at OU 1140 (TA-46).**

(Turin 1992, 11-207). Much of this debris is likely to have originated at other technical areas, since no TA-46 structures have been demolished.

It is also not known when contributions to the landfill ceased. The landfill is identifiable in aerial photograph 372 MCS USAF of TA-46 taken in December 1958. Its footprint today is similar to that depicted in the 1958 photograph.

PRSs that are related to PRS 46-009(a) include:

- PRS 46-003(a), a septic system whose drain field and outfall overlap the landfill;
- PRS 46-004(n), a regulated cooling water outfall that drains into SWSC Canyon; and,
- PRS 46-006(b), a former storage shed near TA-46-1, where surface releases may have moved in the direction of the canyon over the landfill.

PRS 46-009(b) is a site that contains sand discarded from three sand filters associated with sanitary lagoon TA-46-149 (PRS 46-002). It is on the east side of TA-46 outside the security fence, and immediately to the southeast/ south/ southwest of the sand filters. Thin black plastic sheeting of unknown origin is visible at various points of the sand pile. The lagoon system has been in operation since 1973.

Standard practice was to clean the sand filters approximately every two or three months. The sludge mixed with sand (approximately 6 in. deep) was removed by a front-end loader and then transported to MDA G at TA-54 for burial. The next two or three inches of sand were removed from the filters and dumped in PRS 46-009(b). The filters were then filled with fresh sand; any remaining fresh sand was also dumped in PRS 46-009(b). This practice continued until operations ceased in the first quarter of calendar year 1990 (Roberts and Bailey 1992, 11-208).

5.5.1.2 Conceptual Exposure Model

5.5.1.2.1 Existing Information on Nature and Extent of Contamination

In 1989, PRS 46-009(a) was listed under Environmental Problem #22 (LANL 1989, 0425). According to this document, PCOCs in 0 to 6 in. soil samples at PRS 46-009(a) included radioactive isotopes, metals, SVOCs, PCBs, and asbestos. Results of any detectable constituents are listed in Table 5-5-2. See Fig. 5-5-2 for sampling locations.

TABLE 5-5-2

CONTAMINATION DETECTED AT SWMU 46-009(a) ENVIRONMENTAL PROBLEM #22[a, b]

CONTAMINANT	CONCENTRATION RANGE [a] (mg/kg)	LOCAL SOIL BACKGROUND (mg/kg)	SOIL SALs (mg/kg)
Metals			
Barium	49.5 - 83.2	120-810 [c]	5 600[d]
Beryllium	1.3 - 1.7	1.1-3.3[c]	0.16[d]
Cadmium	nd[e] - 2.8	0.03-0.52 [c]	80[d]
Chromium	nd - 5.4	4.2 - 136[c]	400 (VI)[d]
Silver	nd - 6.4	<1.6[f]	400[d]
Uranium (total)	2 - 3	1.5-6.7[f]	240[g, d]
Zinc	19.2 - 37.5	38-71 [c]	24 000[d]
Organic Compounds			
Benzo(a)anthracene	nd - 0.59	0	
Benzo(b)fluoranthene	0.021 - 0.59	0	
Benzoic acid	nd - 0.1	0	320 000 [h]
Chrysene	0.028 - 0.65	0	
Fluoranthene	0.078 - 1.9	0	3 200[d]
Phenanthrene	0.064 - 1.9	0	
Pyrene	0.063 - 1.7	0	2 400[d]
Aroclors (PCB)	nd - 0.96	0	0.09 [i]
Beta-BHC	nd - 0.1	0	4[h]
Chlordane	nd - 0.027	0	0.5[i]
DDT	nd - 0.007	0	2[i]
Endosulfan	nd - 0.009	0	4[i]
Radionuclides	(pCi/g)	(pCi/g)	(pCi/g)
Cesium-137	0.062 - 0.155 [j]	nd - 1.4[k]	4[l]
Thorium-230	1.1 - 3.2		10[l]
Uranium-235	0.04 - 0.098 [j]		18[l]
Plutonium-239, -240	nd - 0.066	nd - 0.052[k]	24[l]

TABLE 5-5-2 (continued)

CONTAMINATION DETECTED AT SWMU 46-009(a)
ENVIRONMENTAL PROBLEM #22[a, b]

CONTAMINANT	CONCENTRATION RANGE [a] (mg/kg)	LOCAL SOIL BACKGROUND (mg/kg)	SOIL SALs (mg/kg)
Miscellaneous			
Chrysotile (asbestos)	1%		

a LANL 1989, 0425.
b Because of data quality concerns, the Environmental Problem data presented in this table are used only to help identify PCOCs, never as a basis for NFA recommendations.
c Ferenbaugh et al. 1990, 0099.
d Appendix J of the IWP (LANL 1992, 0768).
e nd - not detected.
f Duffy and Longmire 1993, 11-239.
g SAL for chemical toxicity only. Radiological SALs presented in radionuclide section.
h SAL calculated using method described in IWP Appendix J (LANL 1992, 0768).
i EPA 1990, 0432.
j Field measurements conducted on soil samples at field moisture content (i.e., wet). No laboratory analysis performed.
k Purtymun et al. 1987, 0211.
l Dorries 1993, 11-237.

Since 1989, there have been three additional characterization efforts at this PRS, all prompted by the construction of a roadway on the site of the landfill:

1. In 1990, soil samples were taken from three 24-ft core holes drilled along the path of the proposed road. Soil samples were screened for gross alpha, beta and gamma radioactivity, and were then analyzed for toxicity characteristic leaching procedure (TCLP) metals as well as RCRA target VOCs, SVOCs, and PCBs. Radioactivity measurements in all samples were found to be at or below background levels; metals were below EPA guidelines under 40 CFR 261.24; and no VOCs, SVOCs, or PCBs were detected (Fresquez 1990, 11-229).

2. In 1992, ten composite surface soil samples were collected at PRS 46-009(a) for asbestos analysis. No detectable levels of asbestos were found in any of these samples. Radiological screening of the samples found gross alpha and beta activity to be <.25 pCi/g., with gross gamma activity ranging from 1.09 to 1.14 pCi/g (Fresquez 1992, 11-230).

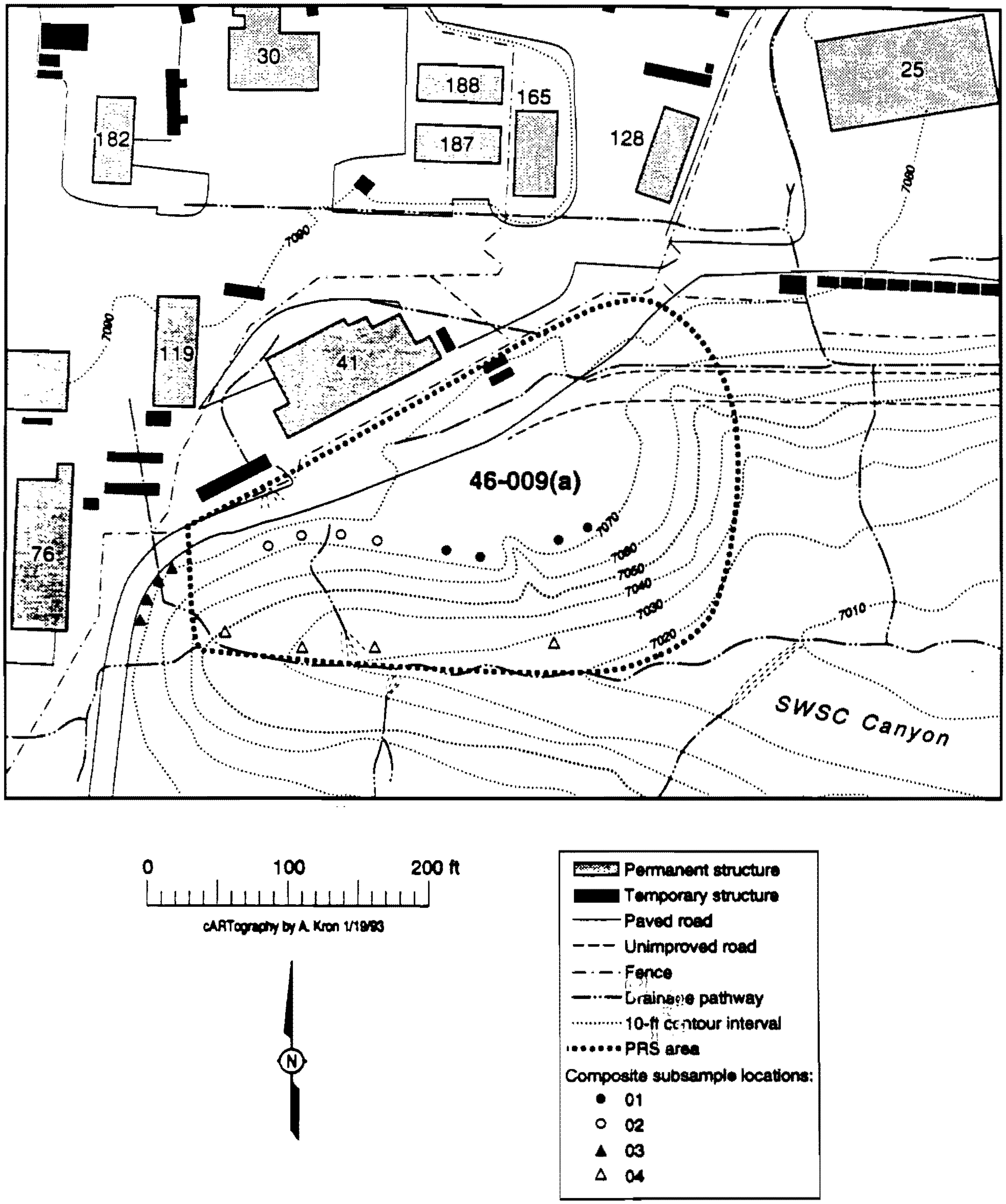


Fig. 5-5-2. Approximate sampling locations for Environmental Problem #22.

3. Also in 1992, seven soil samples were collected at various points at or near this PRS. Although all samples were collected at the surface, the site had recently been disturbed by road construction, and at least three sampling points represented areas that had formerly been subsurface. Samples were screened for gross alpha, beta, and gamma activity, and then analyzed for total uranium, VOCs, SVOCs, PCBs, heavy metals, and asbestos. Total uranium measurements were below upper limit background levels (<3.4 ug/g). No target VOCs, PCBs, or asbestos were detected. One sample from the far eastern end of the road area indicated trace amounts of several SVOCs (all of which are components of asphalt-like materials). All heavy metal measurements proved to be below EPA guidelines under 40 CFR 261.24 (Fresquez 1992, 11-231). No other data on PRS 46-009(a) are available.

Little information is available about potential contamination at PRS 46-009(b). Sludge removed from the sand filters (PRS 46-002) was not routinely screened for radionuclides, although a January 1985 reading indicated levels of 600 pCi/g gross alpha and 79 pCi/g gross beta (LANL 1985, 11-225). There is no record of any historical characterization activity focused directly on PRS 46-009(b).

5.5.1.2.2 Potential Pathways and Exposure Routes

The conceptual exposure model is presented in Fig. 5-5-3. A summary of exposure mechanisms and human receptors is presented in Table 5-5-3.

PCOCs could be transported in the environment by natural weathering processes. Storm water and snowmelt runoff has created a large erosion gully through PRS 46-009(a) transporting contaminants into SWSC Canyon, although recent roadway construction has eliminated the gully and created new drainage patterns from the mesa top. The fill is steep and is not stabilized; therefore, the erosion continues to occur. The eroded material potentially accumulates in sedimentation areas. Discharge of contaminants from these sedimentation areas as well as from the canyon bottom remains possible. PCOCs present in PRS 46-009(b) could also migrate via storm water and snowmelt runoff.

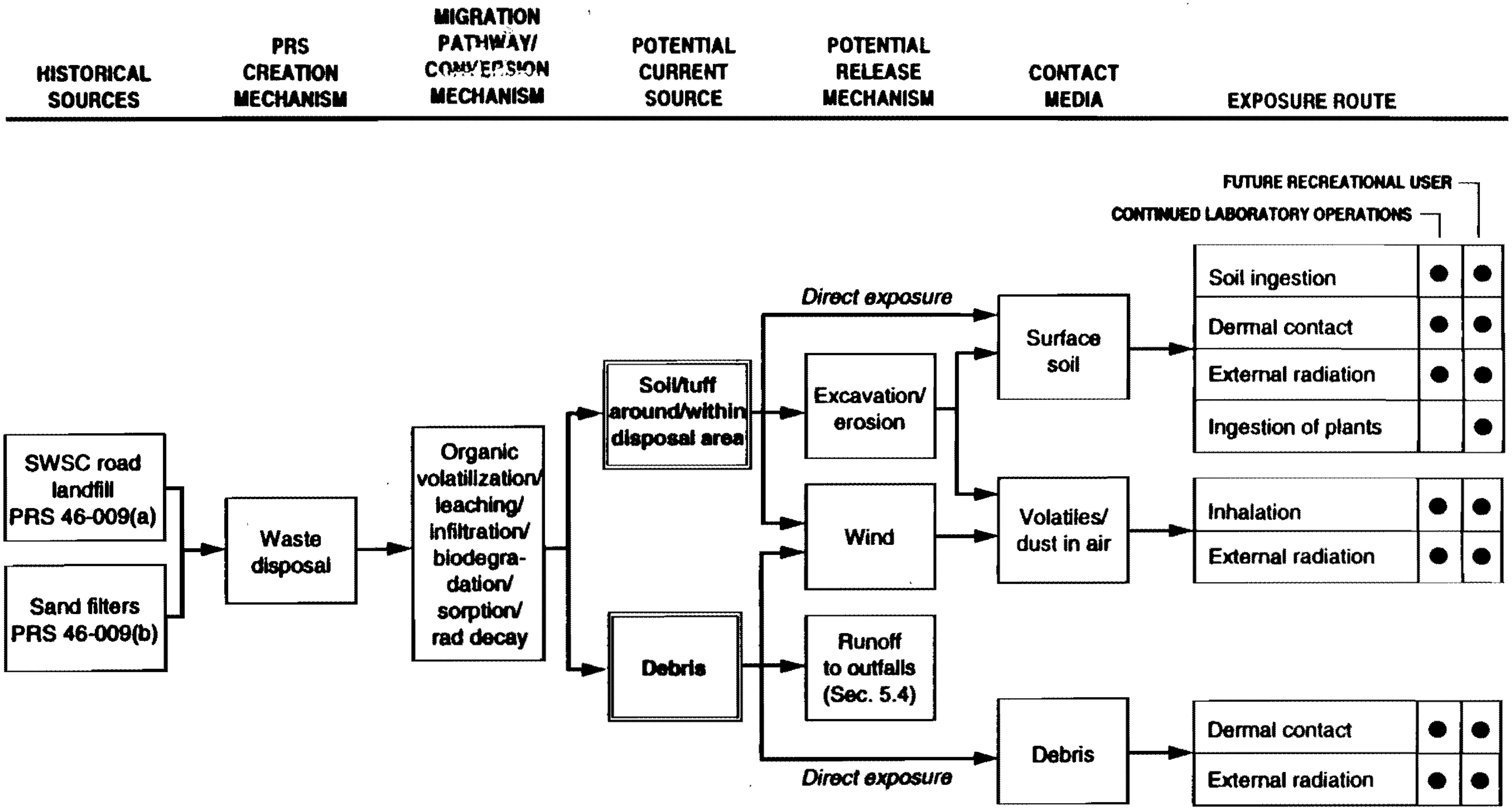


Fig. 5-5-3. Conceptual exposure model for the landfill aggregate at TA-46.

TABLE 5-5-3

EXPOSURE MECHANISMS AND RECEPTORS FOR LANDFILL AGGREGATE

POTENTIAL AREA OF CONTAMINATION	RELEASE MECHANISMS	CURRENT POTENTIAL RECEPTORS	FUTURE POTENTIAL RECEPTORS
Surface soil surrounding landfill	• Erosion, resulting in wind dispersion • Surface water runoff and infiltration • Volatilization • External irradiation	On-site workers at SWSC site or lagoon	Recreational users, construction workers
Sediments in drainage channel	• Wind dispersion • Runoff	On-site workers at SWSC site or lagoon	Recreational users
Subsurface soil beneath landfill	• Excavation or erosion, resulting in surface release mechanisms	None	Recreational users, construction workers
Debris in landfill	• Erosion, resulting in wind dispersion • Surface water runoff and infiltration • External irradiation	On-site workers at SWSC site or lagoon	Recreational users, construction workers

Leaching and infiltration of contaminants into deeper soils, subsequent seepage into surface drainage ways, volatilization of organics, and wind dispersion of soil as dust are additional migration pathways. Potential subsurface contamination can be brought to the surface by erosion or excavation.

Current human receptors for PRS 46-009(a) are limited to on-site workers at the SWSC site about 600 ft down the canyon. For PRS 46-009(b), current human receptors are workers at the sanitary waste lagoon (TA-46-149). A more detailed description of the migration pathways, conversion mechanisms, potential receptors, exposure pathways, and exposure assumptions relevant to the entire OU is presented in Chapter 4.

5.5.2 Remediation Decisions and Investigation Objectives

Problem Statement (DQO Step 1). Historical practices at both of the PRSs in this aggregate have not been thoroughly documented. Consequently, it is not possible either to confirm or to rule out the presence of any of the PCOCs which may have been in use at TA-46. The problem addressed by the Phase I investigation is to establish the presence or absence of these PCOCs at each of the two PRSs in this aggregate. If the Phase I investigation determines that COCs are present at either of these sites, it will be followed by further investigation and remediation if necessary.

Decision Process (DQO Step 2). The objective of the Phase I investigation for this aggregate will be reconnaissance screening of surface and subsurface soils in the PRSs covered by this aggregate. If contamination above SALs is detected in any sample during Phase I, then it will be followed by further investigation aimed at conducting a baseline risk assessment, including additional sampling if required.

Any remediation indicated as a result of this investigation is likely to consist of stabilization in place and/or removal of contaminated soil/materials. If no COCs are found during Phase I, then these PRSs will be recommended for NFA. A separate Phase I decision will be made for each of the two PRSs in this aggregate.

5.5.3 Data Needs and Data Quality Objectives

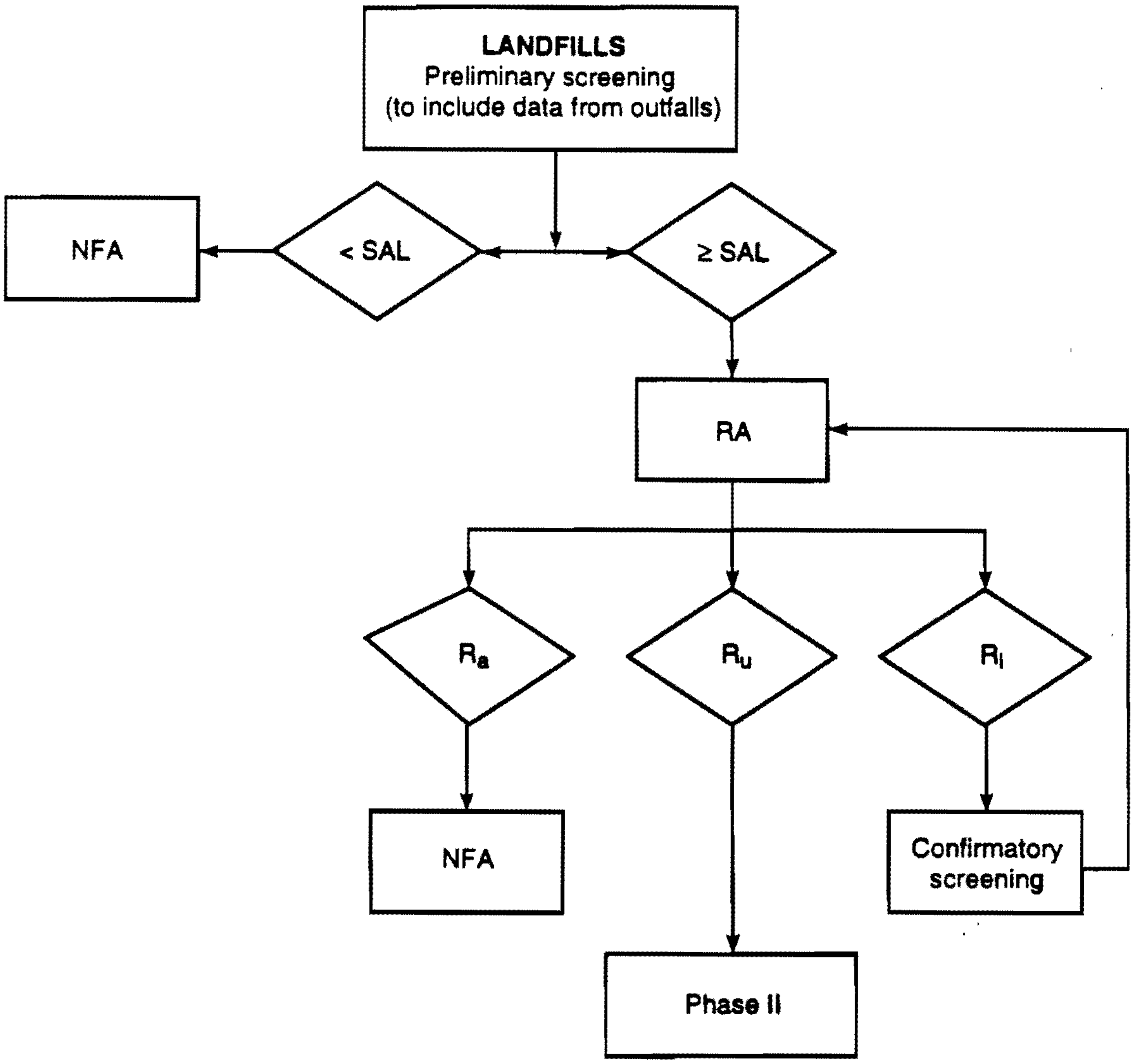
See Fig. 5-5-4 for a summary of the decision logic for this aggregate.

Source characterization data will be required to make the Phase I decision. Data quality objectives specifications required to design the sampling plan for this aggregate are as follows.

Inputs (DQO Step 3). The primary data needs are concentrations of PCOCs in surface or subsurface soils. Because little is known about past waste disposal practices at this site, it will be necessary to screen at both PRSs for a wide range of PCOCs (see Table 5-5-1).

Boundaries (DQO Step 4). The spatial boundaries for the Phase I investigation will be as follows:

1. Surface and subsurface (bounded by the fill-bedrock interface) soil and debris in the PRS 46-009(a) landfill proper, as well as downstream from the landfill.



NFA – No further action
SAL – Screening action levels for potential contaminants of concern
RA – Baseline risk assessment
R_a – Risk acceptable
R_u – Risk unacceptable
R_i – Risk indeterminate

Fig. 5-5-4. Decision logic for landfills (preliminary screening).

2. Surface and subsurface soil on the PRS 46-009(b) sand disposal area slope, as well as surface and subsurface (bounded by the fill-bedrock interface) soil at the toe of the slope and downstream. Vertical depth on the slope will be determined by the capacity to hand auger.

For each PRS, subsurface contamination will be investigated by means of vertical boreholes and hand-augered holes. At each hole, samples will be derived from 0.2-ft specimens removed from the core at designated intervals (or at locations selected based on field screening). The 0.2-ft specimens will be indicative of likely exposure scenarios for this aggregate (e.g., erosion, wind dispersion).

Separate Phase I decisions will be made for each of these two areas.

Decision Logic (DQO Step 5). The decision rule for the PRSs in this aggregate is as follows: If the maximum concentration from any sample drawn from either of the areas defined above exceeds the SAL for any PCOC, then continue the investigation for the PRS by conducting a baseline risk assessment, including additional sampling if required. Exceedances of SALs in samples collected for other aggregates will be taken into account as part of the decision-making process.

Design Criteria (DQO Step 6). For PRS 46-009(a), reconnaissance sampling will be designed so that there is at least a 90% probability of detecting contamination above SALs if as much as 20% of the area is contaminated. The 20% figure is based on the assumption that any contamination found at this site remains relatively heterogeneous, despite the effects of recent roadway construction.

For PRS 46-009(b), reconnaissance sampling will be designed so that there is at least a 90% probability of detecting contamination above SALs if as much as 30% of the area is contaminated. The 30% figure is based on the assumption that any contamination found at this site will be substantially homogeneous.

In addition, results from samples taken for other aggregates will be used to support Phase I decision-making for this aggregate as appropriate and possible. Specifically, analytical data generated from samples collected for

Subsection 5.4 (Outfalls) will be used for evaluation of the presence of PCOCs. Table 5-5-4 is a summary of the DQO specifications for this aggregate.

TABLE 5-5-4

DQO SUMMARY FOR LANDFILLS

DQO STEP	RATIONALE
Problem statement	• Establish presence/absence of PCOCs
Decision process	• Reconnaissance screening • Compare to SALs
Inputs	• Concentration of PCOCs in surface/subsurface soil
Boundaries	• PRS 46-009(a): surface/subsurface soil in landfill as well as downstream, bounded by fill-bedrock interface • PRS 46-009(b): surface/subsurface soil in disposal area as well as downstream, bounded by fill-bedrock interface and (on slope) hand auger capacity
Decision logic	• Compare maximum sample concentration to SALs • Consider data collected for outfalls aggregate also • If any SAL is exceeded, continue investigation (baseline RA) • Make separate decision for each PRS
Design criteria	• 90% probability of detecting contamination if it covers 30% of area (enhanced by judgmental sampling)

5.5.4 Phase I Sampling and Analysis Plan

Phase I reconnaissance sampling will focus on determining the presence or absence of PCOCs above SALs. Refer to Appendixes D, E, and H for additional OU 1140 field sampling information. These appendixes are: Field Investigation Approach and Methods, Sample Data Base, and Maps.

Engineering Surveys. Engineering surveys will be performed to locate precisely all surface features and sample collection locations.

Table 5-5-5 summarizes proposed engineering surveys for this aggregate.

Field Screening. This Phase I investigation will be initiated with a field survey of the PRS aggregate for radiation and organic vapors. The radiation

TABLE 5-5-5

ENGINEERING SURVEYS AT LANDFILLS AGGREGATE

SURVEYS	REFERENCE
Geodetic mapping	Appendix D

survey and organic vapor screening will be performed according to the methods found in the Laboratory's SOPs, which are in preparation.

Appropriate health and safety precautions will be undertaken according to the Laboratory's ER Program SOPs (LANL 1993, 0875). Any accessible residual landfill debris will be field screened for radioactivity.

Sample Control. All samples will be field screened for radioactivity, metals, and organic vapors to identify gross concentrations of contaminants using the methods found in the Laboratory's SOPs, which are in preparation.

All samples will be initially analyzed in the field analytical laboratory. Gamma spectrometry will be used to quantify the radionuclides present in the samples. X-ray fluorescence will be used to detect gross concentrations of metals. The results of the field laboratory analysis will guide the selection of samples (including both positive and negative findings) to be submitted for analytical laboratory analysis. All analytical laboratory samples will be analyzed for all potential contaminants of concern (hazardous and radioactive). Field quality assessment samples will be collected according to the guidance provided in the latest revision to the IWP. Any duplicate samples planned to be collected are listed in Table E-1. See Appendix D, Subsection 2.8, for a discussion of quality control sample duplicates. See Table 5-5-6 for a complete listing of sample and analysis information.

Cesium-137 is a PCOC that is unique to PRS 46-009(a). Cesium is not specifically called out in Table 5-5-6, but gamma spectroscopy will be performed on all samples analyzed for this PRS. Cesium is a gamma emitter and, if present, will be detected by this technique.

5.5.4.1 Sampling

Sampling Rationale. Reconnaissance screening of the surface and subsurface soils is required to determine if potential contamination is above

Table 5-5-6

Summary of OU 1140 TA-46 Landfills Site Surveys, Sampling and Analysis

Structure Sample Total 0
Surface Sample Total 0
Subsurface Sample Total 78

					Field Surveys			Samples				Field Screening						Field Lab.						Laboratory Analyses																
	PRS	Outfall Field ID	PRS Type Outfall Type	Phase 1 Approach	Land Survey	Geophysics	Radiation	Sampled Media	Structure	Surface	Subsurface	Gross Alpha	Gross Gamma/Beta	Organic Vapor	Combustible gas/oxygen	X-Ray Fluorescence	Lithologic Logging	Gross Alpha	Tritium	Soil Moisture	Gamma Spectroscopy	PCB	VOA	Gamma Spectroscopy	Isotopic Americium	Total Uranium	Isotopic Uranium	Isotopic Plutonium	Isotopic Thorium	Isotopic Cesium	VOA (SW 8240)	Semivolatiles (SW 8270)	TCLP	Metals (SW 6010)	PCB (SW 8080)	Asbestos	Mercury	Herbicides	Pesticides	Aggregate
(1)	46-009-a		Landfill	Reconn	1		1	Soil/Debris	0	0	36	1	1	1		1	1	1		1	1	1	1	1			1	1	1	1	1	1		1	1	1				5.5
(2)	46-009-a		Landfill	Reconn	1		1	Soil/Debris	0	0	12	1	1	1		1	1	1			1	1	1	1			1	1	1	1	1	1		1	1	1				5.5
(3)	46-009-a		Landfill	Reconn	1		1	Sediment/Soil	0	0	6	1	1	1		1	1	1			1	1	1	1			1	1	1	1	1	1		1	1	1				5.5
(4)	46-009-b		Landfill	Reconn	1		1	Soil/Debris	0	0	12	1	1	1		1	1	1			1	1	1	1			1	1	1		1	1		1	1	1				5.5
(5)	46-009-b		Landfill	Reconn	1		1	Soil/Debris	0	0	12	1	1	1		1	1	1		1	1	1	1	1			1	1	1		1	1		1	1	1				5.5

SALs. Upon completion of engineering surveys, the Phase I investigation will include drilling of mechanically-augered boreholes and hand-augered holes. Subsurface cores will be bored to the fill bedrock interface in the landfill proper to detect PCOCs from the surface downward to the deepest disturbed horizon. Hand-augered sample holes will evaluate PCOCs in surface soils at the sand dump and in the drainage from the landfill and sand dump.

5.5.4.2 PRS Sampling Summaries

PRS 46-009(a). Sampling at the landfill will consist of the drilling of six boreholes in the landfill proper and the hand augering of four sample holes in the landfill near the canyon bottom (SWSC Canyon). Two hand-augered samples will be taken in the drainage channel in the canyon bottom downstream of the landfill.

Sampling in the landfill will include collection of continuous core using a hollow-stem auger drill rig outfitted with a wire-line coring/sampling system (or equivalent system). Six boreholes will be drilled to the fill-bedrock interface. One analytical sample, 0.2 ft minimum in length, will be removed from each 5-ft run. Specimens for full laboratory analysis will be selected to maximize the probability of detecting contaminants if present. This selection will be guided by field-screening for radioactivity and organic vapors, moisture content variations, or other hydrologic or geologic observations (see Appendix D). In the absence of any distinguishing features, one specimen will be collected form the midpoint of each 5-ft run. One specimen will be collected at the total depth of each core to document the absence of PCOCs at this distal sampling point. One additional specimen will be collected at random from each borehole.

Procedural control of drill site activities will be in accordance with LANL-ER-SOPs, which are in preparation.

The bermed area at the edge of SWSC Canyon has been created by the excavation and redistribution of landfill material during the process of building the new road to the Waste Water Treatment Facility in the canyon bottom. Three of the boreholes will be distributed across the surface of the bermed area and will provide cores that sample the redistributed landfill material. Borehole locations are provided on Fig. 5-5-5.

Two hand-augered sample holes will be bored to a depth of 3 ft or to fill-bedrock interface, which ever is encountered first. Auger hole locations will be immediately above the streambed.

Three analytical samples (specimens), 0.2 ft minimum in length, will be removed from each augered sample; at the surface, mid-point, and total depth.

Sample collection will be procedurally controlled through the use of LANL-ER-SOP-06.10, Hand Auger and Thin-Wall Tube Sampler.

PRS 46-009(b). Sample collection in the sand dump will include drilling four hand-augered holes to a depth of about 3 ft (or deeper to the practical mechanical depth a hand auger can be advanced), or the fill-bedrock interface which ever is encountered first. Auger hole locations will be equally distributed across the upslope surface of the sand dump. Three analytical samples (specimens), 0.2 ft minimum in length, will be removed from each augered sample; at the surface, mid-point, and total depth.

See Fig. 5-5-6 for the location of sampling points.

Sample collection will be procedurally controlled through the use of LANL-ER-SOP-06.10, Hand Auger and Thin-Wall Tube Sampler. Three mechanical boreholes (15 ft deep) will be drilled at the toe of the slope in the bottom of SWSC Canyon. These hollow-stem auger boreholes (or equivalent system) will collect core from the surface to the fill-bedrock interface. The purpose of these three boreholes is to discover any concentrations of contaminants in the thicker layers of waste sand that has accumulated in the canyon bottom.

One analytical sample (specimen), 0.2 ft minimum in length, will be removed from each 5-ft run. Specimens for full laboratory analysis will be selected to maximize the probability of detecting contaminants if present. This selection will be guided by field screening for radioactivity and organic vapors, moisture content variations, fracture locations, or other hydrologic or geologic observations (see Appendix D). In the absence of any distinguishing features,

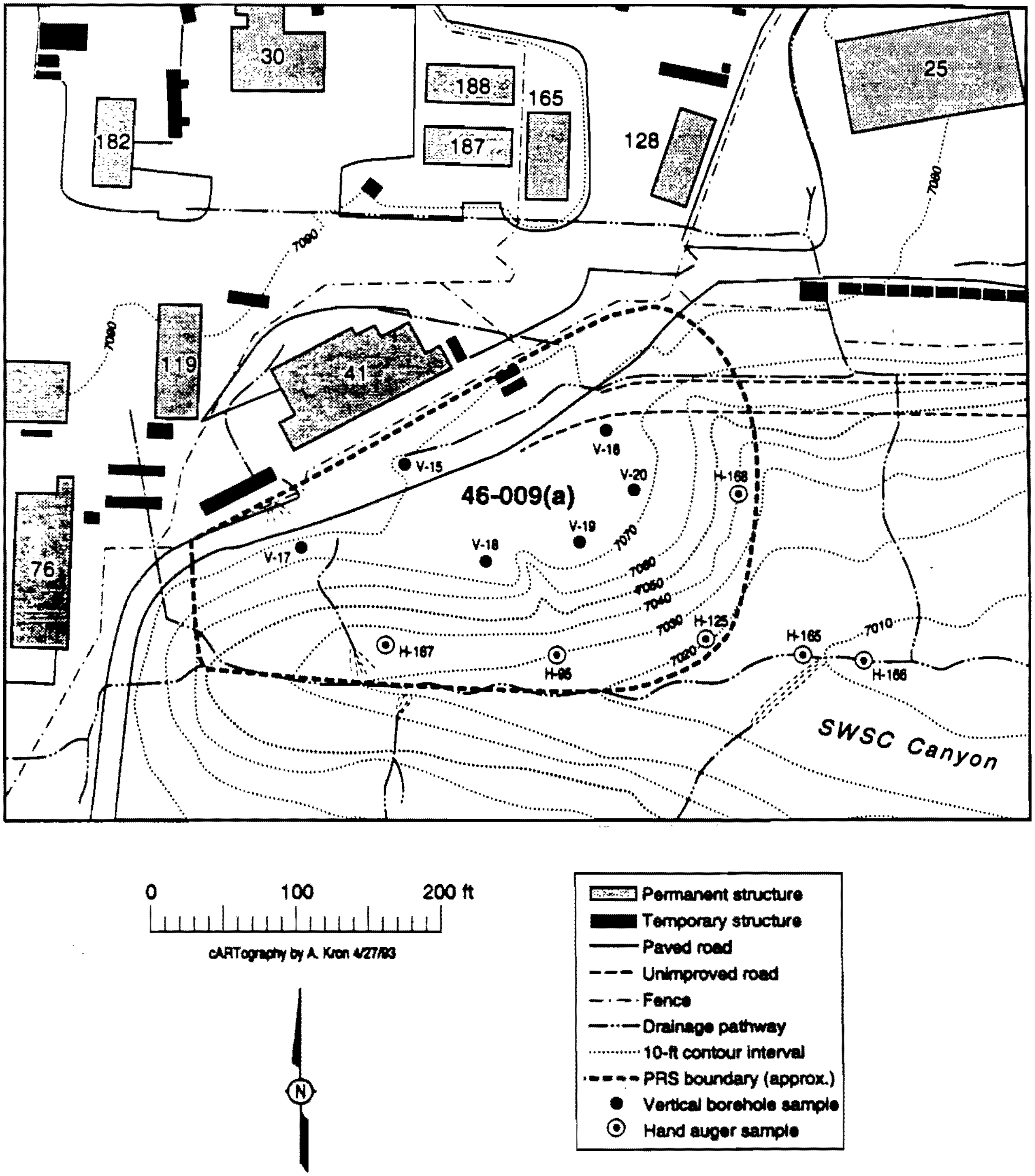


Fig. 5-5-5. Sampling locations at PRS 46-009(a).

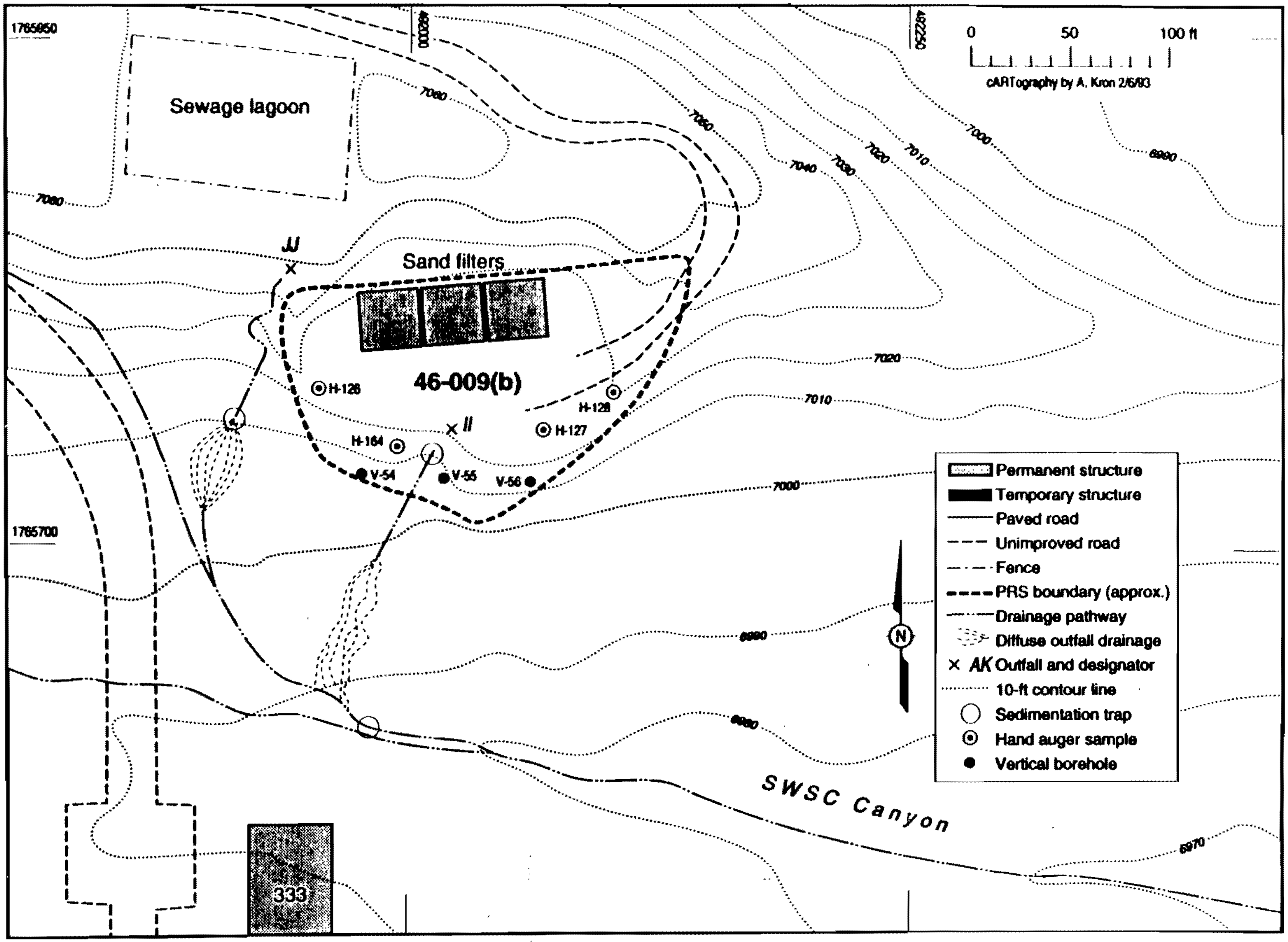


Fig. 5-5-6. **Sampling locations at PRS 46-009(b).**

one specimen will be collected from the midpoint of each 5-ft run. One specimen will be collected at the total depth of each core to document the absence of PCOCs at this distal sampling point. One additional specimen will be collected at random from each borehole.

Procedural control of drill site activities will be in accordance with LANL-ER-SOP-04.01, Drilling Methods and Drill Site Management. Core logging and control will be controlled by ER-SOP, Field Logging, Handling, and Documentation of Borehole Materials.

5.6 Stack Emissions

5.6.1 Background

This aggregate consists of five PRSs in TA-46 where historical practices may have led to the airborne release of hazardous or radioactive constituents through building stacks. Table 5-6-1 is a summary of these PRSs.

TABLE 5-6-1

STACK EMISSIONS AGGREGATE

PRS	DESCRIPTION	STATUS	PCOCs
46-004(g)	Releases from TA-46-1, 1958-1973	Inactive	Uranium-235, -238; thorium
46-004(h)	Releases from TA-46-16, 1958-1973	Inactive	Uranium-235, -238
46-004(d2)	Releases from TA-46-24, early 1960s	Inactive	Beryllium
C-46-002	Releases from TA-46-31, 1958-1973	Inactive	Uranium-235, -238
C-46-003	Releases from TA-46-30, 1978	Inactive	Uranium-235, -238

These PRSs are aggregated because they have similar conceptual models based on airborne releases, as well as similar sampling approaches and potential response actions.

See Fig. 5-6-1 for the location of these PRSs.

5.6.1.1 Description and History

PRS 46-004(g) represents activities conducted at TA-46-1 under the auspices of the Rover Fuel Element Research Program between the late 1950s and the early 1970s. Work involving baking and high-temperature testing of fuel rods had the potential to result in airborne emissions of natural and depleted uranium as well as uranium-235 (Welty 1958, 11-005). In addition, there is a report of work involving thorium at TA-46-1 (H-Division 1960, 0678).

PRS 46-004(g) is described further in Subsection 5.4.

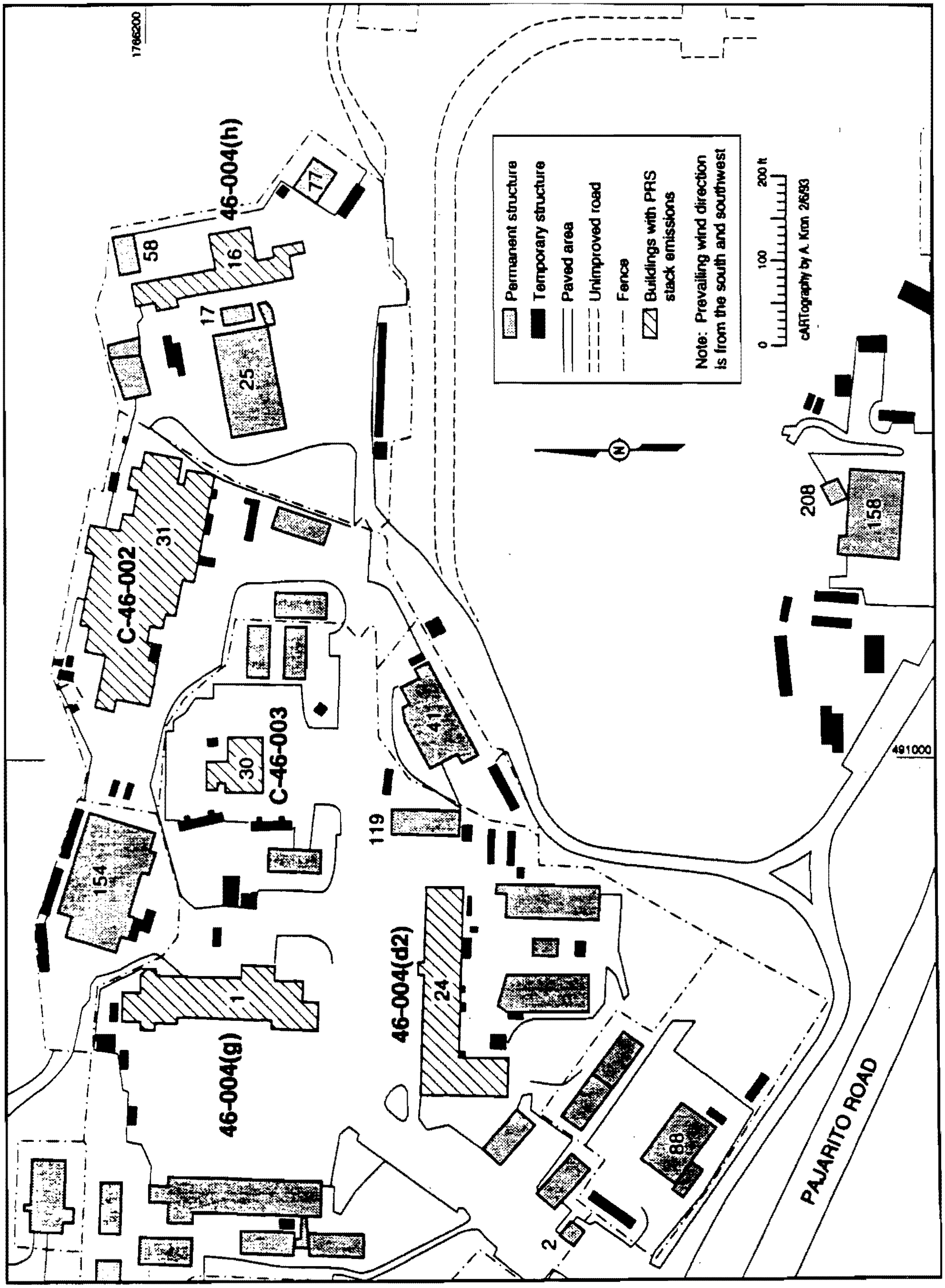


Fig. 5-6-1. Location of PRSs in the stack emission aggregate at OU 1140 (TA-46).

PRS 46-004(h) reflects Rover Program testing of uranium fuel rods at Building TA-46-16 during the same time period (Welty 1958, 11-005). At least one report indicates elevated levels of stack emissions (LASL 1962, 11-022).

PRS 46-004(h) is described further in Subsection 5.4.

PRS 46-004(d2) represents experimentation done at Building TA-46-24 in 1960-61. These experiments used beryllium and beryllium oxide; quantities of these constituents may have been released through building stacks (Mitchell 1960, 11-014).

AOC C-46-002 reflects Rover Program activities at Building TA-46-31. In 1960, an accident released levels of uranium-235 through the stack (Melton 1960, 11-013).

AOC C-46-003 is a one-time release of approximately 5 to 10 g of depleted uranium hexafluoride (UF_6) containing uranium-237 as a tracer (Turin 1993, 11-232). The release took place from Building TA-46-30 on March 29, 1978. The SWMU Report stated inaccurately that the building was TA-46-158. It was followed by a series of decontamination and monitoring efforts within the building as well as downwind (Ahlquist 1978, 11-084).

5.6.1.2 Conceptual Exposure Model

5.6.1.2.1 Existing Information on Nature and Extent of Contamination

There is no direct historical information about any environmental contamination associated with airborne releases at TA-46. The following information is based on measurement of emissions levels.

PRS 46-004(h). Stack monitoring conducted at TA-46-16 during 1962 indicated readings as high as 2 780 dpm/m^3 (LASL 1962, 11-022).

PRS 46-004(d2). Air sample data sheets based on room air monitoring connected with beryllium operations at TA-46 indicate results as high as 16 mg/m^3 (LASL 1960, 11-015).

AOC C-46-002. In April 1960, an accidental tube rupture within Building TA-46-31 led to stack readings as high as 2 998 dpm/m^3; apparently the contaminant was uranium-235 (Melton 1960, 11-013).

AOC C-46-003. A May 1978 report on ambient air monitoring in response to the release from TA-46-30 indicated no detectable level of uranium-237. It is not clear whether investigators looked for uranium-238 as well. Monitoring took place both immediately downwind of TA-46-30 and at the Laboratory perimeter (Ahlquist 1978, 11-084).

TA-46 (general). A report from 1960 refers to stack readings from TA-46 (building not specified) in the 2 000 to 3 000 dpm/m^3 range (H-Division 1960, 11-107).

No other information on these PRSs is available.

5.6.1.2.2 Potential Pathways and Exposure Routes

A summary of exposure mechanisms and human receptors is presented in Table 5-6-2. The conceptual exposure model is presented in Fig. 5-6-2.

TABLE 5-6-2

EXPOSURE MECHANISMS AND RECEPTORS FOR STACK EMISSIONS AGGREGATE

POTENTIAL AREA OF CONTAMINATION	RELEASE MECHANISMS	CURRENT POTENTIAL RECEPTORS	FUTURE POTENTIAL RECEPTORS
Surface soil on site	• Erosion, resulting in wind dispersion • Surface water runoff and infiltration • Volatilization • External irradiation	On-site workers and construction workers	On-site workers, recreational users, and construction workers
Sediment in drainages and pond west of TA-46	• Wind dispersion • Runoff	Recreational users (i.e., hikers and joggers exposed to runoff down drainages), on-site workers, and construction workers	Recreational users, on-site workers, and construction workers

The pond located west of TA-46 is small and shallow; therefore, it is not large enough to support a consistent supply of game fish or as a potential area for swimming. Refer to Chapter 4 for a detailed discussion on the

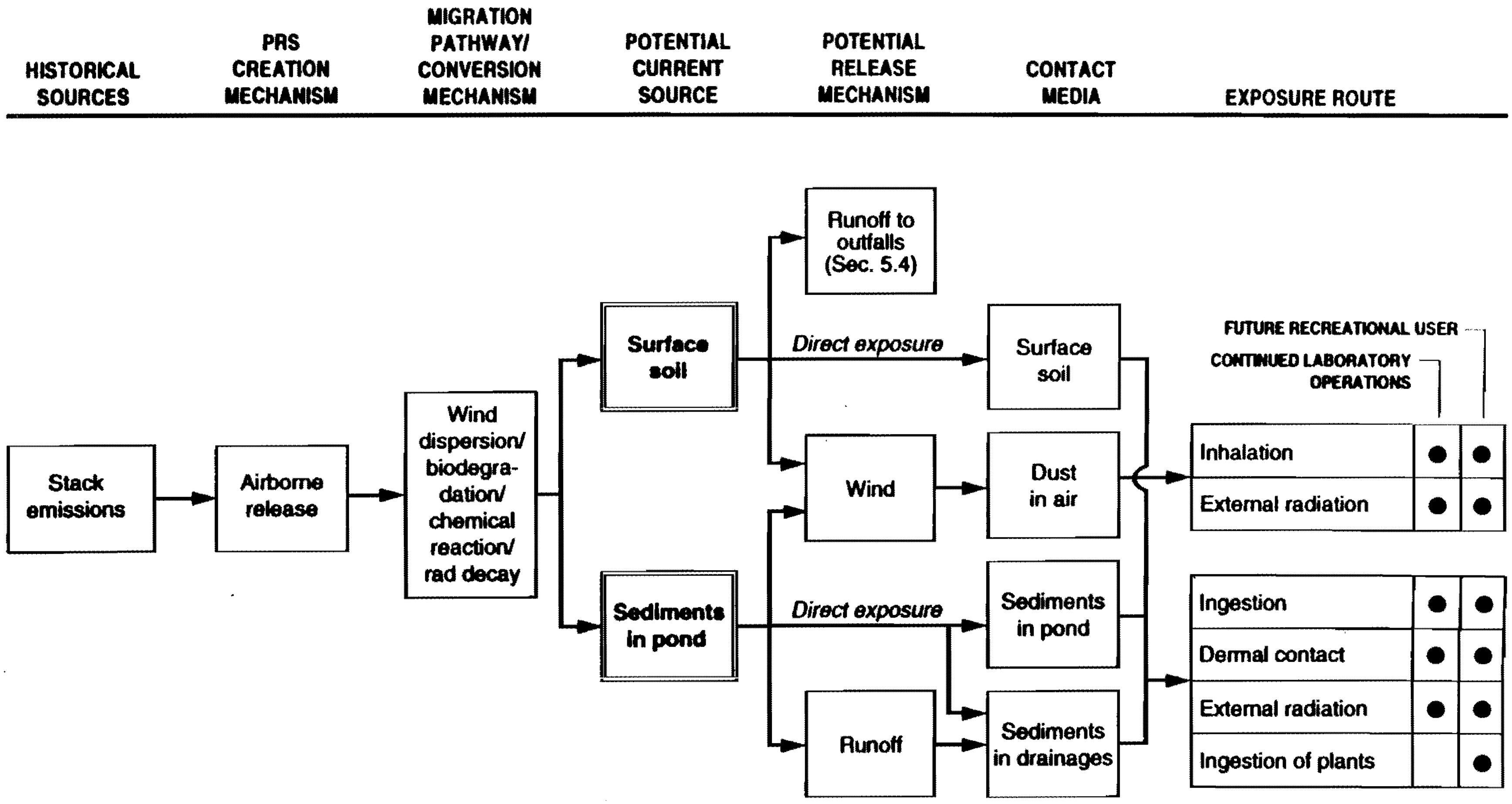


Fig. 5-6-2. **Conceptual exposure model for the stack emission aggregate at TA-46.**

migration pathways, conversion mechanisms, human receptors, and exposure routes.

5.6.2 Remediation Decisions and Investigation Objectives

Problem Statement (DQO Step 1). While there is documentation of airborne releases of radionuclides from several TA-46 buildings, there is no evidence of any resulting environmental contamination. The problem addressed by the Phase I investigation of this aggregate is to assess whether there is evidence of ongoing contamination that can be traced to these airborne emissions. If the Phase I investigation finds such evidence, it will be followed by further investigation and remediation if necessary.

Decision Process (DQO Step 2). The objective of the Phase I investigation for this aggregate will be reconnaissance screening of surface soil in areas which are predominantly downwind from the affected TA-46 buildings. If contamination above SALs is detected in any sample during Phase I, then it will be followed by further investigation aimed at conducting a baseline risk assessment, including additional sampling if required. If no contamination is found during Phase I, these PRSs will be recommended for NFA. For Phase I decision-making, all PRSs except PRS 46-004(d2) will be considered as one unit, while a separate decision will be made for PRS 46-004(d2) because of its unique PCOC (beryllium).

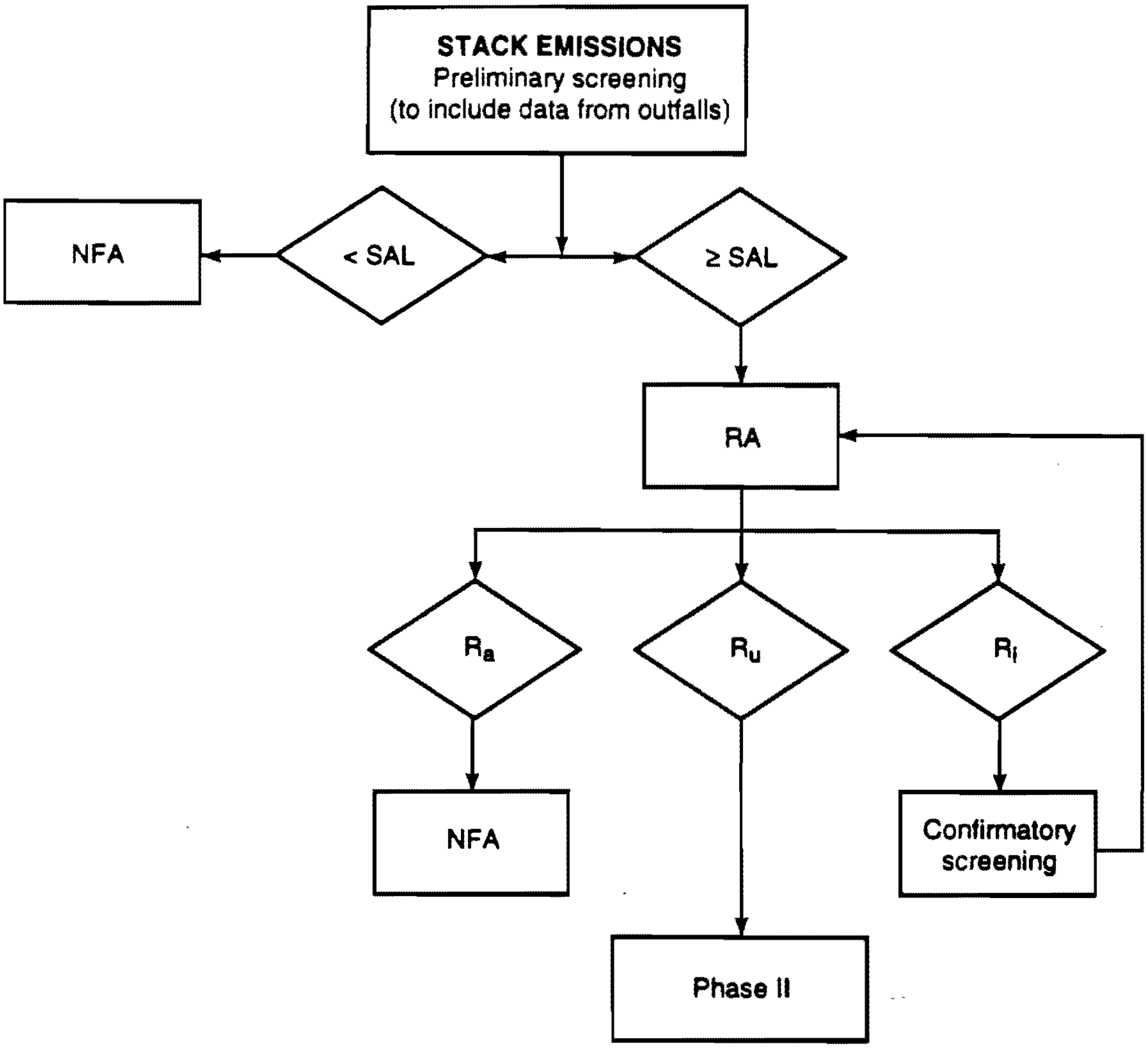
5.6.3 Data Needs and Data Quality Objectives

See Fig. 5-6-3 for a summary of the decision logic for this aggregate.

Source characterization data will be required to make the Phase I decision. Data quality objectives specifications required to design the sampling plan for this aggregate are as follows.

Inputs (DQO Step 3). The primary data needs are concentrations of uranium-235, -238; thorium; and beryllium in surface soil samples.

Boundaries (DQO Step 4). Spatial boundaries include the top 6 in. of soil in mesa top soils, storm drain outfalls, and other selected TA-46 areas downwind of the PRSs in this aggregate. (In the daytime, prevailing winds in TA-46 are from the south; at night, prevailing winds come from the southwest to northwest. See Subsection 3.2 for additional information.) The



NFA – No further action
SAL – Screening action levels for potential contaminants of concern
RA – Baseline risk assessment
R_a – Risk acceptable
R_u – Risk unacceptable
R_i – Risk indeterminate

Fig. 5-6-3. Decision logic for stack emissions (preliminary screening).

boundaries for data collection for this aggregate will be biased to focus on those areas not directly associated with other TA-46 PRSs (i.e., areas which will not be sampled for other reasons).

However, Phase I data collected at other TA-46 locations will be used in support of this aggregate as appropriate. Paved areas will not be included within sampling boundaries for this aggregate because emissions deposits on pavement would have been washed into storm runoff drainages that are sampled in Subsection 5.4.

Decision Logic (DQO Step 5). If the maximum concentration from any sample taken exclusively for this aggregate exceeds the SAL for any PCOC, then continue the investigation by conducting a baseline risk assessment, including additional sampling if required. PRS 46-004(d2) will be included in the continuing investigation only if beryllium or beryllium oxide are detected above SALs during Phase I. Exceedances of SALs in samples collected for other aggregates will be taken into account as part of the decision-making process.

Design Criteria (DQO Step 6). The primary design constraint for this aggregate will be to define appropriate random sampling points within the above-defined boundaries. Selection of sampling locations within these boundaries will be based primarily on judgmental considerations; i.e., it will focus on outfalls and other unpaved areas downwind of potential emissions points. Sample number and placement will be based on the ability to identify locations meeting the unique boundary conditions described above. In addition, results from samples taken for other aggregates will be used to support Phase I decision making for this aggregate as appropriate and possible. Specifically, analytical data generated from samples collected for Subsection 5.4 (Outfalls) will be used for evaluation of the presence of PCOCs resulting from stack emissions.

Table 5-6-3 summarizes the DQO specifications for this aggregate.

5.6.4 Phase I Sampling and Analysis Plan

Phase I reconnaissance sampling will focus on determining the presence or absence of potential stack emission contaminants above SALs for uranium-235, -238; thorium; and beryllium. Refer to Appendixes D, E, and H

TABLE 5-6-3

DQO SUMMARY FOR STACK EMISSIONS AGGREGATE

DQO STEP	RATIONALE
Problem statement	• Establish presence/absence of PCOCs
Decision process	• Reconnaissance screening • Compare to SALs
Inputs	• Concentrations of uranium/thorium/beryllium in surface soil
Boundaries	• Top 6 in. of soil in selected mesa tops, storm drains, other selected areas • Focus primarily on areas not being sampled for other aggregates • No paved areas
Decision logic	• For samples taken specifically for this aggregate, compare maximum concentration to SALs • Consider data collected for outfall aggregate also • If any SAL is exceeded, continue investigation (baseline RA) • Make separate decision for SWMU 46-0004(d2)
Design criteria	• Judgmental sampling

for additional OU 1140 field sampling information. These appendixes are: Field Investigation Approach and Methods, Sample Data Base, and Maps.

Engineering Surveys. Engineering surveys will be performed to precisely locate new sample collection locations. Table 5-6-4 summarizes the surveys to be conducted at this aggregate.

TABLE 5-6-4

ENGINEERING SURVEYS AT STACK EMISSIONS AGGREGATE

SURVEYS	REFERENCE
Geodetic mapping	Appendix D
Geomorphological survey	Appendix D

Field Screening. The Phase I investigation will be initiated with a field survey of the PRS aggregate for radiation. The radiation survey will be performed according to the methods found in the Laboratory's SOPs, which are in preparation.

Appropriate health and safety precautions will be undertaken according to the Laboratory's ER Program SOPs (LANL 1993, 0875).

Sample Control. All samples will be field screened for radioactivity, metals, and organic vapors to identify gross concentrations of contaminants using the methods found in the Laboratory's SOPs, which are in preparation.

All samples will be initially analyzed in the field analytical laboratory. Gamma spectrometry will be used to quantify the radionuclides present in the surface soil samples. The results of the field laboratory analysis will guide the selection of samples (including both positive and negative findings) to be submitted for analytical laboratory analysis. All analytical laboratory samples will be analyzed for all potential contaminants of concern (hazardous and radioactive). Field quality assessment samples will be collected according to the guidance provided in the latest revision to the IWP. See Table 5-6-5 for a complete listing of sample and analysis information. Any duplicate samples planned to be collected are listed in Table E-1. See Appendix D, Subsection 2.8, for a discussion of quality control sample duplicates.

Sample control activities in the field will be performed according to LANL-ER-SOPs 01.01 to 01.06.

5.6.4.1 Sampling

Sampling Rationale. The sampling rationale for the stack emissions aggregate includes taking full advantage of sample analysis data that will be generated for other TA-46 PRS aggregates. Specifically, analytical data generated from samples collected for Subsection 5.4 (Outfalls) will be used for evaluation of the presence of stack emission contaminants. That PRS aggregate will provide approximately an additional 61 sample collection locations that will be investigated for the stack emission aggregate.

Upon completion of engineering surveys, the Phase I investigation will begin with the collection of two surface soil samples on the TA-46 mesa top, three on the rock bench to the north of the mesa near the bottom of Cañada del Buey, and two sediment samples in the intermittent pond to the northwest of the mesa top.

Table 5-6-5

Summary of OU 1140 TA-46
Stack Emissions
Site Surveys,
Sampling and Analysis

Structure Sample Total 0
Surface Sample Total 7
Subsurface Sample Total 0

					Field Surveys			Samples				Field Screening						Field Lab.						Laboratory Analyses																
	PRS	Outfall Field ID	PRS Type Outfall Type	Phase 1 Approach	Land Survey	Geophysics	Radiation	Sampled Media	Structure	Surface	Subsurface	Gross Alpha	Gross Gamma/Beta	Organic Vapor	Combustible gas/oxygen	X-Ray Fluorescence	Lithologic Logging	Gross Alpha	Tritium	Soil Moisture	Gamma Spectroscopy	PCB	VOA	Gamma Spectroscopy	Isotopic Americium	Total Uranium	Isotopic Uranium	Isotopic Plutonium	Isotopic Thorium	Isotopic Cesium	VOA (SW 8240)	Semivolatiles (SW 8270)	TCLP	Metals (SW 6010)	PCB (SW 8080)	Asbestos	Mercury	Herbicides	Pesticides	Aggregate
(1)	Agg 5.6		Stack Emission	Reconn	1	1	1	Soil	0	2	0													1			1		1					1						5.6
(2)	Agg 5.6		Stack Emission	Reconn	1	1	1	Soil	0	3	0													1			1		1					1						5.6
(3)	Agg 5.6		Stack Emission	Reconn	1	1	1	Soil/Sediment	0	2	0													1			1		1					1						5.6

5.6.4.2 SWMU Sampling Summaries

Sediment Samples. Two sediment samples from the seasonal pond will be collected because airborne emissions that deposited elsewhere in TA-46 could have then drained into this pond. The pond lies 300 ft to the northwest of Building TA-46-250.

The pond sediment samples will be gathered with the guidance of LANL-ER-SOP-06.14, Sediment Material Collection. See Fig. 5-6-4 for sample collection locations.

Mesa Top Soil Samples. Two surface soil (0 to 6 in.) samples will be gathered on the mesa top at locations to the northwest of TA-46-188 and to the southeast of TA-46-77. These samples are exclusive to the stack emissions aggregate. See Fig. 5-6-5 for sample collection locations.

Cañada del Buey Bench Samples. A set of three surface soil (0 to 6 in.) samples will be collected from the rock bench to the north of the mesa in Cañada del Buey in areas that do not receive storm water or other drainage. They are designed to be representative of areas where any contamination could have resulted only from air emissions. These three samples are located approximately 300 ft to the north of the edge of the TA-46 mesa top. These samples are exclusive to the stack emissions aggregate. See Fig. 5-6-6 for sample collection locations.

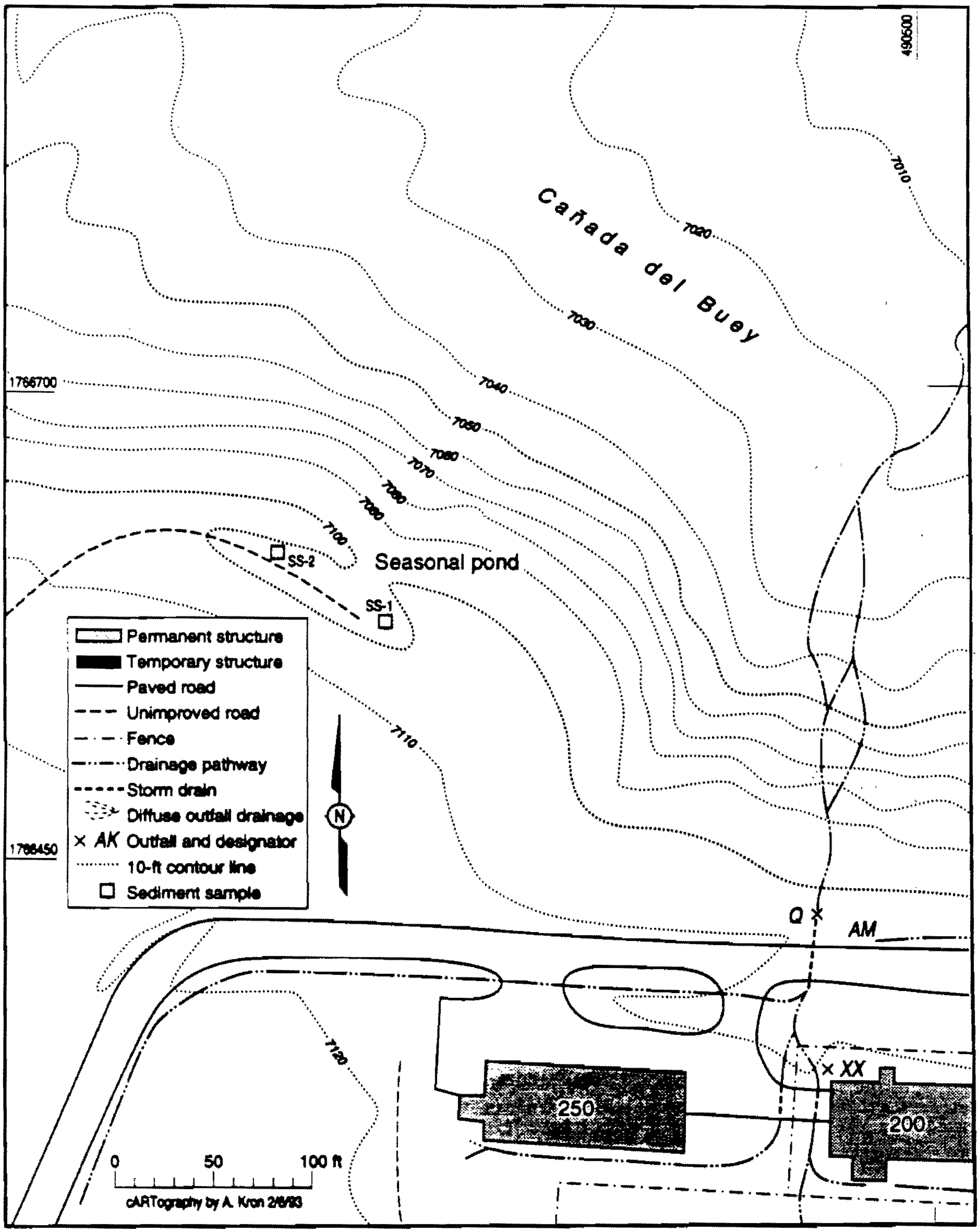


Fig. 5-6-4. **Sampling locations for stack emissions, surface water.**

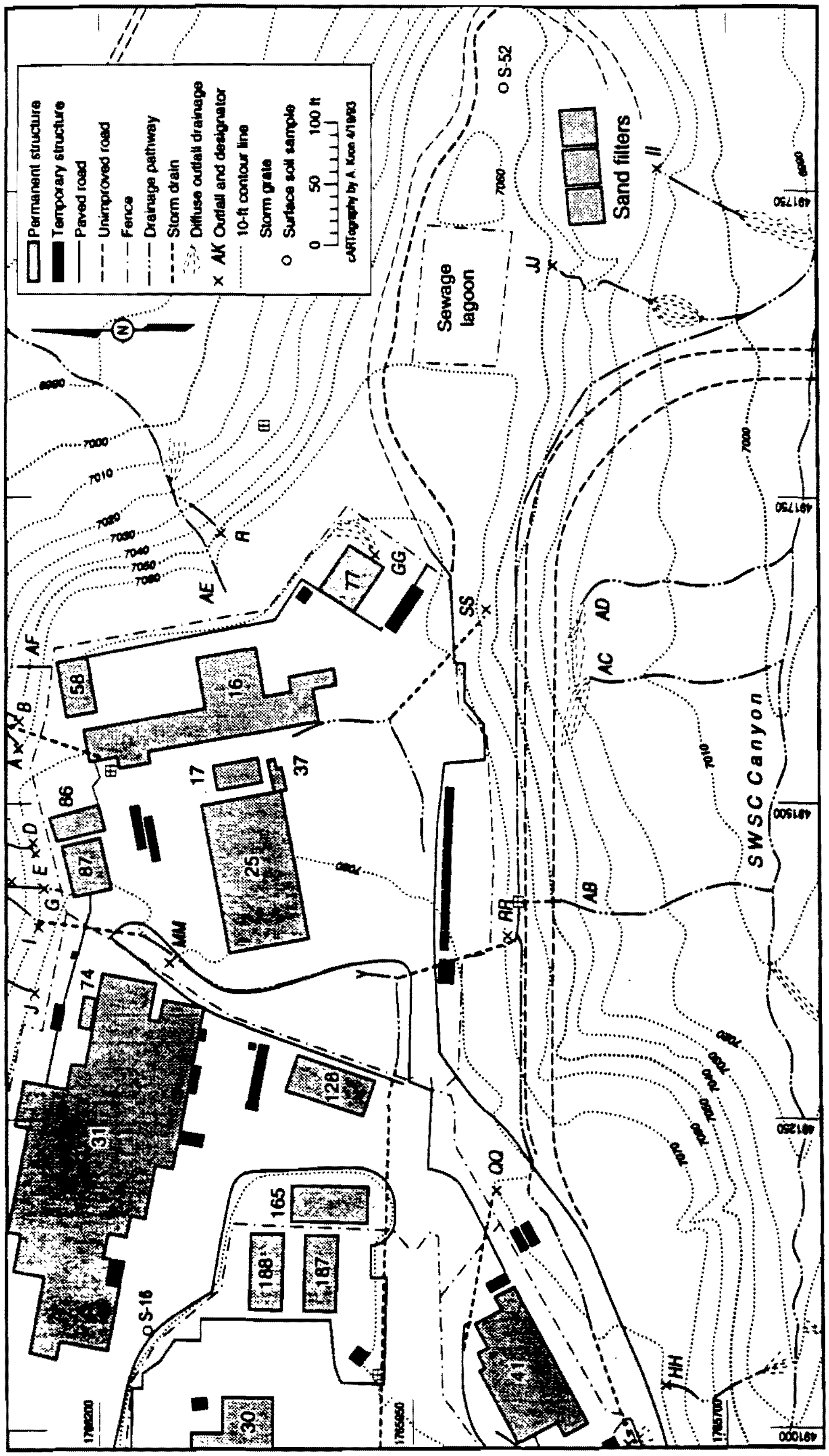


Fig. 5-6-5. Sampling locations for stack emissions, mesa top.

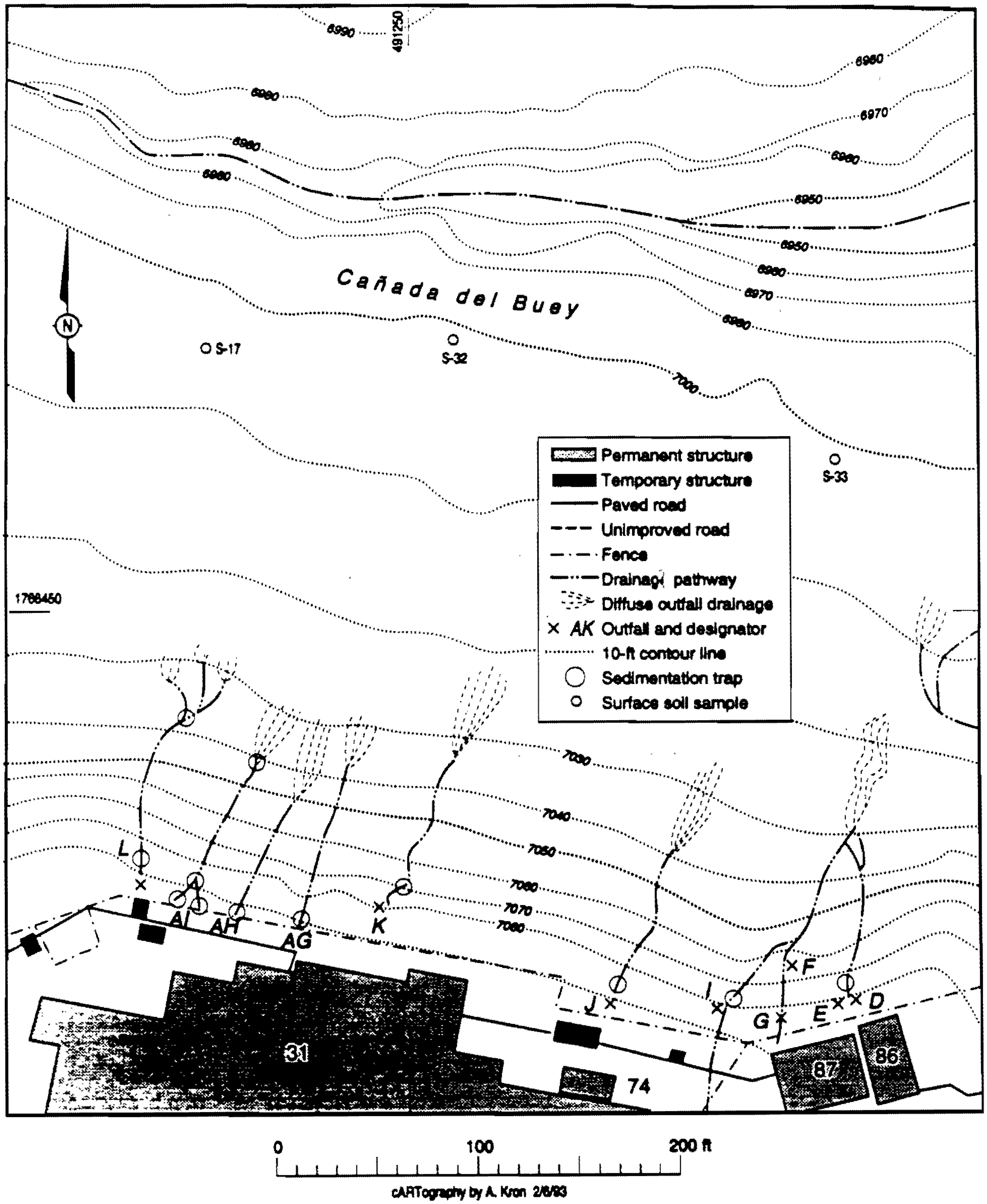


Fig. 5-6-6. **Sampling locations for stack emissions, bench in Cañada del Buey.**

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Chapter 6

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6.0 POTENTIAL RELEASE SITES RECOMMENDED FOR NO FURTHER ACTION OR DEFERRED ACTION

According to Subpart S of 40 CFR 264, potential release sites (PRSs) can be recommended for no further action (NFA) if it can be demonstrated that the unit poses no threat to human health or the environment (EPA 1990, 0432). The recommendation for PRSs in this chapter will be either one of NFA and delisting from the 1990 Laboratory Hazardous and Solid Waste Amendments (HSWA) Module VIII if the solid waste management unit (SWMU) is included therein, or one of deferred action (DA) if the unit is an active site. All PRSs at Operable Unit (OU) 1140 recommended for NFA or DA are listed in Table 6-1 and shown in Fig. 6-1. Further information on several PRSs is also located in Table 6-1 and Table 6-2.

In OU 1140, four PRSs are active sites recommended for partial DA. Four PRSs listed in Module VIII are recommended for NFA under this Resource Conservation and Recovery Act (RCRA) facility investigation (RFI). Module VIII-listed SWMUs are discussed in Subsection 6.1. SWMUs included in the 1990 SWMU Report (LANL 1990, 0145) but not listed in the 1990 Module VIII are also recommended for NFA under this RFI. These are discussed in Subsection 6.2.

Throughout this chapter, the terms “listed” and “unlisted” refer to the status of the PRS as it applies to the 1990 Module VIII (EPA 1990, 0306).

6.1 Listed PRSs Recommended for NFA or DA

6.1.1 Listed PRSs Recommended for DA

In accordance with Step 3, Subsection 4.1, Appendix I of the Installation Work Plan (IWP), a PRS may be recommended for DA if the PRS is an active site from which no credible pathways lead off site (LANL 1992, 0768). Drain lines of four PRSs at OU 1140 meet this criterion and are recommended for characterization as part of decommissioning activities when the buildings are no longer needed. Table 6-2 lists drain line PRSs recommended for NFA or DA. A more detailed description of each PRS is given in the listed subsection.

Rationale for Recommendation of DA. No hazardous waste has entered these drains in many years. Rover Program experiments involving uranium

TABLE 6-1

PRSs RECOMMENDED FOR NFA OR DA

LISTED	PRS	RECOMMENDATION	SUBSECTION
No	46-001	No further action	6.2.2
1988	46-002	Deferred action	6.1.1, 5.2, 5.4
1988	46-003(e)	No further action	6.1.2.2, 5.1
1988	46-004(a)	No further action	6.1.2.1
1988	46-004(b)	No further action	6.1.2.2
1988	46-004(g)	Deferred action	6.1.1, 5.4, 5.6
1988	46-004(h)	Deferred action	6.1.1, 5.4, 5.6
No	46-004(i)	No further action	6.2.3
No	46-004(j)	No further action	6.2.3
No	46-004(k)	No further action	6.2.3
No	46-004(l)	No further action	6.2.3
No	46-004(n)	No further action	6.2.3
No	46-004(o)	No further action	6.2.3
1988	46-005	Deferred action	6.1.1, 5.2, 5.4
No	46-006(e)	No further action	6.2.1
1988	46-008(c)	No further action	6.1.2.1
No	46-008(misc.)	No further action	6.2.1
No	46-010(a)	No further action	6.2.2
No	46-010(b)	No further action	6.2.2
No	46-010(c)	No further action	6.2.2
No	46-010(e)	No further action	6.2.2
No	46-010(f)	No further action	6.2.2
No	46-010(misc.)	No further action	6.2.1

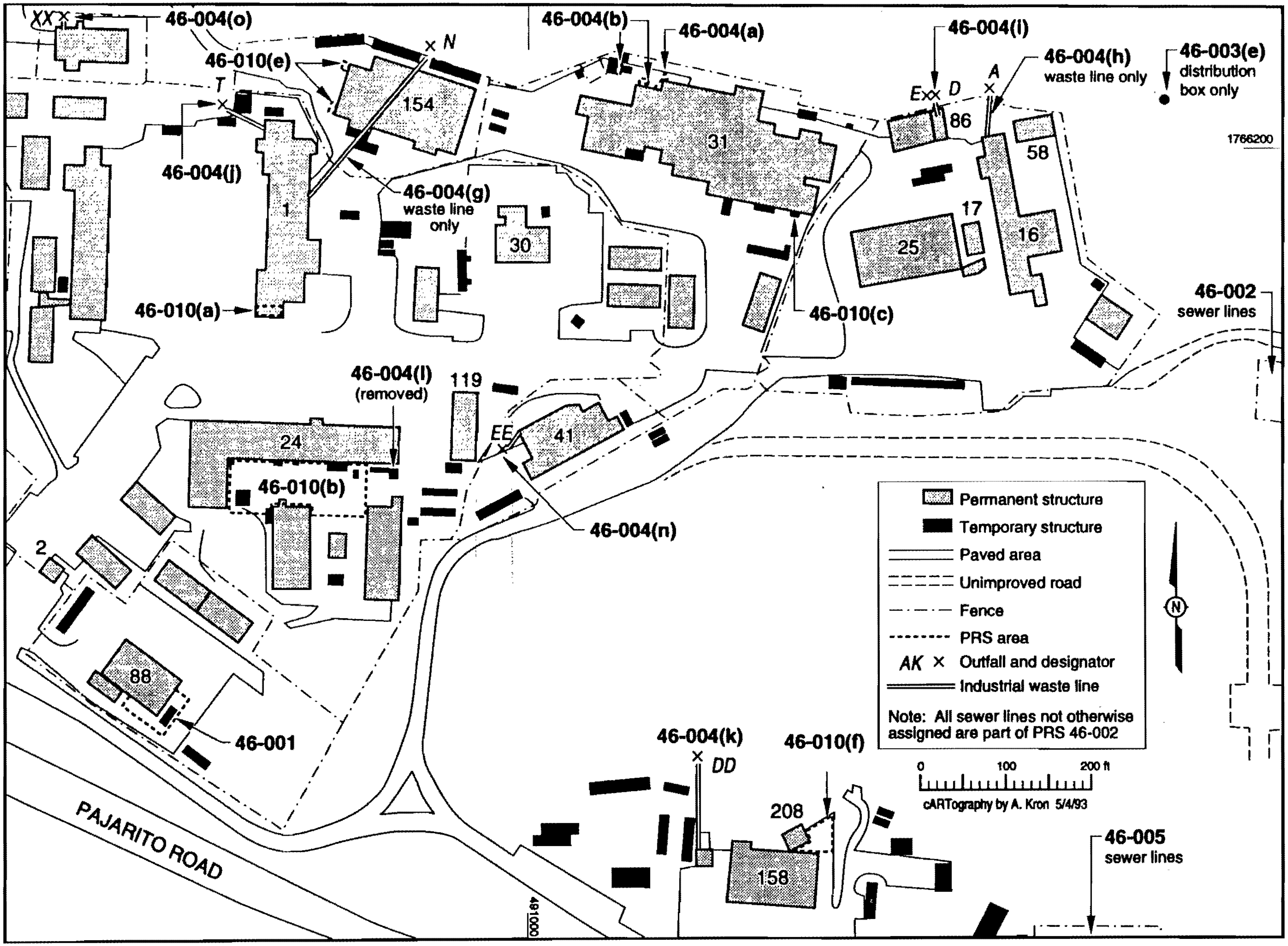

Fig. 6-1. Location of PRSs proposed for no further action or deferred action at OU 1140 (TA-46).

TABLE 6-2

DRAIN LINES RECOMMENDED FOR NFA OR DA

PRS	DESCRIPTION	DISCUSSION (SUBSECTION)
46-002	Sanitary lagoon lines	5.2, 5.4
46-004(g)	TA-46-31 drain lines	5.4, 5.6
46-004(h)	TA-46-16 drain lines	5.4, 5.6
46-005	South lagoon lines	5.2, 5.4

ended in 1973. Although spent solvents may have been poured into drains in subsequent years, this practice was stopped with implementation of disposal restrictions that prohibit discharge of hazardous material to floor drains.

The drains are active and reconnaissance or characterization would disrupt activities within the buildings. The outfalls from these drains will be investigated as described in Chapter 5, Subsection 5.4.4. Similarly, investigation of the lagoon drains would disrupt many facilities at TA-46. Should analytical results from sampling the outfall from any PRS recommended for DA show concentrations of hazardous constituents above screening action levels (SALs), the decision for DA will be reevaluated.

SWMU 46-002 includes the active drain lines associated with the sewage lagoon. Any drain line not incorporated into the Sanitary Waste System Consolidation (SWSC) system will be addressed under decommissioning of the lagoon, discussed in Chapter 5, Subsection 5.2 of this work plan. The outfall is discussed in Subsection 5.4.

SWMU 46-004(g) includes sink and floor drains from Room 8 in TA-46-1. Engineering drawing ENG-C 18070, dated 1955, shows a drain line from TA-46-1 to manhole TA-46-15. This drain receives effluent from all floor and roof drains in the building with the exception of two high bay drains. From manhole TA-46-15, a line drains north to an outfall on the wall of Cañada del Buey. Chapter 5, Subsection 5.4.1.1 provides a description of the outfall. TA-46-1 was used for Rover Program experiments involving graphite impregnated with uranium.

SWMU 46-004(h) includes a 6-in.-cast-iron pipe that serves the floor drains in Building TA-46-16 as shown in Engineering drawing ENG-C 14983. This industrial drain discharges to an outfall on the wall of Cañada del Buey as described in Chapter 5, Subsection 5.4.1.1. Tests with uranium-loaded graphite were conducted in test cells #1 and #2 in TA-46-16 during the Rover Program.

The SWMU Report names ducts and drains in TA-46-1 and TA-46-16 as SWMUs (LANL 1990, 0145). These drains, discussed above, are still active and will be deferred to decommissioning activities when the building is no longer needed. Ducts included as components of these SWMUs are discussed in Chapter 5, Subsection 5.6; outfalls will be investigated as discussed in Subsection 5.4.

SWMU 46-005 is the sanitary lagoons east of TA-46-158. Investigation of the drain lines will be deferred to decommissioning activities when the building is no longer needed. The lagoons are discussed in Chapter 5, Subsection 5.2; the outfall is discussed in Subsection 5.4.

6.1.2 Listed PRSs Recommended for NFA

Recommendations for NFA are based on the four-step evaluation criteria described in Appendix I, Subsection 4.1 of the IWP, Revision 2 (LANL 1992, 0768). Table 6-3 summarizes the four-step criteria used in this document.

TABLE 6-3

FOUR-STEP CRITERIA FOR NFA

STEP	CRITERIA
Step 1	• SWMU Report is not accurate • PRS has undergone RCRA closure
Step 2	• PRS is an active, RCRA-regulated waste accumulation area (WAA) • PRS has always operated under a Part B, NPDES permit, or began operation after 1972
Step 3	• PRS is active site with no credible off-site pathways • PRS is undergoing voluntary corrective action (VCA)
Step 4	• PRS poses no threat, at present or in the future, to on-site or off-site workers, the general public, or the environment

Rationale for these recommendations is based on historical and archival information and field investigations.

Listed PRSs recommended for NFA are listed in Table 6-4, which gives the PRS identification, location, and a brief description. Numbers in the fourth column indicate which of the four steps for evaluating candidacy for NFA is applicable to the relevant PRSs. The fifth column gives the rationale for that step. If only a portion of a PRS is recommended for NFA, then column six lists the location of the previous discussion.

TABLE 6-4

LISTED PRSs RECOMMENDED FOR NFA

PRS	LOCATION	DESCRIPTION	STEP	RATIONALE	PREVIOUS DISCUSSION
46-003(e)	Cañada del Buey	Distribution box	4	No threat	5.1
46-004(a)	TA-46-31	Drain line	1	Not accurate	5.1
46-004(b)	TA-46-31	Cleaning tank	4	No threat	NA
46-008(c)	Unknown	Drum storage	1	Not accurate	NA

6.1.2.1 Listed PRSs Recommended for NFA Under Step One: SWMU Report is Not Accurate

SWMU 46-004(a) is a drain line from Building TA-46-31. This line is determined to be a part of SWMU 46-004(c), a dry well system described in Chapter 5, Subsection 5.1.1 of this work plan. Rationale for recommendation of NFA for the redundant SWMU 46-004(a) relies on the sampling plan to detect all potential contaminants of concern (PCOCs) developed for SWMU 46-004(c).

SWMU 46-008(c) is identified in the SWMU Report as a site where barrels, cans, and drums are located "in a fenced area" (LANL 1990, 0145). The SWMU location is not provided in the maps supplied with either the 1988 or the 1990 SWMU Report. There is no explicit reference in the RCRA facility assessment (RFA) to such a storage area. A diligent search of TA-46 aerial photographs failed to target a candidate area for this SWMU. Since 1986, drum storage areas at TA-46 have been consolidated. In addition, TA-46 has undergone programmatic changes resulting in relocation of fences throughout the site. It is now impossible for the technical team to locate this site from the description.

Rationale for Recommendation of NFA. In Appendix I, Subsection 4.1, step 1 of the IWP, the operable unit project leader (OUPL) is charged with verifying that the PRS is correctly located. Despite the efforts of the TA-46 technical team, verification of SWMU 46-008(c) is impossible from the available information. In addition, an extensive sampling plan, described in Chapter 5, Subsections 5.3.4 and 5.4.4 of this work plan, has been developed for surface SWMUs and outfalls, and a broad surface area is addressed in relation to stack emissions described in Subsection 5.6. This sampling will detect any contaminants remaining from this storage area. If contaminants are detected, either they will be incorporated into the data base for an identified PRS or a new PRS will be created.

6.1.2.2 Listed PRSs Recommended for NFA Under Step Four: No Threat to Receptors

SWMU 46-004(b) was an alkali-metal cleaning tank, TA-46-81, now removed. The unlined concrete tank occupied two different sites. First, it sat on asphalt within 50 ft of the northwest corner of TA-46-31, and then was moved to a nearby 12 x 20 ft concrete pad. The area around the pad is paved. Engineering drawing ENG-C 38763 shows the location and indicates that the tank was approximately 4 x 8 ft in area; height is not specified. It had no outlet. Engineering drawing ENG-R 5124, Rev. 18, indicated that the tank was removed in 1973. The site of this tank is embedded within SWMU 46-006(d). See Fig. 5-3-12 for former locations of this tank within SWMU 46-006(d).

No radioactive isotopes of the alkali metals were used at TA-46. Natural isotopes were used in various experiments, such as the cesium plasma diode mentioned in Chapter 5, Subsection 5.3.1.1 in connection with SWMU 46-007. Alkali metals are corrosive and extremely reactive when in contact with water. Hydrogen produced in dissolution can ignite from the heat of reaction. For these reasons laboratory equipment used in these processes was cleaned to remove bits of metal prior to disposal. The cleaning process was performed outdoors to avoid buildup of explosive hydrogen gas and to keep personnel at a distance from the reaction (Michelotti 1992, 11-177).

Rationale for Recommendation of NFA. No radioactive alkali isotopes were used at TA-46. Naturally-occurring alkali compounds (lithium, sodium, potassium, rubidium, and cesium) are regulated only on the basis of corrosivity and reactivity. The metals form hydroxides in contact with water and organic alcohols; the resulting compounds are readily soluble and disperse quickly to mitigate their corrosive properties. More importantly, SWMU 46-004(b) had no outlet. Salts and hydroxides remained in the cleaning tank and solvents evaporated. In the unlikely event that hazardous material was released outside the tank, the site is embedded in SWMU 46-006(d). Contamination will be detected under the sampling plan described for that PRS in Chapter 5, Subsection 5.3.4.2.3.

46-003(e) is a distribution box component of a septic system. The 4-ft-square box is located on the surface in Cañada del Buey at the base of the fill at the northeast end of TA-46. It probably was displaced to its present location during the construction of the sewage lagoon in 1973. Its location and configuration indicate that it may be a part of SWMU 46-003(e), discussed in Chapter 5, Subsection 5.1.1.1. Swipes taken at the time of discovery indicate below-background levels [9 disintegrations per minute (dpm) per 15.5 sq in. alpha and 23 dpm/15.5 sq in. beta] of radioactivity (Montoya 1992, 11-159).

Rationale for Recommendation of NFA. The surface condition of SWMU 46-003(e) indicates that it has been scoured clean by wind and rain since being exposed on the canyon floor. Swipes analyzed in the laboratory indicate that the box has no residual radioactivity. There are no visual indications, such as stains or deposits, that other hazardous materials may have adhered to the box in its present condition. The OU 1140 team recommends that this box be removed as a VCA and deposited in an appropriate landfill.

6.2 Unlisted PRSs Recommended for NFA

Unlisted PRSs proposed for NFA are listed in Table 6-5, which shows the PRS identification, location, a brief description, the pertinent step under Subsection 4.1, Appendix I of the IWP, and the rationale for the recommendation.

TABLE 6-5

UNLISTED PRSs RECOMMENDED FOR NFA

PRS	LOCATION	DESCRIPTION	STEP	RATIONALE
46-001	TA-46-88	Acid storage	2	<90-day WAA[1]
46-004(i)	TA-46-86	Cooling outfall	4	No threat
46-004(j)	TA-46-1	Cooling outfall	4	No threat
46-004(k)	TA-46-158	Cooling outfall	4	No threat
46-004(l)	TA-46-24	Cooling outfall	4	No threat
46-004(n)	TA-46-41	Cooling outfall	4	No threat
46-004(o)	TA-46-200	Cooling outfall	4	No threat
46-006(e)	TA-46-1	Uranium	1	Not accurate
46-008(misc.)	Unknown	Unknown	1	Not accurate
46-010(a)	TA-46-1	Drum storage	2	SAA[2]
46-010(b)	TA-46-24	Drum storage	2	SAA
46-010(c)	TA-46-24	Drum storage	2	SAA
46-010(d)	TA-46-1	Drum storage	2	SAA
46-010(e)	TA-46-154	Drum storage	2	SAA
46-010(f)	TA-46-158	Drum storage	2	SAA
46-010(misc.)	Unknown	Unknown	1	Not accurate

[1] WAA - waste accumulation area.
[2] SAA - satellite accumulation area.

6.2.1 Unlisted PRSs Recommended for NFA Under Step One: SWMU Report is Not Accurate

SWMU 46-006(e) is described in the SWMU Report as follows: "TA-46-1 released effluent from metallurgical polishing into Cañada del Buey." This SWMU is a duplicate of SWMU 46-004(g), described as follows: "TA-46-1 ...uranium... possible release into Cañada del Buey." SWMU 46-004(g) (Outfall N) is discussed in Chapter 5, Subsection 5.4.1.1.1; sampling points are shown in Fig. 5-4-6.

SWMUs 46-008(misc.) and **46-010(misc.)** are not sufficiently described in the SWMU Report to make a determination on their whereabouts and nature.

6.2.2 Unlisted PRSs Recommended for NFA Under Step Two: PRS is an SAA

As stated in the 1992 IWP, Appendix I, Subsection 4.1, Step 2, an SAA may be recommended for NFA if it is not a historic release site (LANL 1992, 0768). Only one of the following PRSs meets this criterion. However, the remaining five are either embedded in or adjacent to an existing PRS for which a sampling plan has been written. Recommendation for NFA is based on the expectation that any contaminants of concern (COCs) remaining from these SAAs will be detected and assigned to the related PRS.

Table 6-6 lists accumulation areas, the associated building, location, and related PRS under which past potential releases will be investigated. All these accumulation areas are outdoor facilities.

TABLE 6-6

SATELLITE ACCUMULATION AREAS AT TA-46

PRS	BUILDING	LOCATION	RELATED PRS
46-001	TA-46-88	Southeast corner	46-008(a)
46-010(a)	TA-46-1	South loading dock	46-007
46-010(b)	TA-46-24	South side	46-008(d)
46-010(c)	TA-46-31	Outside room 103	46-008(f)
46-010(e)	TA-46-154	West side	None
46-010(f)	TA-46-158	Northeast corner	46-006(c)

SWMU 46-001 is the site of a decommissioned acid-waste tank, currently listed on the Laboratory EM-8 data base as an inactive, less-than-ninety-day WAA. The SWMU Report states: "...one of the two unbermed tanks released hazardous waste (at least 5 gallons of 6 to 7 Molar nitric acid) in 1987. The tanks were subsequently bermed, emptied and cleaned, and no longer contain hazardous waste" (LANL 1990, 0145). The activities in Building TA-46-88 at that time involved production of non-radioactive isotopes of carbon, oxygen, and nitrogen (ICON). When the program ended in 1989, much care was devoted to cleanup and neutralization. Researchers indicate that the ICON process involved the reaction of sulfur dioxide and nitric acid to produce only sulfuric acid and oxides of nitrogen. Nitric and sulfuric acids were the only wastes produced; no regulated hazardous

wastes were generated by these activities (Michelotti 1993, 11-220). While concentrated acids are corrosive, they pose no hazards after dilution and neutralization in the environment (Martell 1992, 11-202). See Fig. 5-3-16 for location of SWMU 46-001 within SWMU 46-008(a).

SWMU 46-010(a) is located on the concrete loading dock outside the south bay of TA-46-1. A shed-like room was built on the original dock in 1955 (Engineering drawing ENG-C 3369), leaving only a 5 x 15 ft strip to serve as a receiving area. There is no direct access into the south bay. In addition to the SAA cabinet, two solvent storage cabinets and a pressurized-gas cylinder storage area are located on the dock. The area is covered but open on three sides. The concrete floor, scoured by wind and rain, shows only rust stains. The area east of the dock is unpaved and slopes steeply to SWMU 46-007, described in Chapter 5, Subsection 5.3.1.1. Sampling plan for the latter SWMU is discussed in Subsection 5.3.4.2.2; sampling points are shown in Fig. 5-3-15.

SWMU 46-010(b) is a 90 x 160 ft area located against the south wall of TA-46-24. It is included in the 100 x 200 ft area of SWMU 46-008(d) discussed in Chapter 5, Subsection 5.3.1.1. The sampling plan is discussed in Subsection 5.4.1.1.2, Outfall NN. The sampling points are shown in Fig. 5-3-18.

SWMU 46-010(c) is an approximately 6 x 10 ft area located against the south wall of TA-46-31. It is included in the 50 x 100 ft area of SWMU 46-008(f) discussed in Chapter 5, Subsection 5.3.1.1. The sampling plan is discussed in Subsection 5.3.4.2.2 and the sampling point is shown in Fig. 5-3-20.

SWMU 46-010(e) is not associated with any surface-release PRS. However, TA-46-154 was constructed in 1978 as a laser-induced-chemistry building. The SWMU has no prior history as an outside storage area (Michelotti 1993, 11-219). There are no historic releases documented from SWMU 46-010(e), nor are there visible stains.

SWMU 46-010(f) is located on a hillock above TA-46-158. It is covered by a shed-like roof and stores product and waste. Any past runoff commingled with PCOCs from 46-006(c) into the same storm drain. These adjacent

PRSs are described in Chapter 5, Subsection 5.3.1.1. Sampling plans are discussed in Subsection 5.3.4.2.2. Sampling points are shown in Fig. 5-3-11.

Rationale for Recommendation of NFA. RCRA SAAs and less-than-ninety-day WAAs were established at OU 1140 in conformance with, and are currently regulated under, 40 CFR 262, Standards Applicable to Generators of Hazardous Waste. Although the SAAs at OU 1140 were used for storage and accumulation prior to establishment of EPA regulations, any past releases from these areas have commingled with, and are indistinguishable from, contaminants from adjacent or enclosing PRSs addressed by individual sampling plans in Chapter 5. Should contamination above hazardous levels be encountered in an adjacent PRS, the associated SAA will be included in Phase II sampling.

The Laboratory and the EPA have agreed that RCRA satellite and less-than-ninety-day hazardous WAAs need not be reported to the RCRA Permits Section, Hazardous Waste Management Division, as PRSs (Twombly 1992, 11-205). The PRSs listed above are such sites. COCs from any historical releases that may have occurred will be investigated under related PRSs in Chapter 5, Subsection 5.3.1.

6.2.3 Unlisted PRSs Recommended for NFA Under Step Four: No Threats to Receptors

Cooling water outfalls were listed in the SWMU Report as being potentially contaminated with scale, corrosion, and algae inhibitors. A review of the 25 treatment chemicals used at the Laboratory over the years indicates that only chromates are considered hazardous, and that no chromates were used to treat cooling water at TA-46 (Radzinski 1992, 11-188). Outfalls designated 03A in this aggregate have NPDES permits for treated cooling water and have no other source of effluent than a cooling tower. Outfalls designated 04A receive only untreated tap water used for cooling. PRS identification, building served, outfall field identification, and NPDES designation are listed in Table 6-7.

SWMUs 46-004(i,j,k,n,o) are outfalls from active cooling towers currently regulated under NPDES permits.

TABLE 6-7

OUTFALLS SERVING COOLING TOWERS

PRS	BUILDING	FIELD ID	NPDES ID
46-004(i)	TA-46-86	D, E	03A044
46-004(j)	TA-46-1	T	03A042
46-004(k)	TA-46-158	DD	04A124
46-004(l)	TA-46-24	NN	None
46-004(n)	TA-46-41	EE	04A117
46-004(o)	TA-46-200	XX	03A136

SWMU 46-004(i) includes Outfalls D and E, located north of Building TA-46-87. Outfall D served cooling tower TA-46-86. Engineering drawing ENG-C 38764 shows that Outfall E, directly above D, served a holding tank located east of the tower. The tank held dilute lithium hydroxide solutions discarded during the Rover Project from the arc jet test facility in Building TA-46-31. At release, the hydroxide solution was diluted by blowdown water to about 96 ppm (Stratton 1969, 11-061). Engineering drawing ENG-C 38763 shows a second, valved, unlocated outfall north of TA-46-31 serving the feed line to the holding tank; this outfall may have been removed when the line was decommissioned. Neither the blowdown water nor dilute lithium hydroxide solution contained regulated substances; the three outfalls are recommended for NFA in this work plan.

SWMU 46-004(l) was a commercial, free-standing cooling unit located on the south side of Building TA-46-24. It has been removed (Griggs 1993, 11-218). Blowdown discharged to Outfall NN is described in Chapter 5, Subsection 5.4.1.1.2.

Rationale for Recommendation of NFA. Two of these outfalls were established after passage of the Clean Water Act in 1972 and have always been regulated and tested: SWMU 46-004(k) in 1983 and SWMU 46-004(o) in 1985 (see also Step 2 rationale, Subsection 6.1.2). Engineering drawings indicate that none of these outfalls have any source other than cooling tower effluent (McCulla 1992, 11-203). Since no chromates were used at TA-46 and other additives are benign (Radzinski 1992, 11-188), these outfalls meet all criteria under Step 4 of Appendix I, Subsection 4.1 of the IWP; the PRSs present no threat to workers, the public, or the environment.

REFERENCES

EPA (US Environmental Protection Agency), April 10, 1990. Module VIII of RCRA Permit No. NM0890010515, EPA Region 6, issued to Los Alamos National Laboratory, Los Alamos, New Mexico, effective May 23, 1990, EPA Region 6, 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., pp. 30798-30884. **(EPA 1990, 0432)**

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McCulla, A., September 3, 1992. "Summary of Summer Work," Los Alamos National Laboratory report CLS-ER-RM-92-028 to Roy Michelotti from Allen McCulla. **(McCulla 1992, 11-203)**

Michelotti, R., April 8, 1992. "Documentation of Cesium-Ditch Waste Practices," Los Alamos National Laboratory Memorandum CLS-ER-RM-004 to File from Roy Michelotti (CLS-DO), Los Alamos, New Mexico. **(Michelotti 1992, 11-177)**

Michelotti, R., January 21, 1993. "Satellite Accumulation Area at TA-46-154," Los Alamos National Laboratory Memorandum CLS-ER-RM-93-003 to File from Roy Michelotti (CLS-DO), Los Alamos, New Mexico. **(Michelotti 1993, 11-219)**

Michelotti, R., January 22, 1993. "Activities in Building TA-46-88," Los Alamos National Laboratory Memorandum CLS-ER-RM-93-004 to File from Roy Michelotti (CLS-DO), Los Alamos, New Mexico. **(Michelotti 1993, 11-220)**

Montoya, A., June 10, 1992. "Swipe Data Results," Los Alamos National Laboratory results to Roy Michelotti (CLS-6) from A. Montoya (EM-7), Los Alamos, New Mexico. **(Montoya 1992, 11-159)**

Radzinski, W., September 23, 1992. "Cooling Water Treatments," Los Alamos National Laboratory Memorandum to Roy Michelotti (CLS-6) from W. Radzinski (ENG-6) Los Alamos, New Mexico. **(Radzinski 1992, 11-188)**

Stratton, T. F., October 20, 1969. "Cleanout of Lithium in the Arc Jet Test Facility," Los Alamos Scientific Laboratory Memorandum N-5 to Paul McConnell (ENG-DO) from T. F. Stratton (N-5), Los Alamos, New Mexico. **(Stratton 1969, 11-061)**

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Annex I

Project Management Plan

Executive Summary

Chapter 1
Introduction

Chapter 2
Background Information

Chapter 3
Environmental Setting

Chapter 4
Technical Approach

Chapter 5
Evaluation of PRS Aggregates

Chapter 6
PRSs Recommended for No Further Action or Deferred Action

Annexes

Appendixes

1.0 PROJECT MANAGEMENT PLAN

This annex presents the technical approach, organizational structure, schedule, budget, and reporting milestones for implementation of the Operable Unit (OU) 1140 Resource Conservation and Recovery Act (RCRA) facility investigation (RFI) work plan. This plan is an extension of the Environmental Restoration (ER) Program Project Management Plan in Annex I of the Installation Work Plan (IWP) (LANL 1992, 0768). The OU 1140 RFI work plan does not contain any deviations from the IWP. This annex addresses the project management requirements of the Hazardous and Solid Waste Amendments (HSWA) Module (Task II, E., p. 39) of the Laboratory's RCRA Part B Permit (EPA 1990, 0306).

1.1 Technical Approach

The technical approach employed for the OU 1140 RFI work plan is described in Chapter 4. The approach used is based on the ER Program's overall technical approach to the RFI/corrective measures study (CMS) process as described in Chapter 3 of the IWP (LANL 1992, 0768). The following key features characterize the ER Program approach:

- use of action levels as criteria to trigger a CMS;
- sampling approach to site characterization;
- decision analysis and cost effectiveness to support the selection of remedial alternatives;
- application of the observational approach to the RFI/ CMS process as a general philosophical framework; and,
- integration of RCRA, Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), National Environmental Policy Act (NEPA), Atomic Energy Act (AEA), and other applicable regulations.

The general philosophy is to develop and iteratively define the nature and extent of contamination at OU 1140 through a planned, phased investigation and data interpretation. An objective is to support no further action (NFA) recommendations, voluntary corrective actions (VCAs), or CMSs using the minimum data necessary.

The technical objectives of the phased RFI, as detailed throughout this work plan, are to:

- identify contaminants present at each potential release site (PRS)
- determine the vertical and lateral extent of the contamination at each PRS
- identify contaminant migration pathways
- acquire sufficient information to quantify migration, exposure, and risk, as necessary
- provide necessary data for the assessment of potential remedial alternatives
- provide the basis for planning VCA removals and detailed corrective measures studies
- conform with RCRA Subpart S

1.1.1 Implementation Rationale

Scheduling of investigations is based on the following rationale and priorities.

Initial efforts are focused on obtaining OU-wide environmental data that form the basis for understanding contaminant transport processes. These investigations, described in Chapter 4, include:

- geomorphic characterization of drainage channels to determine locations for representative sampling of mobile sediments, surface geophysics measurements to locate buried pipes, and radiation surveys to define areas contaminated by radioactive elements; and
- measurement of contaminant levels in surface soils as a basis for determining if low levels of contaminants detected at individual solid waste management units

(SWMUs) are indicative of releases from individual SWMUs or only represent the presence of the OU-wide contamination.

PRS-specific investigations include sediment sampling in structures such as septic tanks, dry wells, and lagoons; surface sampling for stack emissions and in drainage channels; near-surface sampling beneath paved areas; and subsurface sampling in septic system drain fields, dry wells, beneath lagoons, and in landfills.

Scheduling priorities are based on the following:

- Basic information and data obtained from OU-wide characterization are needed as a basis for comparison and must be available before evaluations can be made of the PRS-specific data.
- Surface data and data from easily accessible structures will be acquired first.
- Near-surface and subsurface data, including data from some subsurface structures, will be taken after the surface data have been analyzed in the field laboratory. Surface data analysis results may influence the locations and extent of near-surface and subsurface sampling activities.

1.2 Schedule

The schedule for the RCRA assessment process at OU 1140 is provided in Table I-1.

Where possible, fieldwork has not been scheduled between November 15 and March 15 each year, to avoid inclement weather.

1.3 Reporting

Results of RFI fieldwork will be presented in four principal documents: quarterly technical progress reports, RFI phase reports/work plan modifications, the RFI report, and the CMS report if required. The purpose of each of these reports is detailed below. A schedule for submission of draft and final reports is presented in Table I-2.

TABLE I-1

PROJECTED SCHEDULE FOR CORRECTIVE ACTION PROCESS OPERABLE UNIT 1140

MILESTONE	DATE
Submit EPA/NMED work plan	8/20/93
Start RFI	9/22/93
Start RFI report	12/27/94
Complete RFI fieldwork	1/26/96
Complete draft RFI report	2/28/97
Complete RFI	5/30/97
Complete assessment	9/30/98

TABLE I-2

REPORTS PLANNED FOR OPERABLE UNIT 1140 RFI

REPORT TYPE	EPA	DOE	DATE DUE
Monthly reports	X	X	25th of the following month
Quarterly reports	X		February 15, yearly
	X		May 15, yearly
	X		August 15, yearly
Annual reports	X	X	November 15, yearly
Phase reports			
Draft RFI work plan	X	X	8/20/93
Draft Phase I report	X	X	7/19/95
Draft RFI report	X	X	2/28/97

1.3.1 Quarterly Technical Progress Reports

As the OU 1140 RFI is implemented, technical progress will be summarized in quarterly technical progress reports, as required by the HSWA Module of the Laboratory's RCRA Part B operating permit (Task V, C, p. 46). Detailed technical assessments will be provided in RFI phase report/work plan modifications.

1.3.2 RFI Phase Report/Work Plan Modifications

RFI phase reports/work plan modifications will be submitted for work conducted on aggregates of PRSs or on individual PRSs. These phase reports 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-on activities being planned (including any modifications to field sampling plans suggested by initial findings). VCA activities and confirmatory-sampling results will also be reported.

1.3.3 RFI Report

The RFI report will summarize all fieldwork conducted during the RFI. As required by the HSWA module of the Laboratory's RCRA Part B operating permit (Task V, D, p. 46), the Laboratory will submit an RFI report within 60 days of completion of the RFI. As stated in the IWP, Subsection 3.5.1.2 (LANL 1992, 0768), the RFI report will describe the procedures, methods, and results of field investigations and will include information on the type and extent of contamination, sources and migration pathways, and exposure and risk assessment. The report will also contain adequate information to support justification for NFA and corrective action decisions for PRSs.

1.3.4 CMS Report

The CMS report, if needed, will propose methods of remediation for selected SWMUs listed in the RFI report. Not all SWMUs will need remediation because some will have been delisted based on recommendations made in the RFI report. The CMS report will describe the proposed remediation methods, procedures, and expected results, along with a plan, schedule, and cost estimate.

1.4 Budget

The schedule presented above is based on fixed budgets for the first two years of the RFI. The fixed budgets in fiscal years 1993 and 1994 (FY93 and FY94) are based on expected Department of Energy (DOE) funding levels. DOE funding requests are set two years in advance: thus, the first year in which the RFI is not constrained by past budget estimates will be FY95. Funding requests for FY95 and beyond will reflect the cost and schedule that most efficiently complete the RFI plans. Table I-3 (included at the end of Annex I) presents a cost estimate for the OU 1140 RFI. Schedules and costs will be updated through DOE change control procedures as appropriate with revisions submitted to the Environmental Protection Agency (EPA) for approval.

1.5 Organization

The organizational structure for the ER Program is presented in Section 3.0, Annex I of the IWP (LANL 1992, 0768). Organization of the ER Program is presented in Fig. 3-2 of the IWP.

This section details the management organization for the OU 1140 RFI. A list of contributors to the OU 1140 RFI Work Plan is in Appendix C.

The following are the responsibilities of the program manager (PM), programmatic project leader (PPL), operable unit project leader (OUPL), technical team, field teams manager, field team leader (FTL), and field teams.

Program Manager

- ensures that the Laboratory's ER activities are consistent with the goals and objectives of the Environmental Management (EM) Division Leader, DOE, EPA, New Mexico Environment Department (NMED), and others, as appropriate;
- ensures compliance with the HSWA Module;
- ensures compliance with change control procedures;
- evaluates costs, schedules, and performance;
- submits monthly and quarterly reports to DOE, EPA, and NMED;
- tracks deliverables and milestones established by DOE, EPA, and NMED;
- ensures the establishment and implementation of the quality, health and safety, records management, and community relations programs; and,

- ensures 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.

Programmatic Project Leader

The PPL provides technical and administrative programmatic guidance to OUPLs and technical team leaders (TTLs) including the following:

- regulatory compliance requirements (especially RCRA and CERCLA), RFI/CMS/corrective measures implementation (CMI), document content, administrative and technical standard operating procedures, quality assurance and health and safety requirements, and general policies and requirements for doing business in the Laboratory's ER Program;
- defining allocation of resources to Laboratory and contractor personnel to accomplish required technical and management activities, and tracking progress and fiscal spending;
- assisting OUPLs and TTLs in obtaining appropriate and sufficient resources to perform their assigned duties;
- performing technical and policy reviews of documents prepared for the ER Program by OUPLs, TTLs, and affiliated staff;
- reviewing and recommending management action as appropriate for scopes of work, proposals, or requests for work to be supported by the ER Program;

- reviewing progress of OUPLs and TTLs;
- recommending to the management corrective or enhancement actions as appropriate to expeditiously meet ER Program goals;
- working closely with other PPLs and group leaders to assure proper integration of program activities and fiscal responsibility and to ensure compliance with applicable federal and state regulations;
- interacting with federal and state regulatory agencies; and,
- providing input to monthly, quarterly, and/or annual progress reports as required.

OU 1140 Project Leader

- oversees day-to-day operations including planning, scheduling, and reporting technical and related administrative activities;
- ensures preparation of scientific investigation planning documents and procedures;
- prepares monthly and quarterly reports for the project manager;
- oversees subcontractors, as appropriate;
- coordinates with TTLs;
- conducts technical reviews of the milestones and final reports;
- interfaces with the ER quality program project leader (QPPL) to resolve quality concerns and to coordinate with the quality assurance (QA) staff for audits;

- complies with the ER Program health and safety (H&S), records management and community relations requirements;
- oversees RFI fieldwork and manages the field teams manager; and,
- complies with the Laboratory's technical and QA requirements for the ER Program.

Technical Team Members

Technical team members are responsible for providing technical input for their discipline throughout the RFI/CMS process. They have participated in the development of this work plan and the individual field sampling plans and will participate in the fieldwork, data analysis, report preparation, work plan modifications, and planning of subsequent investigations as necessary.

The primary disciplines currently represented on the technical team are environmental sciences, engineering, environmental regulations, statistics, and health physics. The composition of the technical team may change with time as the technical expertise needed to implement the RFI changes.

Field Teams Manager

- oversees day-to-day field operations,
- conducts planning and scheduling for the implementation of the RFI field activities detailed in Chapters 4 and 5, and,
- manages field team leaders.

Field Team Leader

The field teams manager will assign fieldwork to FTLs for implementation in the field. Each FTL will direct the execution of field sampling activities using crews of field team members appropriate for the activity.

Field Team Member(s)

Field team members may include, as appropriate

- sampling personnel,
- site safety officer,
- geologists,
- hydrologists,
- health physicists, and
- other applicable disciplines.

All teams will have, at a minimum, a site safety officer and a qualified field sampler. They are responsible for conducting the work detailed in field sampling plans under the direction of the FTL.

REFERENCES

EPA (US Environmental Protection Agency), April 10, 1990. RCRA Permit No. NM0890010515, EPA Region VI, issued to Los Alamos National Laboratory, Los Alamos, New Mexico, effective May 23, 1990, EPA Region 6, Hazardous Waste Management Division, Dallas, Texas. **(EPA 1990, 0306)**

LANL (Los Alamos National Laboratory), November 1992. "Installation Work Plan for Environmental Restoration," Revision 2, Los Alamos National Laboratory Report LA-UR-92-3795, Los Alamos, New Mexico. **(LANL 1992, 0768)**

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LOS ALAMOS NATIONAL LABORATORY                         FINEST HOUR                            ADS 1140: TA-46

REPORT DATE 25JAN93  RUN NO.  678              ENVIRONMENTAL RESTORATION                      START DATE  1OCT91   FIN DATE 30SEP98
            23:06
SUMMARY COSTS BY ACTIVITY                                                                     DATA DATE   1OCT92   PAGE NO.     1


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   ACTIVITY    ORIG REM                               ACTIVITY DESCRIPTION                 SCHEDULED
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   230120050    53   53      0          1140: DEVELOP HEALTH & SAFETY PLAN RFI WP         1OCT92   18DEC92
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   230120100    53   53      0          1140: DEVELOP INTERNAL DRAFT       RFI WP         1OCT92*  18DEC92
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   230120105    13   13      0          1140: LANL REVIEW INT DRAFT        RFI WP         5JAN93   22JAN93
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   230120110    19   19      0          1140: INC LANL COMMENTS            RFI WP        25JAN93   19FEB93
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   230120115    10   10      0          1140: ISSUE DOE DRAFT              RFI WP        22FEB93    5MAR93
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   230120125    19   19      0          1140: INC DOE COMMENTS             RFI WP         7APR93    3MAY93
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      ID      DUR  DUR      %                                       BUDGET       EARNED     START    FINISH
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   230120130    10   10     0            1140: ISSUE EPA/NMED DRAFT           RFI WP      4MAY93  17MAY93
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                                                                      2257.00          .00

   230120140    44   44     0            1140: NMED REVIEW                    RFI WP     18MAY93  20JUL93
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   230121010    88   88     0            1140: FIELD WORK PLAN                RFI WP     18MAY93  21SEP93
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   230120145    20   20     0            1140: INC EPA/NMED COMMENTS          RFI WP     21JUL93  17AUG93
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   230120150    10   10     0            1140: ISSUE FINAL                    RFI WP     18AUG93  31AUG93
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   230160704   249  249     0            1140: BENCH/PILOT FY94                             1OCT93* 30SEP94
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   230131005    40   40     0            1140: READINESS REVIEW & DRY RUN     RFI PH1       3JAN94*  1MAR94
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   230131000    10   10     0            1140: MOBILIZE                       RFI PH1      16FEB94   1MAR94
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REPORT DATE 25JAN93  RUN NO.  678            ENVIRONMENTAL RESTORATION                          START DATE  1OCT91   FIN DATE 30SEP98
            23:06
SUMMARY COSTS BY ACTIVITY                                                                       DATA DATE   1OCT92   PAGE NO.     3


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  ACTIVITY    ORIG REM                                    ACTIVITY DESCRIPTION                     SCHEDULED
     ID       DUR  DUR     %                                        BUDGET       EARNED      START    FINISH
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  230180804   151  151     0           1140: CONDUCT VCA FOR FY94                      (LOE)  1MAR94* 30SEP94
                                                                     .00          .00

  230131202   100  100     0           1140: LAND SURVEY                         RFI PH1      2MAR94   21JUL94
                                                                68204.00          .00

  230131204    20   20     0           1140: RADIATION SURVEY                    RFI PH1      2MAR94   29MAR94
                                                                56784.00          .00

  230131206    10   10     0           1140: SURFACE GEOPHYSICS SURVEY           RFI PH1     16MAR94   29MAR94
                                                                32529.00          .00

  230131208    80   80     0           1140: SURFACE SAMPLE RAD SCREENING        RFI PH1     30MAR94   21JUL94
                                                                32480.00          .00

  230131210    80   80     0           1140: SURFACE SAMPLES                     RFI PH1     30MAR94   21JUL94
                                                               221222.00          .00

  230131216    10   10     0           1140: SUBSURFACE GEOPHYSICS SURVEY        RFI PH1     30MAR94   12APR94
                                                                48079.00          .00

  230131402   145  145     0           1140: SURFACE SAMPLE ANALYSIS             RFI PH1     30MAR94   24OCT94
                                                              1044202.00          .00

  230131602   185  185     0           1140: SURFACE DATA ASSESSMENT             RFI PH1     30MAR94   22DEC94
                                                               381195.00          .00

  230131218    80   80     0           1140: SUBSURF SAMPLE RAD SCREENING        RFI PH1     27APR94   18AUG94
                                                                21600.00          .00

  230131220    80   80     0           1140: SUBSURFACE SAMPLES                  RFI PH1     27APR94   18AUG94
                                                                14850.00          .00

  230131404   145  145     0           1140: SUBSURF SAMPLE ANALYSIS             RFI PH1     27APR94   22NOV94
                                                               696222.00          .00

  230131604   185  185     0           1140: SUBSURFACE DATA ASSESSMENT          RFI PH1     27APR94   25JAN95
                                                               258230.00          .00

  230131800    20   20     0           1140: DEMOBILIZE                          RFI PH1     19AUG94   16SEP94
                                                                 5000.00          .00

  230110905   248  248     0           1140: MANAGE ADS DURING FY-95                   (LOE)  3OCT94   29SEP95
                                                               180940.00          .00
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----- -----  ---- ---- - --- ----------  ------------------------------------------ -------- -------- -------- -------- -----
  ACTIVITY   ORIG REM                                  ACTIVITY DESCRIPTION                 SCHEDULED
     ID      DUR  DUR      %                                     BUDGET       EARNED     START    FINISH
----- -----  ---- ---- - --- ----------  ------------------------------------------ -------- -------- -------- -------- -----
  230160705   248  248     0               1140: BENCH/PILOT FY95, DRAINFIELD SAMPLING(LOE)  3OCT94  29SEP95
                                                                 200000.00           .00

  230180800    44   44     0               1140: TREATABILITY STUDIES VCA'S                  3OCT94*  7DEC94
                                                                 180940.00           .00

  230140100    33   33     0               1140: SURFACE REPORT/WP MOD        PH1 RPT     27DEC94  13FEB95
                                                                  70196.00           .00

 23014M300      0    0     0               1140: START DEVELOPING RFI REPORT              27DEC94
                                                                       .00           .00

  230140101    20   20     0               1140: SUBSURFACE REPORT/WP MOD     PH1 RPT     26JAN95  23FEB95
                                                                 103882.00           .00

  230132001    10   10     0               1140: WRITE CONTRACTS              RFI PH2     24FEB95   9MAR95
                                                                   9485.00           .00

  230140105    20   20     0               1140: LANL REVIEW RPT/WP MOD       PH1 RPT     24FEB95  23MAR95
                                                                   3352.00           .00

  230180805   150  150     0               1140: CONDUCT VCA FOR FY95, SEPTIC SYST    (LOE)  1MAR95  29SEP95
                                                                1609767.00           .00

  230132000    20   20     0               1140: MOBILIZE                     RFI PH2     10MAR95   6APR95
                                                                  15000.00           .00

  230140110    20   20     0               1140: INC LANL COMM RPT/WP MOD     PH1 RPT     24MAR95  20APR95
                                                                  89601.00           .00

  230132202    90   90     0               1140: SURFACE FIELD WORK           RFI PH2      7APR95  14AUG95
                                                                 270068.00           .00

  230132402   155  155     0               1140: SURFACE SAMPLE ANALYSIS      RFI PH2      7APR95  16NOV95
                                                                1275323.00           .00

  230132602   190  190     0               1140: SURFACE DATA ASSESSMENT      RFI PH2      7APR95  11JAN96
                                                                 258230.00           .00

  230132204    90   90     0               1140: SUBSURFACE FIELD WORK        RFI PH2     21APR95  28AUG95
                                                                  18150.00           .00

  230132404   150  150     0               1140: SUBSURFACE SAMPLE ANALYSIS   RFI PH2     21APR95  27NOV95
                                                                 850940.00           .00
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 ACTIVITY    ORIG REM                             ACTIVITY DESCRIPTION                 SCHEDULED
    ID       DUR  DUR      %                                  BUDGET       EARNED    START    FINISH
----- -----  ---- ---- - --- ----------  ----------------------------------------- -------- -------- -------- -------- -----
  230132604   190  190     0             1140: SUBSURFACE DATA ASSESSMENT   RFI PH2     21APR95  26JAN96
                                                                172154.00         .00

  230140115    10   10     0             1140: ISSUE DOE DRAFT              PH1 RPT     21APR95   4MAY95
                                                                   966.00         .00

 23014M115      0    0     0             1140: DOE DRAFT OF PH1 RPT COMPLETE                      4MAY95
                                                                      .00         .00

  230140120    22   22     0             1140: DOE REVIEW REPORT/WP MOD     PH1 RPT      5MAY95   6JUN95
                                                                  3352.00         .00

  230140125    20   20     0             1140: INC DOE COMM DOE DRAFT       PH1 RPT      7JUN95   5JUL95
                                                                 89601.00         .00

  230140130    10   10     0             1140: ISSUE EPA/NMED DFT RPT/WP MOD PH1 RPT     6JUL95  19JUL95
                                                                   966.00         .00

 23014M130      0    0     0             1140: EPA/NMED DRAFT OF PH1 RPT COMPLETE                19JUL95
                                                                      .00         .00

  230140135    22   22     0             1140: EPA/NMED REVIEW REPORT/WP MOD PH1 RPT    20JUL95  18AUG95
                                                                  3352.00         .00

  230140145    20   20     0             1140: INC EPA/NMED COMM RPT/WP MOD  PH1 RPT    21AUG95  18SEP95
                                                                 89601.00         .00

  230132800    20   20     0             1140: DEMOBILIZE                   RFI PH2     29AUG95  26SEP95
                                                                  5000.00         .00

  230140150    10   10     0             1140: ISSUE FINAL RPT/WP MOD       PH1 RPT     19SEP95   2OCT95
                                                                   966.00         .00

  230110906   249  249     0             1140: MANAGE ADS DURING FY-96             (LOE)  2OCT95  30SEP96
                                                                180940.00         .00

  230160706   249  249     0             1140: BENCH/PILOT STUDIES FY96            (LOE)  2OCT95  30SEP96
                                                                      .00         .00

 23013M500      0    0     0             1140: RFI FIELD WORK COMPLETE                           26JAN96
                                                                      .00         .00

  230140290   100  100     0             1140: FACILITY INVESTIGATION       RFI RPT     29JAN96  18JUN96
                                                                112656.00         .00
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LOS ALAMOS NATIONAL LABORATORY                          FINEST HOUR                              ADS 1140: TA-46

REPORT DATE 25JAN93  RUN NO.  678              ENVIRONMENTAL RESTORATION                         START DATE  1OCT91  FIN DATE 30SEP98
             23:06
SUMMARY COSTS BY ACTIVITY                                                                        DATA DATE   1OCT92  PAGE NO.    6


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   ACTIVITY   ORIG REM  .                                ACTIVITY DESCRIPTION                 SCHEDULED
      ID      DUR  DUR       %                                        BUDGET       EARNED     START    FINISH
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   230140295   110  110      0             1140: INVESTIGATION ANALYSIS        RFI RPT      29JAN96   2JUL96
                                                                   457115.00          .00

   230180806   149  149      0             1140: CONDUCT VCA FOR FY96, SEPTIC SYST    (LOE)  1MAR96  30SEP96
                                                                  2146356.00          .00

   230140300    60   60      0             1140: PREPARE INTERNAL DRAFT        RFI RPT       3JUL96  26SEP96
                                                                   648824.00          .00

   230140305    20   20      0             1140: LANL RVW INTERN DRAFT         RFI RPT      27SEP96  25OCT96
                                                                     3352.00          .00

   230110907   164  164      0             1140: MANAGE ADS DURING FY-97              (LOE)  1OCT96  30MAY97
                                                                   180940.00          .00

   230140310    20   20      0             E140: INC LANL COMMENT INT DRFT     RFI RPT      28OCT96  25NOV96
                                                                    89601.00          .00

   230140315    10   10      0             1140: ISSUE DOE DRAFT               RFI RPT      26NOV96  11DEC96
                                                                      966.00          .00

  23014M315      0    0      0             1140: DOE DRAFT OF RFI REPORT COMPLETE                    11DEC96
                                                                         .00          .00

   230140320    22   22      0             1140: DOE REVIEW DOE DRAFT          RFI RPT      12DEC96  16JAN97
                                                                     3352.00          .00

   230140325    20   20      0             1140: INC DOE COMMENTS DOE DRAFT    RFI RPT      17JAN97  13FEB97
                                                                    89601.00          .00

   230140330    10   10      0             1140: ISSUE EPA/NMED DRAFT          RFI RPT      14FEB97  28FEB97
                                                                      966.00          .00

  23014M330      0    0      0             1140: EPA/NMED DRAFT; COMPLETION OF RFI                   28FEB97
                                                                         .00          .00

   230140335    44   44      0             1140: EPA REVIEW                    RFI RPT       3MAR97   1MAY97
                                                                     3352.00          .00

   230140340    44   44      0             1140: NMED REVIEW                   RFI RPT       3MAR97   1MAY97
                                                                     3352.00          .00

   230280807   149  149      0             1140: CONDUCT VCA FOR FY97                 (LOE)  3MAR97  30SEP97
                                                                         .00          .00
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LOS ALAMOS NATIONAL LABORATORY                     FINEST HOUR                                 ADS 1140: TA-46

REPORT DATE 25JAN93  RUN NO.  678          ENVIRONMENTAL RESTORATION                          START DATE  1OCT91  FIN DATE 30SEP98
            23:06
SUMMARY COSTS BY ACTIVITY                                                                      DATA DATE   1OCT92  PAGE NO.    7


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  ACTIVITY    ORIG REM                                  ACTIVITY DESCRIPTION                SCHEDULED
     ID       DUR  DUR      %                                           BUDGET       EARNED    START    FINISH
 ----- -----  ---- ---- - --- ----------  --------------------------------------------- -------- -------- -------- -------- -----

  230140345    15   15      0           1140: INC EPA/NMED COMMENTS         RFI RPT      2MAY97  22MAY97
                                                                     89601.00           .00

  230140350     5    5      0           1140: ISSUE FINAL                   RFI RPT     23MAY97  30MAY97
                                                                       966.00           .00

 23014M350      0    0      0           1140: REVISED RFI REPORT COMPLETE                        30MAY97
                                                                          .00           .00

 23017M150      0    0      0           1140: ASSESSMENT COMPLETE                                30MAY97
                                                                          .00           .00

  230210925   249  249      0           1140: SUPERVISE SOILS REMEDIATION         (LOE)  1OCT97* 30SEP98
                                                                     36115.00           .00

  230280826   150  150      0           1140: CONDUCT VCA FOR LLW SOIL REMEDIATION       2MAR98  30SEP98
                                                                    127000.00           .00

 23028M000      0    0      0           1140: START VCA SOILS REMEDIATION                2MAR98
                                                                          .00           .00

 23028M500      0    0      0           1140: VCA SOILS REMEDIATION COMPLETE                     30SEP98
                                                                          .00           .00

 23028M750      0    0      0           1140: PROJECT COMPLETE                                   30SEP98
                                                                          .00           .00


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  REPORT TOTAL                                                   14003016.00           .00
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Annex II

Quality Assurance Project Plan

Executive Summary

Chapter 1
Introduction

Chapter 2
Background Information

Chapter 3
Environmental Setting

Chapter 4
Technical Approach

Chapter 5
Evaluation of PRS Aggregates

Chapter 6
PRSs Recommended for No Further Action or Deferred Action

Annexes

Appendixes

1.0 APPROVAL FOR IMPLEMENTATION

1. NAME: Robert Vocke
   TITLE: ER Program Manager, Los Alamos National Laboratory

   SIGNATURE: ______________________ DATE: ____________

2. NAME: Ted Norris
   TITLE: Acting 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: Barbara Driscoll
   TITLE: Geologist, Region 6, Environmental Protection Agency

   SIGNATURE: ______________________ DATE: ____________

6. NAME: Alva Smith
   TITLE: Chief of Office of Quality Assurance, Region 6, Environmental Protection Agency

   SIGNATURE: ______________________ DATE: ____________

7. NAME: Roy Michelotti
   TITLE: Operable Unit Project Leader, CLS-DO, Los Alamos National Laboratory

   SIGNATURE: ______________________ DATE: ____________

Distribution of Official Copies

A list of the recipients of the official copies of this plan and any subsequent revisions will be developed and maintained as a document control activity.

INTRODUCTION

This Quality Assurance Project Plan (QAPjP) for the Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) Work Plan for Operable Unit (OU) 1140 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. The generic QAPjP is 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 Approval for Implementation, which is included in the front of this annex. Section 2.0 of the generic QAPjP is the Table of Contents, which was omitted from this annex because the OU 1140 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 1140 QAPjP matrix appears as a table (Table II-1) 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 1140 QAPjP must meet; the subsection titles and numbers in the second column correspond directly with those contained in the generic QAPjP. Subsections of the generic QAPjP that do not contain specific requirements are not included in the matrix, e.g., Subsection 3.4. The third column lists the location of information in the IWP and/or the OU 1140 Work Plan that fulfills the requirements in the generic QAPjP. If OU 1140 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.

Note 1: Section 4.0 Project Organization and Responsibility

The organizational structure of the ER Program is presented in Section 2.0 of the Laboratory ER Quality Program Plan (QPP) to the project leader (PL) level, including quality assurance functions. The OU 1140 Work Plan, Annex I, describes the organizational structure from the PL level down and presents an organizational chart to demonstrate line authority.

Note 2: Subsection 6.1 Quality Control Samples

Soil samples for geotechnical analyses will be collected during the OU 1140 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 do not meet specific method requirements.

Note 3: Subsection 14.3 Sample Representativeness

The field sampling plans presented in the OU 1140 Work Plan, Chapter 5, were developed to meet the sample representativeness criteria described in Subsection 14.3 of the Laboratory ER Program generic QAPjP (Appendix T) (LANL 1991, 0553).

Note 4: Subsection 16.1 Field Quality Assurance Reports to Management

The OU 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) (LANL 1991, 0553).

TABLE II-1

OU 1140 QAPjP MATRIX

GENERIC QAPjP CRITERIA	GENERIC QAPjP[1] REQUIREMENTS BY SUBSECTION	OU 1140 INCORPORATION OF GENERIC QAPjP REQUIREMENTS
Project description	3.2 Facility Description	Los Alamos National Laboratory (LANL) ER Program IWP[2], Section 3.0, and OU 1140 Work Plan, Chapter 2
	3.3 ER Program	LANL ER Program IWP, Section 2.0
	3.4.1 Project Objectives	OU 1140 Work Plan, Chapters 1 and 5
	3.4.2 Project Schedule	OU 1140 Work Plan, Annex I
	3.4.3 Project Scope	OU 1140 Work Plan, Chapters 1 and 5
	3.4.4 Background Information	OU 1140 Work Plan, Chapters 1, 2, and 3
	3.4.5 Data Management	OU 1140 Work Plan, Annex IV, and LANL ER Program IWP, Annex IV
Project organization	4.1 Line Authority	OU 1140 Work Plan, Annex I
	4.2 Personnel Qualifications, Training, Resumes	Maintained as records within OU 1140 record system
	4.3 Organizational Structure	LANL-ER-QPP, Section 2.0, *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 1140 Work Plan, Chapter 5
Sampling procedures	6.0 Sampling Procedures	OU 1140 Work Plan, Appendix D
	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

TABLE II-1 (continued)

OU 1140 QAPjP MATRIX

GENERIC QAPjP CRITERIA	GENERIC QAPjP[1] REQUIREMENTS BY SUBSECTION	OU 1140 INCORPORATION OF GENERIC QAPjP REQUIREMENTS
Analytical procedures[3]	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 1140 Work Plan, Chapter 5
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
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 Corrective 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

1 LANL 1991, 0553
2 LANL 1992, 0768
3 Although the generic QAPjP criteria are accepted, special sampling limits, parameters, and analyses will be established for operable unit-specific cases. See the note at the top of page 9-2, Generic QA Project Plan (LANL 1991, 0553).

REFERENCE

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), November 1992. "Installation Work Plan for Environmental Restoration," Revision 2, Los Alamos National Laboratory Report LA-UR-92-3795, Los Alamos, New Mexico. **(LANL 1992, 0768)**

Annex III

Health and Safety Project Plan

Executive Summary

Chapter 1
Introduction

Chapter 2
Background Information

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Environmental Setting

Chapter 4
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Appendixes

1.0 INTRODUCTION

1.1 Purpose

The purpose of this Operable Unit (OU) Health and Safety Plan (OUHSP) is to recognize potential safety and health hazards, describe techniques for their evaluation, and identify control methods. The goal is to eliminate injuries and illness; to minimize exposure to physical, chemical, biological, and radiological agents during environmental restoration (ER) activities; and to provide contingencies for events that may occur while these efforts are under way.

It is intended that project managers, health and safety professionals, laboratory managers, and regulators use this OUHSP as a reference for information about health and safety programs and procedures as they relate to this OU. Detailed site-specific health and safety plans (SSHSPs) and procedures will be prepared subsequent to this document.

The Health and Safety Division Hazardous Waste Operations (HAZWOP) Program establishes laboratory policies for health and safety activities at ER sites. The hierarchy of health and safety documents for the Los Alamos National Laboratory (the Laboratory) ER Program is as follows:

1. Installation Work Plan, Health and Safety Program Plan (IWPHSPP) (LANL 1992, 0768)
2. OUHSP
3. SSHSP

The first document is more general, while the others become increasingly more specific and detailed. While each document is written so that it can stand alone, the contents and references to these and other documents should always be considered when making decisions.

1.2 Applicability

These requirements apply to all personnel at ER sites, including Laboratory employees, supplemental work force personnel, regulators, and visitors. There are no exceptions.

1.3 Regulatory Requirements

Government-owned, contractor-operated facilities must comply with Occupational Safety and Health Administration (OSHA), US Environmental Protection Agency (EPA) regulations, and US Department of Energy (DOE) orders. The following is a brief synopsis of hazardous waste-related requirements.

The first federal effort to address hazardous waste problems followed the passage of the Resource Conservation and Recovery Act of 1976 (RCRA).

RCRA mandated the development of federal and state programs for the disposal and resource recovery of waste materials. RCRA regulates generation, treatment, storage, disposal, and transportation of hazardous waste.

Historically, many hazardous waste sites were abandoned. Congress enacted the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, commonly known as "Superfund" to clean up and reclaim these sites.

The treatment and disposal of hazardous wastes posed health and safety risks to the workers engaged in these operations. These risks and the need for protecting workers engaged in hazardous waste site operations are addressed in the Superfund Amendments and Reauthorization Act of 1986 (SARA).

Under SARA, the Secretary of Labor is required to promulgate worker protection regulations. After consulting with many organizations, including EPA, OSHA, the US Coast Guard, and the National Institute for Occupational Safety and Health (NIOSH), a set of regulations was published in March 1989. This is 29 Code of Federal Regulations (CFR) Part 1910.120, Hazardous Waste Operations and Emergency Response (HAZWOPER) (OSHA 1991, 0610).

DOE Orders 5480.4 and 5483.1A require DOE employees and contractors to comply with OSHA regulations. DOE 5480.11 sets radiation protection standards for all DOE activities (DOE 1990, 0732). The DOE Radiological Control Manual established practices for the conduct of radiological control activities at all DOE sites and is used by DOE to evaluate contractor performance (DOE 1992, 11-245).

The Laboratory Director's policies "Environment, Safety, and Health" and "Environmental Protection and Restoration," both dated September 1991, require compliance with federal regulations, DOE orders, and state and local laws.

1.4 Variances From Health and Safety Requirements

When special conditions exist, the site safety officer (SSO) may submit to the health and safety project leader (HSPL) a written request for variance from a specific health and safety requirement. If the HSPL agrees with the request, it will be reviewed by the operable unit project leader (OUPL) or a designee. Higher levels of management may be consulted as appropriate. The conditions of the request will be evaluated, and if appropriate, the HSPL will grant a written variance specifying the conditions under which the requirements may be modified. The variance will become part of the SSHSP.

1.5 Review and Approval

This document will be effective after it has been reviewed and approved by the appropriate Laboratory subject matter experts. Signatures of approval are required.

This document will be revised at least annually. Revisions will reflect changes in the scope of work, site conditions, work procedures, site data, contaminant monitoring, or visual information technology, policies, and/or procedures. Changes must be approved by the HSPL and OUPL. A complete review will be conducted should feasibility studies or remediation be necessary.

2.0 ORGANIZATION, RESPONSIBILITY, AND AUTHORITY

This section describes the general and individual responsibilities for health and safety, roles in field organization, and organizational structure. The health and safety oversight mechanism is also provided.

2.1 General Responsibilities

The Laboratory's Environment, Safety, and Health (ES&H) Manual delineates managers' and employees' responsibilities for conducting safe operations and providing for the safety of contract personnel and visitors. The general safety responsibilities for ER activities are summarized in the IWPHSPP (LANL 1992, 0768). Line management is responsible for implementing health and safety requirements.

An individual observing an operation that presents a clear and imminent danger to the environment or to the safety and health of employees, subcontractors, visitors, or the public has the authority to initiate a stop-work action. The requirements, responsibilities, and basis for stop-work actions and for restarting activities is established in Laboratory Procedure (LP) 116-01.0. Any individual observing or performing operations that meet the criteria for stop-work actions shall follow the procedural steps described in LP 116-01.0. Those with stop-work authority include employees, subcontractors, or visitors performing the affected work, ES&H discipline experts, and line managers responsible for the operation. Any individual who observes work being performed by another individual that presents a clear and imminent danger shall follow reporting requirements as specified in LP 116-01.0. Upon initiation of stop-work actions, related activities are documented on the Stop-Work Report Form and the log for Stop-Work Reports.

Personnel conducting work for the ER Program shall comply with the Laboratory's stop-work policy and the requirements of LP 116-01.0. In addition, upon initiation of stop-work actions, ER Program personnel shall notify the SSO, the ER Program HSPL, and the OUPL.

2.1.1 Kick-Off Meeting

A health and safety kick-off meeting will be held before fieldwork begins. The purpose of the meeting is to reach a consensus on responsibility, authority, lines of communication, and scheduling. The HSPL will organize the meeting and has the authority to delay fieldwork until the kick-off meeting is held.

2.1.2 Readiness Review

A field readiness review must be completed by the OUPL before field activities begin. The HSPL is responsible for approving the health and safety section of the readiness review.

2.2 Individual Responsibilities

Laboratory employees and supplemental work force personnel are responsible for health and safety during ER Program activities.

2.2.1 Environmental Management and Health and Safety Division Leaders

The Environmental Management (EM) and Health and Safety (HS) Divisions Leaders are responsible for addressing programmatic health and safety concerns. They shall promote a comprehensive health and safety program that includes radiation protection, occupational medicine, industrial safety, industrial hygiene, criticality safety, waste management, and environmental protection and preservation.

2.2.2 Environmental Restoration Program Manager

The ER Program Manager (EM-13) is responsible for implementing the overall heath and safety program plan. The program manager provides for the establishment, implementation, and support of health and safety measures.

2.2.3 Health and Safety Project Leader

The HSPL is responsible for preparing and updating the IWPHSPP (LANL 1992, 0768). The HSPL helps the OUPL in identifying resources to be used for the preparation and implementation of the OUHSP. Final approval of the IWPHSPP, OUHSP, and SSHSP is the responsibility of the HSPL. In conjunction with the field team leaders, the HSPL oversees daily health and safety activities in the field, including scheduling, tracking deliverables, and resource utilization.

2.2.4 Operable Unit Project Leader

The OUPL is responsible for all investigation activities for his/her assigned OU. Specific health and safety responsibilities include:

- preparing, reviewing, implementing, and revising OUHSPs;
- interfacing with the HSPL to resolve health and safety concerns; and,
- notifying the HSPL of schedule and project changes.

2.2.5 Field Teams Manager

The OU field teams manager is responsible for:

- scheduling tasks and manpower,
- conducting site tours,
- overseeing engineering and construction activity at the sites, and
- overseeing waste management.

2.2.6 Field Team Leader

The field team leader is responsible for implementing the sampling and analysis plan, the OUHSP, and the project-specific Quality Assurance Project Plan (Annex II). He/she may also serve as the SSO. Safety responsibilities include:

- ensuring the health and safety of field team members,
- implementing emergency response procedures and fulfilling notification requirements, and
- notifying the HSPL of schedule changes.

2.2.7 Site Safety Officer

An SSO other than the field team leader may be assigned depending on the potential hazards. Contractors must assign their own SSO.

The SSO is responsible for ensuring that trained and competent personnel are on site. This includes industrial hygiene and health physics technicians and first aid/cardiopulmonary resuscitation responders. The SSO may fill any or all of these roles.

The SSO has the following responsibilities:

- advising the HSPL and OUPL of health and safety issues;
- performing and documenting initial inspections for all site equipment;
- notifying proper Laboratory authorities of injuries or illnesses, emergencies, or stop-work orders;
- evaluating the analytical results for health and safety concerns;
- determining protective clothing (PC) requirements;
- determining personal dosimetry requirements for workers;
- maintaining a current list of telephone numbers for emergency situations;
- providing an operating radio transmitter/receiver if necessary;
- maintaining an up-to-date copy of the SSHSP for work at the site;
- establishing and enforcing the safety requirements to be followed by visitors;
- briefing visitors on health and safety issues;
- maintaining a logbook of workers entering the site;
- determining whether workers can perform their jobs safely under prevailing weather conditions;

- controlling emergency situations in collaboration with Laboratory personnel;
- ensuring that all personnel are trained in the appropriate safety procedures and are familiar with the SSHSP and that all requirements are followed during OU activities;
- conducting daily health and safety briefings for field team members;
- stopping work when unsafe conditions develop or an imminent hazard is perceived; and,
- maintaining first aid supplies.

2.2.8 Field Team Members

Field team members are responsible for following safe work practices, notifying their supervisor or the SSO if unsafe conditions exist, and immediately reporting any injury, illness, or unusual event that could impact the health and safety of site personnel.

2.2.9 Visitors

Site access will be controlled so that only verified team members and previously approved visitors will be allowed in work areas or areas containing potentially hazardous materials or conditions. Special passes or badges may be issued. There are two types of visitors: those who collect samples and those who do not.

Any visitors who are on site to collect samples or split samples must meet all the health and safety requirements of any field sampling team for that site. Visitors must comply with the provisions of the SSHSP and sign an acknowledgment agreement to that effect. In addition, visitors will be expected to comply with relevant OSHA requirements, such as medical monitoring, training, and respiratory protection.

The following rules govern the conduct of site visitors who will not be collecting samples. The site visitor will:

1. Report to the SSO upon arrival at the site.

2. Log in/log out upon entry/exit to the site.

3. Receive abbreviated site training from the SSO on the following topics:

   - site-specific hazards,
   - site protocol,
   - emergency response actions, and
   - muster areas.

4. Not be permitted to enter the exclusion zone.

5. Receive escort from the SSO or other trained individuals at all times.

If a visitor does not adhere to these requirements, the SSO will request the visitor leave the site. All nonconformance incidents will be recorded on the site log.

2.2.10 Supplemental Work Force

All supplemental work force personnel performing site investigations will be responsible for developing health and safety plans that cover their specific project assignments. At a minimum, the plans shall conform to the requirements of this OUHSP. Deficiencies in health and safety plans will be resolved before the contractor is authorized to proceed.

Contractors will adhere to the requirements of all applicable health and safety plans. Laboratory personnel will monitor activities to ensure that this is done. Failure to adhere to these requirements can cause work to stop until compliance is achieved.

Contractors will provide their own health and safety functions unless other contractual agreements have been arranged. Such functions may include, but are not limited to, providing qualified health and safety officers for site work, imparting a corporate health and safety environment to their employees, providing calibrated industrial hygiene and radiological monitoring equipment, enrolling in an approved medical surveillance program, supplying approved respiratory and personal protective equipment (PPE), providing safe work practices, and training hazardous waste workers.

2.3 Personnel Qualifications

The HSPL will establish minimum training and competency requirements for on-site personnel. These requirements will meet or exceed 29 CFR 1910.120 regulations (OSHA 1991, 0610).

2.4 Health and Safety Oversight

Oversight will be maintained to ensure compliance with regulatory requirements. The Health and Safety Division is responsible for developing and implementing the oversight program. The frequency of field verifications will depend on the characteristics of the site, the equipment used, and the scope of work.

3.0 SCOPE OF WORK

3.1 Comprehensive Work Plan

The IWPHSPP for ER targets OU 1140 for investigation. A major component of Phase I is investigation and characterization, involving environmental sampling and field assessment of the areas. This OUHSP addresses these tasks in the Phase I study. Voluntary corrective actions (VCAs) (e.g., septic system and dry well removal) and tasks for additional phases will be addressed in revisions to this document.

3.2 Operable Unit Description

OU 1140 consists of six potential release site (PRS) aggregates. These include solid waste management units and areas of concern. Thorough descriptions and histories of these sites can be found in Chapter 5 of this work plan. The following is a list of the PRS aggregates for OU 1140. Table III-1 summarizes the aggregates, the potential hazards, and the work planned at this time.

1. Septic tanks and dry wells aggregate
2. Lagoon systems aggregate

TABLE III-1

SUMMARY OF PRSs, OU 1140

DESCRIPTION	TASKS	CHEMICALS OF CONCERN	RADIONUCLIDES OF CONCERN
Septic tanks and dry wells aggregate	Engineering surveys, geophysical surveys, field screening surveys for radioactivity and organics, subsurface sampling of septic tanks, distribution boxes, dry wells, VCA removal, and subsurface soil sampling during and after excavation	Volatile organic compounds (trichloroethylene, TCA), semivolatile organic compounds (polychlorinated biphenyls, polynuclear aromatic hydrocarbons), metals (mercury, and others), asbestos	Uranium -234, -235, -238; plutonium -238, -239/240; cesium -137; thorium-230
Lagoon systems aggregate	Field screening surveys for radioactivity and organics, subsurface sludge and soil sampling, surface soil sampling	Volatile organic compounds, semivolatile organic compounds (including polychlorinated biphenyls), metals (mercury and others)	Uranium-235, -238; plutonium-238, -239/240
Surface release aggregate	Field screening for radioactivity and organics, engineering surveys, subsurface core hand-auger sampling, surface sampling, near-surface sampling beneath pavements	Volatile organic compounds, semivolatile organic compounds (including polychlorinated biphenyls), oils; metals (mercury and others), asbestos, pesticides	Uranium-234, -235, -238; cesium-137; americium-241; plutonium - 238, -239/240
Outfalls aggregate	Engineering surveys, field screening for radioactivity and organics, surface sediment sampling, hand-auger and thin-wall tube near-surface sampling	Volatile organic compounds, semivolatile organic compounds (including polychlorinated biphenyls), metals	Radionuclides anticipated, specifics unknown
Landfills aggregate	Engineering surveys, field screening for radioactivity and organics, hand-auger and machine-auger subsurface sampling	Volatile organic compounds, semivolatile organic compounds, metals (barium, beryllium, silver, zinc, cadmium, chromium), pesticides, asbestos	Uranium-235, -238; cesium-137; plutonium -238, -239/240; thorium-230
Stack emissions aggregate	Engineering surveys, field screening for radioactivity and organics, surface soil sampling, surface water sediment sampling	Beryllium, beryllium oxide	Uranium-235, -238; thorium-230

3. Surface release aggregate
4. Outfalls aggregate
5. Landfills aggregate
6. Stack emissions aggregate

4.0 HAZARD IDENTIFICATION AND ASSESSMENT

The SSO or designee will monitor field conditions and personnel exposure to physical, chemical, biological, and radiological hazards. If a previously unidentified hazard is discovered, the SSO will contact the field team leader and the HSPL and assess the hazard. A hazard assessment will be performed to identify the potential harm, the likelihood of occurrence, and the measures to reduce risk. The assessment will be documented, reviewed, and approved by the HSPL and OUPL. Appropriate field team leaders and field team members will receive copies of the assessment, and it will be discussed in a tailgate meeting or other appropriate forum. The approved assessment will be added to this plan as an amendment.

4.1 Physical Hazards

Injuries caused by physical hazards are preventable. Some physical hazards such as open trenches, loud noise, and heavy lifting are easily recognized. Others, such as heat stress and sunburn, are less apparent. The purpose of this section is to list some anticipated physical hazards. These hazards are listed because they often occur during these types of ER activities. Some, such as altitude sickness, are more unique. For these unique physical hazards, a brief discussion is provided. For other, more common hazards, no detailed discussion is provided. Detailed information about these potential hazards can be found in Health and Safety Division HAZWOP Program documentation or almost any industrial hygiene reference book (e.g., *Fundamentals of Industrial Hygiene*, Plog 1988, 0943).

Table III-2 lists some of the anticipated physical hazards representative of the types of hazards inherent to ER work. It is not inclusive. If additional physical hazards are identified, they will be added to this table by the SSO.

TABLE III-2

PHYSICAL HAZARDS OF CONCERN, OU 1140

HAZARD DESCRIPTION	PPE	PREVENTION METHODS	MONITORING METHODS
Noise	Ear plugs and muffs	Engineering controls, mufflers, noise absorbers, PPE	Sound level meter, noise dosimeter
Vibration	Gloves, absorbing materials	Prevention or attenuation, isolation, increasing distance from source	Accelerometers and mechanoelectrical transducers with electronic instrumentation
Energized equipment	Gloves, safety shoes, safety glasses	Lockout/tagout of equipment	Circuit test light/meter, grounding stick
Confined space entry	Gloves, boots, full-body suit, supplied-air or self-contained breathing apparatus, safety glasses, lifeline	Ventilation, oxygen, combustible gas monitoring, following procedure	Combustible gas meter, oxygen monitors
Trenching	Hard hats, safety shoes, safety glasses	Protective shoring, proper excavation access/egress	Visual, oxygen meter, determining soil type
Fire/ explosion	Hard hat, gloves, face shield, fire-resistant full-body suit	Ventilation, containment of fuel source, isolation/insulation from ignition source or heat	Combustible gas meter
Welding/ cutting/ brazing	Fire-resistant gloves and clothing (aprons, coveralls, leggings), welding helmets or goggles	Ventilation, PPE	Personal sampling for metal fumes
Compressed gas cylinders	Face shield, safety shoes, gloves	PPE. Cylinders should be stored in areas protected from weather. Cylinders should be secured and stored with protective caps in place. Regulators are not to be used on cylinders.	Visual, combustible gas meter, photoionization detector
Material handling	Hard hat, safety shoes, gloves	Lifting aids, correct lifting procedure, work/rest periods	Weigh or estimate weight of typical materials and set limits for lifting

Table III-2 (continued)

PHYSICAL HAZARDS OF CONCERN, OU 1140

HAZARD DESCRIPTION	PPE	PREVENTION METHODS	MONITORING METHODS
Walking/ working surfaces	Safety shoes	Clean and dry surfaces, nonskid surfacing material	Visual inspection
Machine guarding	Face shield, gloves, safety shoes	Guard interlocks, maintain guards in good condition	Visual monitoring, observation of work practices
Motor vehicle accidents	Seat belt	Defensive driving training, reduced speed during adverse conditions	Observation of work practices
Heavy equipment	Hard hat, safety shoes, gloves	Operator training. Stay clear of energized sources	Observation of work practices
Heat stress	Hat, cooling vest	ACGIH work/rest regimens	Wet bulb globe thermometer
Cold stress	Hat, gloves, insulated boots, coat, face protection	ACGIH work/warm-up schedule, heated shelters	Thermometer and wind speed measurement, wind chill chart
Sunburn	Hat, safety sunglasses, full-body protection	Cover body with clothing or sunscreen	Solar load chart
Altitude sickness	None	Acclimatization ascent/descent schedule	Self-monitoring for symptoms
Lightning	None	Grounding all equipment, stop work during thunderstorms and seek shelter	Weather reports and visual observation
Flash floods	None	Seek shelter on high ground	Weather reports and visual observation

ACGIH = American Conference of Governmental Industrial Hygienists

NIOSH 1985, 0414; DOL 1989, 0946; Plog 1988, 0943

4.1.1 Altitude Sickness

Individuals coming to the Laboratory from lower elevations may experience altitude sickness. Workers coming from sea level and who are expected to perform heavy physical labor may be at highest risk. Recognition of individual risk factors and allowance for acclimatization are the keys to prevention.

At higher altitude, atmospheric pressure is reduced. There is a smaller number of oxygen molecules per unit volume and the partial pressure of oxygen is lower. A unit of work, whether performed at altitude or sea level, requires the same amount of oxygen. Oxygen flow to body tissues must remain constant to maintain that level of work. Increased respiration and cardiovascular response can only partially compensate for these factors in individuals suddenly placed at high altitude.

The factors playing a part in determining working capacity at altitude are:

- actual height (low, moderate, high altitude),
- duration of exposure, and,
- individual factors.

The Laboratory's moderate altitude (approximately 7 500 ft) will probably have an effect on prolonged endurance for unacclimatized individuals. At this level, acclimatization should be rapid (one or two weeks). Duration of exposure will dictate whether persons have an opportunity to acclimate or not. Individuals working on short-term assignments of less than two weeks will probably not acclimate.

It is not anticipated that work will require ascents of more than 200 to 300 ft at any time. Thus, too rapid ascension to high altitudes should not be a problem. It is assumed that all workers will be enrolled in a medical surveillance program. This will help identify individuals who may have existing conditions, such as respiratory or cardiovascular disease, that would put them at higher risk of altitude sickness. Each individual will adapt at a slightly different rate, but in about two weeks the impact of altitude on work capacity should be minimal.

4.2 Chemical Hazards

This section identifies and provides information on chemical contaminants that are known or are suspected to be present at this OU. When unknowns are identified, they will be added to the plan's list of chemical contaminants of concern. The SSO will be responsible for adding chemicals to this table and notifying field personnel as needed.

The SSHSP will provide information for known contaminants, which will include: American Conference of Governmental Industrial Hygienists (ACGIH) threshold limit value (TLV), immediately dangerous to life and health (IDLH) concentrations, exposure symptoms, ionization potential and relative response factor for commonly used instruments (re-evaluated when the particular instrument is selected), and the best instrument for screening (ACGIH 1992, 0858; NIOSH 1990, 0709).

Table III-3 lists the chemical contaminants of concern. This table should be used for general recognition of the chemicals to which workers may be exposed. More detailed information should be obtained from reliable references, such as *Patty's Industrial Hygiene and Toxicology* (Clayton and Clayton 1981, 0939).

4.3 Radiological Hazards

The principal pathways by which individuals may be exposed to radioactivity during field investigations include:

- inhalation or ingestion of radionuclide particles or vapors,
- dermal absorption of radionuclide particulates or vapors through wounds,
- dermal absorption through intact skin, and
- exposure to direct gamma radiation from contaminated materials.

Table III-4 provides the specific properties of the radionuclides of concern in this OU, including type of emission and half-life. As concentrations of these radionuclides are determined and additional radionuclides identified,

TABLE III-3

CHEMICAL CONTAMINANTS OF CONCERN, OU 1140[a]

CONTAMINANT	EXPOSURE LIMIT (8-HOUR TWA)	IDLH	SYMPTOMS OF EXPOSURE	ROUTE(S) OF EXPOSURE	MONITORING INSTRUMENT	
					DIRECT READING	INDIRECT METHOD
Acetone	750 ppm	20 000 ppm	Irritation of eyes, nose, and throat; dermatitis; dizziness	Inhalation, ingestion, skin contact	PID, FID, detector tube	Charcoal tube, GC, NIOSH Method 1300
Asbestos	0.2 fibers/cm^3	Ca	Dyspnea, fibrosis, restricted pulmonary function	Inhalation, ingestion	FAM	MCEF, Microscopy, NIOSH Method 7400
Barium	0.5 mg/m^3	1 100 mg/m^3	Upper respiratory irritation, gastroenteritis, muscular paralysis, eye and skin irritation	Inhalation, ingestion, skin contact	None	MCEF, AA, OSHA Method
Beryllium	0.002 mg/m^3 0.005 mg/m^3 - ceiling 0.025 mg/m^3 - 30 min maximum peak	Ca	Dermatitis, pneumonitis dyspnea, chronic cough, weight loss, weakness, chest pain	Inhalation, ingestion, skin contact	None	MCEF, AA, NIOSH Method 7102
Cadmium	0.05 mg/m^3	Ca	Pulmonary edema, dyspnea, cough, tight chest, chills, nausea, vomiting, muscle aches, diarrhea, emphysema, proteinuria, mild anemia	Inhalation, ingestion	None	MCEF, AA, NIOSH Method 7048
Chromic acid and chromates (as CrO_3)	0.1 mg/m^3 - ceiling	Ca	Respiratory system irritation, nasal septum perforation; liver, kidney damage; leukocytosis, leukopenia, monocytosis, eosinophilia; eye injury, conjunctivitis; skin ulcer, sensitization	Inhalation, ingestion, skin contact	Detector tube (chromic acid)	MCEF, AA, NIOSH Method 7024 or PVC, Visible Absorption Spectrophotometry, NIOSH Method 7600
Copper	1.0 mg/m^3 (dust and mist)	None	Irritation of nasal mucous membrane, pharynx, nasal perforation dermatitis	Inhalation, ingestion, skin contact	None	MCEF, AA, NIOSH Method 7029
Ethylene glycol	50 ppm - ceiling	None	Inhalation - central nervous system depression and hematopoietic dysfunction; ingestion -depression, respiratory and cardiac failure, renal and brain damage	Inhalation (if heated), ingestion	None	GFF + Silica gel tube, GC, NIOSH Method 5500

Table III-3 (continued)

CHEMICAL CONTAMINANTS OF CONCERN, OU 1140[a]

CONTAMINANT	EXPOSURE LIMIT (8-HOUR TWA)	IDLH	SYMPTOMS OF EXPOSURE	ROUTE(S) OF EXPOSURE	MONITORING INSTRUMENT	
					DIRECT READING	INDIRECT METHOD
Lead	0.05 mg/m^3	700 mg/m^3	Weakness, insomnia, constipation, malnutrition, abdominal pain, tremor, anorexia, anemia, face pallor, encephalopathy	Inhalation, ingestion, skin contact	None	MCEF, AA, NIOSH Method 7082
Mercury	0.05 mg/m^3 (skin)	None	Cough, chest pains, tremor, insomnia, weakness, excessive salivation, dizziness, nausea, vomiting, constipation, irritated eyes and skin	Inhalation, ingestion, skin contact	Mercury vapor meter, detector tube	GFF + silvered Chromosorb P tube, AA, NIOSH Method 6000
Methyl ethyl ketone	200 ppm, 300 ppm -STEL	3 000 ppm	Eye, nose, throat irritation; headache, dizziness; vomiting	Inhalation, ingestion, skin contact	PID, FID, detector tube	Ambersorb tube, GC, NIOSH Method 2500
Methylene chloride	50 ppm	Ca	Eye, nose, throat irritation, headache, stupor, fatigue, weakness, sleepiness, lightheadness, numb limbs; tingling, nausea	Inhalation, ingestion, skin contact	Detector tube	Charcoal tube, GC, NIOSH Method 1005
Polychlorinated biphenyls (Aroclor 1242 or 1254)	1 mg/m^3 (skin) (Aroclor 1242), 0.5 mg/m^3 (skin) (Aroclor 1254)	Ca	Irritated eyes, skin; chloracne	Inhalation, absorption, ingestion, skin contact	None	GFF + Florisil tube, GC, NIOSH Method 5503
Silver	0.01 mg/m^3	None	Nasal septum, throat, and skin irritation; skin ulceration, gastrointestinal irritation, blue-gray eyes and patches on skin	Inhalation, ingestion, skin contact	None	MCEF, ICP, NIOSH Method 7300
Toluene	100 ppm, 150 ppm -STEL	2 000 ppm	Fatigue, weakness, confusion, euphoria, dizziness, headache, dilated pupils, lacrimation, nervousness, muscle fatigue, insomnia, paresthesia, dermatitis	Inhalation, ingestion, skin contact	PID, FID, detector tube	Charcoal tube, GC, NIOSH Method 1501

[a] Pesticides of concern will be added to this table as they are identitifed.

AA = atomic absorption
Ca = potential human carcinogen
FAM = fibrous aerosol monitor
FID = flame ionization detector
GC = gas chromatograph
GFF = glass fiber filter
GLC = gas liquid chromatography
ICP = inductively coupled plasma
IDLH = immediately dangerous to life and health
MCEF = mixed, cellulose ester filter
NIOSH = National Institute for Occupational Safety and Health
PID = photoionization detector
PVC = polyvinyl chloride
STEL = short-term exposure limit
TWA = time-weighted average
ppm = parts per million
mg/m^3 = milligrams per cubic meter of air

ACGIH 1992, 0858; Clayton and Clayton 1981, 0939; NIOSH 1985, 0414; OSHA 1991, 0610

TABLE III-4

RADIONUCLIDES OF CONCERN, OU 1140

RADIONUCLIDE	MAJOR RADIATION	DAC (μCI/ML)	RADIOACTIVE HALF-LIFE (years)	MONITORING INSTRUMENT
Cesium-137	Gamma	5×10^{-5}	30	Geiger-Mueller survey meter
Plutonium-238	Alpha, gamma	3×10^{-12}	87.7	Alpha scintillometer, FIDLER
Plutonium-239	Alpha, gamma	2×10^{-12}	2.4×10^{4}	Alpha scintillometer, FIDLER
Plutonium-240	Alpha, gamma	2×10^{-12}	6537	Alpha scintillometer, FIDLER
Uranium-233	Alpha, gamma	4×10^{-12}	1.6×10^{5}	Alpha scintillometer, FIDLER
Uranium-234	Alpha, gamma	4×10^{-12}	2.5×10^{5}	Alpha scintillometer, FIDLER
Uranium-235	Alpha, gamma	2×10^{-11}	7×10^{8}	Alpha scintillometer, FIDLER
Uranium-238	Alpha, gamma	2×10^{-11}	4.5×10^{9}	Alpha scintillometer, FIDLER

DAC = derived air concentration (DOE Order 5480.11) (DOE 1990, 0732)
FIDLER = field instrument for the detection of low-energy radiation

the table will be updated. The SSO will be responsible for adding radionuclides to this table and notifying field personnel as needed.

4.4 Biological Hazards

There are several biological hazards found at Los Alamos that are not common in other parts of the country. These include, but are not limited to: rattlesnakes, wild animals, ticks, plague, giardia lamblia, and black widow spiders. Table III-5 summarizes some of the potential biological hazards for this OU.

4.5 Task-by-Task Risk Analysis

A task-by-task risk analysis is required by 29 CFR 1910.120 and will be included with each SSHSP (OSHA 1991, 0610). This process analyzes the operations and activities for specific hazards by task. Examples of some of the tasks that should be analyzed and documented in the SSHSP are:

- drilling,
- hand augering,
- trenching,

TABLE III-5

BIOLOGICAL HAZARDS OF CONCERN, OU 1140

HAZARD DESCRIPTION	PPE	PREVENTION METHODS
Snake bites (rattlesnake)	Long pants, snake leggings, boots	Wear PPE where footing is difficult to see. Avoid blind reaches
Animal bites (dog, cat, coyote, mountain lion, bear)	Long pants, boots	Avoid wild or domestic animals; do not approach or attempt to feed
Ticks (may cause Lyme disease or tick fever)	Long pants, long-sleeved shirts, boots	Perform tick inspections of team members after working in brushy or wooded areas
Rodents (prairie dogs and squirrels may carry plague-infected fleas)	Long pants, boots	Do not handle live or dead rodents
Human sewage (may contain pathogenic bacteria)	Disposable coveralls and gloves	When sampling in septic systems, wear protective gear and dispose of properly. Wash hands thoroughly after contact
Bloodborne pathogens (blood, blood products, and human body fluids may contain Hepatitis B virus or HIV)	Latex gloves, mouthguards, protective eyewear	Only trained personnel should perform first aid procedures. Follow laboratory bloodborne pathogen control procedures
Poisonous plants (poison ivy)	Gloves, long pants, long-sleeved shirts, boots	Recognize plants, avoid contact, wash hands and garments thoroughly after contact
Waterborne infectious agents (stream water may contain giardia lamblia)	None	Drink water only from potable sources
Spiders (brown recluse, black widow)	Gloves, long pants, long-sleeved shirt, boots	Use caution when in wood piles or dark, enclosed places

- septic system sampling, and
- canyon-side sampling.

Other tasks should be considered for inclusion by the SSO.

5.0 SITE CONTROL

5.1 Initial Site Reconnaissance

Initial site reconnaissance may involve surveyors, archaeologists, biological resource personnel, etc. Health and safety concerns that may be present must be addressed to protect personnel. The OUPL and HSPL will identify these concerns and institute measures to protect environmental impact assessment personnel.

5.2 Site-Specific Health and Safety Plans

Each field event within an OU requires an SSHSP. Planning, special training, supervision, protective measures, and oversight needs are different for each event, and the SSHSP addresses this variability.

The OUHSP provides detailed information to project managers, Laboratory managers, regulators, and health and safety professionals about health and safety programs and procedures as they relate to an OU. The SSHSP addresses the safety and health hazards of each phase of site operations and includes requirements and procedures for employee protection. All SSHSPs in that OU derive from the OUHSP.

The standard outline for an SSHSP follows OSHA requirements and serves as a guide for best-management practice. Those performing the fieldwork are responsible for completing the plan.

Changes to the SSHSP must be made in writing. The HSPL shall approve changes, and site personnel shall be updated through daily tailgate meetings. Records of SSHSP approvals and changes will be maintained by the SSO.

5.3 Work Zones

Maps identifying work zones will be included with each SSHSP. Markings used to designate each zone boundary (red or yellow tape, fences, barricades, etc.) will be discussed in the plan. Evacuation routes should be upwind or crosswind of the exclusion zone. A muster area must be designated for each evacuation route. Discrete zones are not required for every field event. The SSO will determine work zones. The following sections discuss the work zones.

- **Exclusion zone**. The exclusion zone is the area where contamination is either known or likely to be present or, because of work activities, will present a potential hazard to personnel. Entry into the exclusion zone requires the use of PPE.

- **Decontamination zone.** The decontamination zone is the area where personnel conduct personal and equipment decontamination. This zone provides a buffer between contaminated areas and clean areas. Activities in the decontamination zone require the use of PPE as defined in the decontamination plan.

- **Support zone.** The support zone is a clean area where the chance to contact hazardous materials or conditions is minimal. PPE other than safety equipment appropriate to the tasks performed (e.g., safety glasses, protective footwear, etc.) is not required.

5.4 Secured Areas

Secured areas shall be identified and shown on the site maps. Procedures and responsibilities for maintaining secured areas must be described. Standard Laboratory security procedures should be followed for accessing secure areas.

All contractors and visitors must be processed through the badge office before entering secure areas. It is the responsibility of the OUPL to see that contractor personnel have badges. It is the responsibility of all Laboratory employees to enforce security measures.

5.5 Communications Systems

Portable telephones, CB radios, and two-way radios may be used for on-site communications. This type of equipment must not be used in areas where there may be high explosives; hand signals and verbal communications should be used in these areas.

5.6 General Safe Work Practices

Workers will be instructed on safe work practices to be followed when performing tasks and operating equipment needed to complete the project. Daily safety tailgate meetings will be conducted at the beginning of the shift to brief workers on proposed activities and special precautions to be taken.

The following items are requirements necessary to protect fieldworkers and will be iterated in SSHSPs. Depending on site-specific conditions, items may be added or deleted.

- The buddy system will be used. Hand signals will be established and used.
- During site operations, each worker should be a safety back-up to his/her partner. All personnel should be aware of dangerous situations that may develop.
- Visual contact must be maintained between buddies on site.
- Eating, drinking, chewing gum or tobacco, smoking, or any practice that increases the probability of hand-to-mouth transfer and ingestion of potentially-contaminated material is prohibited in any area designated as contaminated.
- Prescription drugs should not be taken by personnel where the potential for contact with toxic substances exist, unless specifically approved by a qualified physical.
- Alcoholic beverage intake is prohibited during the work day.
- Disposable clothing will be used whenever possible to minimize the risk of cross-contamination.
- The number of personnel and equipment in any contaminated area should be minimized, but effective site operations must be allowed for.
- Staging areas for various operational activities (equipment testing, decontamination, etc.) will be established.
- Motorized equipment will be inspected to ensure that brakes, hoists, cables, and other mechanical components are operating properly.

- Procedures for leaving any contaminated area will be planned and reviewed before entering these areas.

- Work areas and decontamination procedures will be established based on prevailing site conditions and will be subject to change.

- Wind direction indicators will be strategically located on site.

- Contact with contaminated or potentially-contaminated surfaces should be avoided. Whenever possible, do not walk through puddles, mud, or discolored ground surface; do not kneel on the ground or lean, sit, or place equipment on drums, containers, vehicles, or on the ground.

- No personnel will be allowed to enter the site without proper safety equipment.

- Proper decontamination procedures will be followed before leaving the site, except in medical emergencies.

- Any medical emergency supersedes routine safety requirements.

- Housekeeping will be emphasized to prevent injury from tripping, falling objects, and accumulation of combustible materials.

- All personnel must comply with established safety procedures. Any staff member or visitor who does not comply with safety policy, as established by the field safety coordinator, will be immediately dismissed from the site.

5.7 Specific Safe Work Practices

5.7.1 Electrical Safety-Related Work Practices

The most effective way to avoid accidental contact with electricity is to de-energize the system or maintain a safe distance from the energized parts/

line. OSHA regulations require minimum distances from energized parts. An individual working near power lines must maintain at least a 10 ft clearance from overhead lines of 50 kilovolts (kV) or less. The clearance includes any conductive material the individual may be using. For voltages over 50 kV, the 10 ft clearance must be increased 4 in. for every 10 kV over 50 kV.

5.7.2 Grounding

Grounding is a secondary form of protection that ensures a path of low resistance to ground if there is an electrical equipment failure. A properly installed ground wire becomes the path for electrical current if the equipment malfunctions. Without proper grounding, an individual could become the path to ground if he/she touches the equipment. An assured electrical grounding program or ground fault circuit interrupters are required.

5.7.3 Lockout/Tagout

All site workers follow a standard operating procedure for control of hazardous energy sources [Laboratory Administrative Requirement (AR) 8-6, LP 106-01.1]. Lockout/tagout procedures are used to control hazardous energy sources, such as electricity, potential energy, thermal energy, chemical corrosivity, chemical toxicity, or hydraulic and pneumatic pressure.

5.7.4 Confined Space

Entry and work to be conducted in confined spaces shall adhere to procedures proposed in the Laboratory Confined Space Entry Program. These procedures require that a Confined Space Entry Permit be obtained and posted at the work site. Prior to entry, the atmosphere shall be tested for oxygen content, flammable vapors, carbon monoxide, and other hazardous gases. Continuous monitoring for these constituents shall be performed if conditions or activities have the potential to adversely affect the atmosphere.

5.7.5 Handling Drums and Containers

Drums and containers used during cleanup shall meet US Department of Transportation, OSHA, and EPA regulations. Work practices, labeling requirements, spill containment measures, and precautions for opening drums and containers shall be in accordance with 29 CFR 1910.120 (OSHA 1991, 0610). Drums and containers that contain radioactive material must also be labeled in accordance with AR 3-5, Shipment of Radioactive Materials; AR 3-7, Radiation Exposure Control; and Article 412, Radioactive Material Laboratory, DOE Radiological Control Manual. Provisions for these activities shall be clearly outlined in the SSHSP, if applicable.

5.7.6 Illumination

Illumination shall meet the requirements of Table H-120.1, 29 CFR 1910.120 (OSHA 1991, 0610). Table III-6 lists OSHA-required illumination levels.

TABLE III-6

OSHA-REQUIRED ILLUMINATION LEVELS

FOOT-CANDLES	AREA OF OPERATIONS
5	General site areas
3	Excavation and waste areas, access ways, active storage areas, loading platforms, refueling, and field maintenance areas
5	Indoors: warehouses, corridors, hallways, and exitways
5	Tunnels, shafts, and general underground work areas. (Exception: a minimum of 10 foot-candles is required at tunnel and shaft heading during drilling, mucking, and scaling. Bureau of Mines-approved cap lights shall be acceptable for use in the tunnel heading.)
10	General shops (e.g., mechanical and electrical equipment rooms, active storerooms, barracks or living quarters, locker or dressing rooms, dining areas, and indoor toilets and workrooms)
30	First aid stations, infirmaries, and offices

5.7.7 Sanitation

An adequate supply of potable water shall be provided at the site. Nonpotable water sources shall be clearly marked as not suitable for drinking or washing. There shall be no cross-connections between potable and nonpotable water systems.

At remote sites, at least one toilet facility shall be provided, unless the crew is mobile and has transportation readily available to nearby toilet facilities.

Adequate washing facilities shall be provided when personnel are potentially exposed to hazardous substances. Washing facilities shall be in areas where exposures to hazardous materials are below permissible exposure limits (PELs) and where employees may decontaminate themselves before entering clean areas. When showers and change rooms are required, they shall be provided and meet the requirements of 29 CFR 1910.141 (OSHA 1991, 0610). In this instance, employees shall be required to shower when leaving the decontamination zone.

5.7.8 Packaging and Transport

The OUPL should contact the Waste Management Group (EM-7) to determine requirements for storing and transporting hazardous waste to ensure that practices for storage, packaging, and transportation comply with ARs 10-2 and 10-3. Disposal of hazardous wastes generated from a project will be handled by EM-7.

5.7.9 Government Vehicle Use

Only government vehicles can be driven onto contaminated sites. No personal vehicles are allowed. All personnel must wear a seat belt when in a moving vehicle, whether it is government or privately owned.

5.7.10 Extended Work Schedules

Scheduled work outside normal work hours must have the prior approval of the OUPL and SSO.

5.8 Permits

5.8.1 Excavation Permits

Any excavation at OU sites must be conducted in accordance with Laboratory AR 1-12, Excavation or Fill Permit Review. Field team leaders will be responsible for determining when excavation permits are required. The OUPL and field team leader are responsible for requesting the Excavation Permit (Form 70-10-00.1) from the support services contractor. At the top of the form, indicate that this is an ER Program activity. The permit is reviewed by Health and Safety and EM Divisions for environmental safety and health concerns.

5.8.2 Other Permits

The following permits may be required for field activities. The SSO and OUPL are responsible for obtaining permits and maintaining documentation. Permits are specifically addressed in the SSHSP.

- Radiation Work Permits
- Special Work Permit for Spark/Flame-Producing Operations
- Confined Space Entry
- Lockout/Tagout

6.0 PERSONAL PROTECTIVE EQUIPMENT

6.1 General Requirements

PPE shall be selected, provided, and used in accordance with the requirements of this section.

If engineering controls and work practices do not provide adequate protection against hazards, PPE may be required. Use of PPE is required by OSHA regulations in 29 CFR Part 1910 Subpart I (Table III-7) (OSHA 1991, 0610). These regulations are reinforced by EPA regulation 40 CFR Part 300, which requires private contractors working on Superfund sites to conform to applicable OSHA provisions and any other federal or state safety requirements deemed necessary by the lead agency overseeing the activities (EPA 1990, 0559).

In addition, the use of PPE for radiological protection shall be governed by the Radiation Work Permit (or Safety Work Permits/Radiation Work). AR 3-7 and Article 325, Article 461, Table 3.1, and Appendix 3C of the DOE Radiological Control Manual contain guidelines for the use of protective clothing during radiological operations (DOE 1992, 11-245). Efforts should be made to keep disposable PPE used exclusively for radiological work from becoming contaminated with hazardous chemicals, which would generate mixed waste unnecessarily. Where both types of contaminants are present, this may not be possible.

TABLE III-7

OSHA STANDARDS FOR PPE USE

TYPE OF PROTECTION	REGULATION
General	29 CFR 1910.132 29 CFR 1910.1000 29 CFR 1910.1001-1045
Eye and face	29 CFR 1910.133(a)
Hearing	29 CFR 1910.95
Respiratory	29 CFR 1910.134
Head	29 CFR 1910.135
Foot	29 CFR 1910.136
Electrical protective devices	29 CFR 1910.137

6.1.1 PPE Program Elements

PPE programs protect workers from health and safety hazards and prevent injuries as a result of incorrect use and/or malfunction of PPE. Hazard identification, medical monitoring, training, environmental surveillance, selection criteria, use, maintenance, and decontamination of PPE are the essential program elements.

6.1.2 Medical Certification

Medical approval may be required before donning certain PPE. See Section 9.0 for more details.

6.2 Levels of PPE

The individual components of clothing and equipment must be assembled into a full protective ensemble that protects the worker from site-specific hazards and minimizes the hazards and disadvantages of the PPE. Attachment 1 lists ensemble components based on the widely used EPA Levels of Protection: Levels A, B, C, and D. These lists can be used as a starting point for ensemble creation; however, each ensemble must be tailored to the specific situation in order to provide the most appropriate level of protection.

The type of equipment used and the overall level of protection should be re-evaluated periodically as information about the site increases and as workers are required to perform different tasks. Personnel should be able to upgrade or downgrade their level of chemical protection with the concurrence of the SSO. The level of radiological PPE may only be changed as specified in the Radiation Work Permits (or Safety Work Permits/ Radiation Work). The following are reasons to upgrade:

- known or suspected presence of dermal hazards,
- occurrence or likely occurrence of gas or vapor emission,
- change in work task that will increase contact or potential contact with hazardous materials, or
- request of the individual performing the task.

The following are reasons to downgrade:

- new information indicating that the situation is less hazardous than was originally thought,
- change in site conditions that decreases the hazard, or
- change in work task that will reduce contact with hazardous materials.

6.3 Selection, Use, and Limitations

Selection of PPE for a particular activity will be based on an evaluation of the hazards anticipated or previously detected at a work site. The equipment selected will provide protection from chemical and/or radiological materials contamination that is known or suspected to be present and that exhibits any potential for worker exposure.

6.3.1 Chemical Protective Clothing

The selection of chemical PC shall be based on an evaluation of the performance characteristics of the clothing relative to the requirements and limitations of the site, the task-specific conditions and duration, and the potential hazards identified at the site.

6.3.2 Radiological Protective Clothing

Radiological PC as prescribed by the Radiological Work Permit should be selected based on the contamination level in the work area, the anticipated work activity, worker health considerations, and regard for nonradiological hazards that may be present. A full set of radiological PC includes coveralls, cotton glove liners, gloves, shoe covers, rubber overshoes, and a hood. A double set of PC includes two pairs of coveralls, cotton glove liners, two pairs of gloves, two pairs of shoe covers, rubber overshoes, and a hood. The following practices apply to radiological PC.

1. Cotton glove liners may be worn inside standard gloves for comfort but should not be worn alone or considered a layer of protection.
2. Shoe covers and gloves should be sufficiently durable for the intended use. Leather or canvas work gloves should be worn in lieu of, or in addition to, standard gloves for work activities requiring additional strength or abrasion resistance.
3. Use of hard hats in contamination areas should be controlled by the Radiological Work Permit. Hard hats designated for use in such areas should be distinctly colored or marked.

Table III-8 provides general guidelines for selection.

TABLE III-8

GUIDELINES FOR SELECTING RADIOLOGICAL PROTECTIVE CLOTHING

WORK ACTIVITY	REMOVABLE CONTAMINATION LEVELS		
	LOW (1 TO 10 TIMES TABLE 11-2 VALUES)	MODERATE (10 TO 100 TIMES TABLE 11-2 VALUES)	HIGH (>100 TIMES TABLE 11-2 VALUES)
Routine	Full set of PC	Full set of PC	Full set of PC, double gloves, double shoe covers
Heavy work	Full set of PC, work gloves	Double set of PC, work gloves	Double set of PC, work gloves
Work with pressurized or large volume liquids, closed system breach	Full set of non-permeable PC	Double set of PC (outer set non-permeable), rubber boots	Double set of PC, nonpermeable outer clothing, rubber boots

6.3.3 Protective Equipment

Protective equipment, including protective eyewear and shoes, head gear, hearing protection, splash protection, life lines, and safety harnesses, must meet American National Standards Institute standards.

6.4 Respiratory Protection Program

When engineering controls cannot maintain airborne contaminants at acceptable levels, appropriate respiratory protective measures shall be instituted. The Health and Safety Division administers the respiratory protection program, which defines respiratory protection requirements; verifies that personnel have met the criteria for training, medical surveillance, and fit testing; and maintains the appropriate records.

All supplemental workers shall submit documentation of participation in an acceptable respiratory protection program to the Industrial Hygiene Group (HS-5) for review and signature approval before using respirators on site.

7.0 HAZARD CONTROLS

7.1 Engineering Controls

OSHA regulations state that, when possible, engineering controls should be used as the first line of defense for protecting workers from hazards. Engineering controls are mechanical means for reducing hazards to workers, such as guarding moving parts on machinery and tools or using ventilation during confined space entry.

7.1.1 Engineering Controls for Airborne Dust

Airborne dust can be a hazard when it is a nuisance or when radionuclides and/or hazardous substances attach to soil particles.

During drilling or any other activity where localized dust is being generated, a sprayer containing water or water amended with surfactants may be used to wet the soil and suppress the dust. Spraying must be repeated often to maintain moist soil.

A windscreen may be effective in reducing dust from relatively small earth-moving operations. In extreme cases, a temporary enclosure can be constructed to control dust. This method is the more expensive and may increase the level of PPE required for workers in the enclosure.

Where there are high winds in an area of little or no vegetation or a large, dusty area, small quantities of water are not effective. In these instances, a water truck may be used to wet the area to suppress the dust. This may require frequent spraying to be effective. Other materials may also be considered for dust suppression. The amount of water applied needs to be carefully controlled so that enough is used to be effective without spreading contamination by runoff or as mud tracked off site on vehicle tires. Positive air pressure cabs are an effective method for controlling equipment operator dust exposure.

7.1.2 Engineering Controls for Airborne Volatiles

Drilling, trenching, and soil and tank sampling activities may produce gases, fumes, or mists that may be inhaled or ingested by workers without protection. Engineering controls may be implemented to reduce exposure to these hazards. Natural ventilation (wind) can be an effective control measure; workers should be located upwind of the activity whenever possible.

Mechanical ventilation is desirable in closed or confined spaces. The fan or blower may be attached to a large hose to push or pull the contaminant from the confined space. Pulling the air from the space is more effective at removing the vapors, whereas forcing air into the confined area ensures acceptable oxygen levels from ambient air.

7.1.3 Engineering Controls for Noise

Drilling and trenching are likely to produce high noise levels. On most rigs, the highest noise levels are encountered on the side of the rig because the front and rear of the rig's engine is covered, whereas the sides are left open to cool the engine. Additional barriers may be constructed to reduce high noise levels on the sides of the rig. Insulated cabs usually reduce noise to an acceptable level for equipment operators (Berger et al. 1988, 0940).

7.1.4 Engineering Controls for Trenching

Entry into an excavation deeper than 5 ft should be avoided if possible. However, it is sometimes necessary to enter trenches to obtain needed information. OSHA regulations for trenches and excavations require engineering controls to prevent cave-ins. These controls include the use of shoring, sloping, and benching.

Benching is a series of steps dug around the excavation at a specified angle of repose determined by the soil type. Benching will normally be found in large excavations. Sloping is a similar system of stabilizing soil but is performed without the steps. Again, the angle of repose is determined by the soil type. This method is generally used for medium-sized excavations, such as tank removal. Shoring is available in many different varieties, but the principle theory is the same. The sides of the excavation are supported by some type of wall that is braced to prevent cave-ins. This method is used most often in deep, narrow trenches for installing water pipe or drainage systems and exploratory trenching. Engineering controls for excavations should be approved by a competent person before entering the excavation.

7.1.5 Engineering Controls for Drilling

Working with and around drilling rigs presents workers with a number of hazards from moving parts and hazardous energy associated with the equipment. Engineering controls include guards to prevent crushing injuries and a maintenance program to ensure replacement of worn or broken parts. Inspections should be performed at the beginning of the job and periodically during the project.

7.2 Administrative Controls

Administrative controls are necessary when hazards are present and engineering controls are not feasible. Administrative controls are a method for controlling the degree of exposure (e.g., how long or how close to the hazard the worker remains). Worker rotation shall not be used to achieve compliance with PELs or dose limits.

7.2.1 Administrative Controls for Airborne Chemical and Radiological Hazards

Personnel should only enter the exclusion zone when required. Chemical and radiological hazards are to be monitored during performance of duties in the exclusion zone. If the concentration of radionuclides or toxic materials exceeds acceptable limits, personnel should be removed from the area until natural or mechanical ventilation reduces concentrations to an acceptable level.

7.2.2 Administrative Controls for Noise

Another approach to noise exposure control, besides engineering measures, is the use of administrative controls. This is often thought of as the rotation of workers between noisy jobs and less noisy jobs. This is not a good health practice because, while it may reduce the amount of hearing loss individuals incur, it spreads the risk among other workers. The final result tends to be that many workers develop small hearing losses rather than a few workers developing greater loss. One control that can partially mitigate the problem is to provide workers with rest and lunch areas that are quiet enough to allow some recovery from temporary threshold shifts. The levels in these areas should not exceed 70 decibels. Workers should also be located as far from loud noise sources as practicable. This allows for noise attenuation before it reaches the individual. Finally, duration of exposure should be limited to the minimum time. Under no circumstances should workers be exposed to noise levels in excess of the time limits specified in 29 CFR 1910.95, Occupational Noise Exposure, Table G-16 (OSHA 1990, 0610).

7.2.3 Administrative Controls for Trenching

Trenches less than 5 ft deep do not require protective systems (sloping, benching, or shoring). All trenches should be excavated to a depth of less than 5 ft if possible. However, monitoring inside the trench and means of egress (every 25 ft) must be implemented when the trench reaches a depth of 4 ft. Soil piles, tools, and other debris must be stored at least 2 ft from the edge of the excavation. Inspections should be made by a competent person before any field team member is allowed to enter the excavation. When the area is not occupied, all excavations must be marked to restrict access.

7.2.4 Administrative Controls for Working Near the Mesa Edge

Slip, trip, and fall hazards exist around the mesa edge. These hazards may be avoided by good housekeeping in the work area near the edge of the mesa. Additionally, personnel shall remain 5 ft from the edge. If necessary, ropes or guards will be used to delineate this restricted area. Exceptions to this requirement are for canyon-side sampling and outfall sampling. In those instances, the worker taking the sample must be tied to a life line before descending over the edge. When working with a life line, an attendant must always be present (Parmeggiani 1983, 0945).

8.0 SITE MONITORING

This section describes the requirements for chemical, physical, and radiological agent monitoring. This does not include biological monitoring, which is covered in Sections 9.0 and 10.0. This information will be used to delineate work zone boundaries, identify appropriate engineering controls, select the appropriate level of PPE, ensure the effectiveness of decontamination procedures, and protect public health and safety.

A monitoring program or plan that meets the requirements of 29 CFR 1910.120 will be implemented for each OU (OSHA 1991, 0610). Laboratory-approved sampling, analytical, and recordkeeping methods must be used. A detailed monitoring strategy will be incorporated into each SSHSP. The strategy will describe the frequency, duration, and type of samples to be collected.

If exposures exceed acceptable limits, the ER Program Manager and HSPL will be notified. An investigation of the source, exposures to personnel working in the OU and in adjoining areas, any bioassay or other medical evaluations needed, and an assessment of environmental impacts shall be initiated as soon as possible under the guidance of HS Division.

Contractors will be responsible for providing their own monitoring equipment and for determining their employees' occupational exposures to hazardous chemical and physical agents during activities performed at the OU. The Laboratory will perform oversight duties during these activities.

8.1 Chemical Air Contaminants

DOE has adopted OSHA PELs and ACGIH TLVs as standards for defining acceptable levels of exposure. The more stringent of the two limits applies.

8.1.1 Measurement

Measurements of chemical contaminants can be performed using direct or indirect sampling methods. Direct methods provide near real-time results and are often used as screening tools to determine levels of PPE, the need for additional sampling, etc. Examples of direct-reading instruments include the HNU photoionization detector, the organic vapor analyzer with flame ionization detector, and a gas detector pump with colorimetric tubes. Generally, these instruments are portable, easy to operate, and durable. They are less specific and sensitive than many indirect methods.

Indirect sampling means that a sample is collected in the field and transported to a laboratory for analysis. This usually involves setting up a sampling train consisting of a portable sampling pump, tubing, and sampling media (cassette, sorbent tube, impinger, etc.). The advantage of the indirect method is greater specificity and sensitivity than many direct-reading instruments. The disadvantage is the longer turnaround time for results and the inconvenience.

Air sampling for chemical contaminants at this OU will use both direct and indirect methods. It will be up to the SSO to determine the most appropriate sampling method for each situation. If there are any questions about sampling methodology, the SSO should consult with the HSPL or a certified industrial hygienist.

Perimeter monitoring shall be performed to characterize airborne concentrations in adjoining areas. If results indicate that contaminants are moving off site, control measures must be re-evaluated. The perimeter is defined as the boundary of the OU site.

8.1.2 Personal Monitoring

The site history should be used to determine the need for monitoring for specific chemical agents. Instruments that monitor for a wide range of chemicals, such as the organic vapor analyzer, combustible gas indicator, and HNU, may be used for screening purposes.

Initial air monitoring shall be performed to characterize the exposure levels at the site and to determine the appropriate level of personal protection needed. In addition, periodic monitoring is required when:

- work is initiated in a different part of the site,
- unanticipated contaminants are identified,
- a different type of operation is initiated (i.e., soil boring versus drum opening), or
- spills or leakage of containers is discovered.

Instrument readings should be taken in or near the worker's breathing zone. Individuals working closest to the source have the greatest potential for exposure to concentrations above acceptable limits. Monitoring strategies will emphasize worst-case conditions if monitoring each individual is inappropriate.

8.2 Physical Hazards

Physical hazards of concern that can be readily measured include noise, vibration, and temperature. These variables must be monitored to prevent injuries and illnesses related to overexposure.

8.2.1 Measurement

Most of the instruments used to measure these agents are direct reading. Many have the ability to take short-term measurements and/or integrated, longer-term measurements. Typically, short-term measurements are made during an initial survey. The results can then be used to determine whether longer-term (i.e., full shift) monitoring is warranted.

A sound level survey meter should be used to initially characterize sound pressure levels. These data can help guide the personal monitoring efforts. If the sound level survey and personal dosimetry indicate that sound levels exceed acceptable levels, then an octave band analyzer may be used to characterize the noise. This provides important data for designing engineering controls.

Area monitoring for temperature extremes are usually sufficient for determining whether workers are potentially exposed to harmful conditions. Thermometers, psychrometers, and anemometers are direct-reading instruments that provide the data necessary to make heat and cold stress calculations.

Accelerometers can be used to monitor vibration levels. Vibration is usually an isolated problem and does not warrant an ongoing monitoring program. Rather, the SSO should be alert for equipment and tasks that might expose workers to significant whole-body or hand and arm vibration. Typically, these include operation of dozers, scrapers, and other heavy equipment and power hand tools, such as impact wrenches and concrete breakers.

8.2.2 Personal Monitoring

Noise dosimeters are used to estimate the actual exposure or dose that a worker receives during the shift. Results of personal noise monitoring should be compared to the ACGIH TLVs in accordance with Laboratory policy. These results dictate whether workers must be included in a hearing conservation program.

Instrumentation is now available for personal monitoring for heat stress. This type of measurement is not mandated but can provide useful exposure information. Use of personal heat stress monitors must be approved by the HSPL prior to field use.

Personal monitoring for vibration and cold stress is generally not performed or warranted for this type of operation.

8.3 Radiological Hazards

When radiological hazards are known or suspected, workplace monitoring shall be performed as necessary to ensure that exposures are within the requirements of DOE Order 5480.11 and are as low as reasonably achievable (ALARA) (DOE 1990, 0732). Workplace monitoring consists of monitoring for airborne radioactivity, external radiation fields, and surface contamination. The Laboratory's workplace monitoring program is described in AR 3-7, Radiation Exposure Control. The success of the monitoring program in controlling exposures is measured by the personal dosimetry and bioassay programs. Chapter 3, Part 7, of the DOE Radiological Control Manual provides additional guidelines for radiological control during construction and restoration projects (DOE 1990, 0732). All monitoring instruments shall meet the Laboratory's requirements for sensitivity, calibration, and quality assurance. In addition, all monitoring shall be carried out in accordance with approved procedures.

8.3.1 Airborne Radioactivity Monitoring

Air monitoring shall be performed in occupied areas with the potential for airborne radioactivity. Air monitoring may include the use of portable high and low volume samplers, continuous air monitors, and personnel breathing zone samplers. In areas where concentrations are likely to exceed 10% of any derived air concentration listed in DOE Order 5480.11, real-time continuous air monitoring shall be provided. Action levels based on air monitoring results shall be established to increase dust suppression activities, upgrade PPE, and stop work.

8.3.2 Area Monitoring for External Radiation Fields

Area monitoring for external radiation fields shall be performed with portable survey instruments capable of measuring a wide range of beta/gamma dose rates. In areas where dose rates above a preset action level are expected, the monitoring should be continuous. Additional action levels shall be established based on external radiation monitoring results.

8.3.3 Monitoring for Surface Contamination

Area monitoring for surface contamination during operations shall be conducted whenever a new surface is uncovered in a suspected radioactively-contaminated area [i.e., the levels may exceed the surface contamination limits in DOE Order 5480.11 (DOE 1990, 0732]. Personnel and equipment shall be monitored whenever there is reason to suspect contamination and upon exit from a suspected radioactively contaminated area. Action levels for decontamination shall be established.

8.3.4 Personnel Monitoring for External Exposure

Personnel dosimetry shall be provided to OU workers who have the potential in a year to exceed any one of the following from external sources in accordance with DOE Order 5480.11 (DOE 1992, 0732).

- 100 mrem (0.001 sievert) annual effective dose equivalent to the whole body,
- 5 rem (0.05 sievert) annual dose equivalent to the skin,

- 5 rem (0.05 sievert) annual dose equivalent to any extremity, or
- 1.5 rem (0.015 sievert) annual dose equivalent to the lens of the eye.

Normally, workers meeting the above criteria will be monitored with thermoluminescent dosimeters (TLDs). TLDs shall either be provided by the Laboratory or shall meet DOE requirements if provided by the subcontractor. Section 10.0 (Bioassay Program) discusses personnel monitoring for internal exposure.

8.3.5 ALARA Program

ALARA considerations in the workplace are best served by near real-time knowledge of personnel exposures and frequent workplace monitoring to establish adequate administrative control of exposure conditions. Consequently, for the OU site projects, ALARA efforts consist of two integrated approaches, which are described in the following sections.

8.3.5.1 Workplace ALARA Efforts

Judicious application of basic time, distance, physical controls, and PPE principles will be used to limit exposures to ALARA levels. To verify that established control is adequate, workplace monitoring for radioactive materials and field instrument detectable chemicals will be conducted in direct proportion to expected and/or observed levels of exposure. Activities that result in unexpectedly high potential exposures will be terminated until provisions are made that permit work to proceed in acceptable ALARA fashion.

8.3.5.2 Programmatic ALARA Efforts

External and internal exposures of record are comprised of TLD badges and bioassay data, respectively. Field dose calculation, direct-reading pocket meters, and event-based lapel air sampling data are used to maintain estimates of personnel exposures to both radioactive materials and hazardous chemicals. These estimates are correlated with job-specific activities (work location and work category) and individual-specific activities (job function).

Periodic reviews of personnel exposure estimates are conducted to identify unfavorable trends and unexpectedly high potential exposures. Activities (as functions of work location, work categories, and job functions) that indicate unfavorable trends will be investigated, and recommendations will be made for additional administrative and/or physical controls, as appropriate.

All unfavorable trends and unexpectedly high potential exposures must be reported to the HSPL, who will make recommendations for corrective action.

9.0 MEDICAL SURVEILLANCE AND MONITORING

9.1 General Requirements

A medical surveillance program shall be instituted to assess and monitor the health and fitness of workers engaged in hazardous waste operations. Medical surveillance is required for personnel who are or may be exposed to hazardous substances at or above established PELs for 30 days in a 12-month period, as detailed in 29 CFR 1910.120 (OSHA 1991, 0610). Medical surveillance is also required for personnel with duties that require the use of respirators or with symptoms indicating possible overexposure to hazardous substances.

Contractors are responsible for medical surveillance of their employees. The Health and Safety Division will audit contractor programs.

9.2 Medical Surveillance Program

All field team members who participate in ER Program investigations shall participate in a medical surveillance program. The program shall conform to DOE Order 5480.10, 29 CFR 1910.120, AR 2-1, and any criteria established by the Occupational Medicine Group (HS-2) at the Laboratory (DOE 1985, 0062; OSHA 1991, 0610). The program shall provide for initial medical evaluations to determine fitness for duty and subsequent medical surveillance of individuals engaged in hazardous waste operations. At a minimum, the program shall include:

- **Surveillance.** An occupational and medical history, a baseline exam prior to employment, periodic medical exams, and termination exams shall be included. The frequency of medical exams may vary because of the exposure potential at hazardous waste sites. The frequency of exams will be determined by the physician.

- **Treatment**. Immediate consultation shall be made available to any employee who develops signs or symptoms of exposure or who has been exposed at or above PELs in an uncontrolled or emergency situation.
- **Recordkeeping**. An accurate record of the medical surveillance required by 20 CFR 1910.120 shall be retained (OSHA 1991, 0610). This record shall be retained for the period specified and meet the criteria of 29 CFR 1910.20.
- **Program review**. Contractors must provide adequate documentation that their medical program complies with all applicable standards, DOE orders, and Laboratory requirements. This documentation must be submitted for review and approval before work begins.
- **Program participation**. Line management is responsible for identifying employees for inclusion in the surveillance program.

9.2.1 Medical Surveillance Exams

AR 2-1 from the Laboratory's ES&H Manual specifies that medical surveillance examinations are required for employees who work with asbestos, beryllium, carcinogens, hazardous waste, high noise, lasers, and certain other materials. As specified above, Laboratory employees who work with hazardous waste must undergo periodic special examinations by HS-2.

The content and frequency of medical exams is dependent on site conditions, current and expected exposures, job tasks, and the medical history of the workers.

9.2.2 Certification Exams

In addition to the above medical surveillance requirements, medical certification is required for employees whose work assignments include respirator use, Level A PPE, and/or operation of cranes and heavy equipment. To become certified and maintain certification, medical evaluations as specified by HS-2 are required.

9.2.3 Fitness for Duty

A fitness for duty determination will be made for each site worker. The examining physician shall provide a report to the OUPL indicating:

- approval to work on hazardous waste sites,
- approval to wear respiratory protective equipment, and
- a statement of work restrictions.

9.3 Emergency Treatment

In the event of an on-the-job injury, HS-2 will implement required reporting and recordkeeping procedures. The SSHSP describes the actions to be taken by the employee at the time of the injury/illness.

10.0 BIOASSAY PROGRAM

The OU site field characterization efforts will include intrusive investigations of areas of unknown but highly probable contamination potential. Given the uncertainties associated with this type of fieldwork, the project internal exposure monitoring program is based on the assumption that personnel will be exposed to significant quantities of radioactive and/or hazardous chemical contaminants. Accordingly, the project internal dosimetry program will be conducted in accordance with the provisions of the Health Physics Group (HS-1). These provisions are outlined in the following sections. (Monitoring and control of internal contamination by hazardous chemical contaminants is included in the medical surveillance program.)

10.1 Baseline Bioassays

Individuals who are assigned to field activities or who have reason to visit or inspect field activities are assigned one of the following job categories:

I. Work involving full-time on-site activities.

II. Work involving support activities (e.g., supervision or inspection).

III. Work involving routine or frequent visits (e.g., observing, auditing).

IV. Work involving nonroutine or infrequent visits (e.g., management observations).

All such individuals (except category IV individuals) must submit urine samples and submit to whole-body counting prior to participation in field activities. The baseline urine samples are analyzed for the solubility Class D and Class W compounds that could reasonably be expected to be encountered at the Laboratory. Whole-body counting analyzes for the gamma-emitting radionuclides that could reasonably be expected to be encountered at the Laboratory.

Results of the baseline bioassay analyses are evaluated by a health physics specialist for evidence of previous exposure. Individuals exhibiting evidence of previous internal contamination will not be permitted to enter OU sites until an evaluation of the previous exposure indicates that additional, planned radiation exposure will not result in doses in excess of applicable regulatory limits. This evaluation may include additional, rigorous sampling and/or counting to establish the physical and temporal parameters necessary to adequately assess the committed effective dose equivalent.

10.2 Routine Bioassays

The routine bioassay program is used as a measure of the effectiveness of the respiratory protection program. As such, the bioassay frequency will be a function of potential exposure to airborne radioactive materials and will be determined by a health physics specialist.

Evidence of inadequate respiratory protection will be cause for an investigation of the responsible field operation(s). The HSPL is responsible for investigating and identifying probable causes of the respiratory protection program failure and for recommending corrective actions.

11.0 DECONTAMINATION

11.1 Introduction

Decontamination is the process of removing or neutralizing contaminants that have accumulated on personnel and equipment and is critical to health and safety at hazardous waste sites. Decontamination protects workers from hazardous substances that may contaminate PC, respiratory protection equipment, tools, vehicles, and other equipment used on site. It minimizes the transfer of harmful materials into clean areas, helps prevent mixing of incompatible chemicals, and prevents uncontrolled transportation of contaminants from the site into the community.

All personnel and equipment exiting an exclusion zone will be monitored to detect possible contamination. Monitoring will verify that all personnel and equipment are free of significant contamination prior to exiting the exclusion zone and shall be performed in accordance with Health and Safety Division requirements.

If monitoring indicates that an employee is contaminated with chemicals, biological agents, or radioactive materials, the employee's immediate supervisor shall notify the SSO, who records the details of the incident, determines whether any personal injury is involved, initiates decontamination, and, when necessary, notifies the OUPL and HSPL. All contamination incidents shall be immediately reported following Laboratory Occurrence Reporting Program requirements to ensure that prompt notifications and appropriate emergency response actions are enacted.

11.1.1 Decontamination Plan

A site decontamination plan is mandatory. The site decontamination plan shall be part of the SSHSP and must include:

- the number and layout of decontamination stations,
- the decontamination equipment needed,

- appropriate decontamination methods,
- procedures to prevent contamination of clean areas,
- methods and procedures to minimize worker contact with contaminants during removal of personal PC, and
- methods for disposing of clothing and equipment that are not completely decontaminated.

The plan should be revised whenever the type of personal PC or equipment changes, the site conditions change, or the site hazards are re-assessed based on new information.

11.1.2 Facilities

Clean areas shall be separate from contaminated areas and materials. The SSO will verify that decontamination facilities are maintained in acceptable condition and that supplies of decontaminating agents and other materials are available. Personnel decontamination facilities shall be equipped with showers, clean work clothing, decontamination agents, and, when necessary, a decontamination area where Health and Safety Division personnel can assist in decontaminating individuals. All wash solutions shall be retained for appropriate disposal.

11.1.3 General Decontamination Methods

Many factors such as cost, availability, and ease of implementation influence the selection of a decontamination method. From a health and safety standpoint, two key questions must be addressed:

- Is the decontamination method effective for the specific substances present?
- Does the method itself pose any health or safety hazards?

The details of decontamination techniques shall be included in the site decontamination plan. The following are some decontamination methods.

Removal

- Contaminant removal
    - Water rinse using pressurized spray or gravity flow shower
    - Chemical leaching and extraction
    - Evaporation/vaporization
    - Pressurized air jets
    - Scrubbing/scraping (using brushes, scrapers, or sponges and water-compatible solvent cleaning solutions)
    - Steam jets
- Removal of contaminated surfaces
    - Disposal of deeply permeated materials (e.g., clothing, floor mats, and seats)
    - Disposal of protective coverings/coatings

Inactivation

- Chemical detoxification
    - Halogen stripping
    - Neutralization
    - Oxidation/reduction
    - Thermal degradation
- Disinfection/sterilization
    - Chemical disinfection
    - Dry heat sterilization
    - Gas/vapor sterilization
    - Irradiation
    - Steam sterilization

11.1.3.1 Physical Removal

In many cases, gross contamination can be removed by dislodging/ displacement, rinsing, wiping off, and evaporation. Physical methods involving high pressure and/or heat should be used only as necessary and with caution because they can spread contamination and cause burns. Contaminants that can be removed by physical means can be categorized as follows:

- **Loose contaminants**. Dusts and vapors that cling to equipment and workers or become trapped in small openings, such as the weave of fabrics, can be removed with water or a liquid rinse. Removal of electrostatically-attached materials can be enhanced by coating the clothing or equipment with antistatic solutions. These are available commercially as wash additives or antistatic sprays.

- **Adhering contaminants**. Some contaminants adhere by forces other than electrostatic attraction. Adhesive qualities vary greatly with the specific contaminants and temperature. For example, contaminants such as glues, cements, resins, and muds have much greater adhesive properties than elemental mercury, and consequently, are difficult to remove by physical means. Physical removal methods for gross contaminants include scraping, brushing, and wiping. Removal of adhesive contaminants can be enhanced through certain methods such as solidifying, freezing (e.g., using dry ice or ice water), adsorption or absorption (e.g., with powdered lime or ground clay), or melting.

- **Volatile liquids**. Volatile liquid contaminants can be removed from PC or equipment by evaporation followed by a water rinse. Evaporation of volatile liquids can be enhanced by using steam jets. With any evaporation or vaporization process, care must be taken to prevent worker inhalation of the vaporized chemicals.

11.1.3.2 Chemical Removal

Physical removal of gross contamination should be followed by a wash/ rinse process using cleaning solutions. These cleaning solutions normally use one or more of the following methods:

- **Dissolving contaminants.** Chemical removal of surface contaminants can be accomplished by dissolving them in a solvent. The solvent must be chemically compatible with the equipment being cleaned. This is particularly important when decontaminating PC. In addition, care must be taken in selecting, using, and disposing of any organic solvents that may be flammable or potentially toxic. Organic solvents include alcohols, ethers, ketones, aromatics, straight-chain alkanes, and common petroleum products.

  Halogenated solvents are generally incompatible with PPE and are toxic. They should only be used for decontamination in extreme cases, when other cleaning agents will not remove the contaminant. Use of halogenated solvents must be approved by the HSPL.

  Table III-9 provides a general guide to the solubility of several contaminants in four types of solvents: water, dilute acids, dilute bases, and organic solvents. Because of the potential hazards, decontamination using chemicals should only be performed if recommended by an industrial hygienist or other qualified health professional.

- **Surfactants.** Surfactants augment physical cleaning methods by reducing adhesion forces between contaminants and the surface being cleaned and by preventing redeposit of the contaminants. Household detergents are among the most common surfactants. Some detergents can be used with organic solvents to improve the dissolving and dispersal of contaminants into the solvent.

TABLE III-9

GENERAL GUIDE TO CONTAMINANT SOLUBILITY

SOLVENT	SOLUBLE CONTAMINANTS
Water	Low-chain hydrocarbons, inorganic compounds, salts, some organic acids and other polar compounds
Dilute acids	Basic (caustic) compounds, amines, hydrazines
Dilute bases detergent soap	Acidic compounds, phenols, thiols, some nitro and sulfonic compounds
Organic solvents[a] alcohols ethers ketones aromatics straight-chain alkanes (e.g., hexane) common petroleum products (e.g., fuel oil, kerosene)	Nonpolar compounds (e.g., some organic compounds)

[a] WARNING: Some organic solvents can permeate and/or degrade the PC.

- **Solidification.** Solidifying liquid or gel contaminants can enhance their physical removal. The mechanisms of solidification are: 1) moisture removal through the use of adsorbents such as ground clay or powdered lime, 2) chemical reactions via polymerization catalysts and chemical reagents, and, 3) freezing using ice water.

- **Rinsing.** Rinsing removes contaminants through dilution, physical attraction, and solubilization. Multiple rinses with clean solutions remove more contaminants than a single rinse with the same volume of solution. Continuous rinsing with large volumes will remove even more contaminants than multiple rinsings with a lesser total volume.

- **Disinfection/Sterilization.** Chemical disinfectants are a practical means of inactivating infectious agents. Unfortunately, standard sterilization techniques are generally impractical for large equipment and for personal

PC and equipment. For this reason, disposable PPE is recommended for use with infectious agents.

11.1.4 Emergency Decontamination

In the event of personnel contamination with highly caustic, strongly acidic, and/or high levels of radioactive materials (100 mrad/hour), emergency shower facilities shall be used as a first level decontamination. These facilities shall be adequate to treat a minimum of two contaminated individuals at one time. Appropriate medical and radiation safety personnel will be relied upon to assist as needed. Use of these facilities shall be in accordance with Health and Safety Division requirements.

11.2 Personnel

The SSO is responsible for enforcing the decontamination plan. All personnel leaving the exclusion zone must be decontaminated to remove any chemical or infectious agents that may have adhered to them.

11.2.1 Radiological Decontamination

Personnel exiting contamination areas, high contamination areas, airborne radioactivity areas, or radiological buffer areas established for contamination control shall be frisked for contamination. This does not apply to personnel exiting areas containing only radionuclides, such as tritium, that cannot be detected using hand-held or automatic frisking equipment.

Monitoring for contamination should be performed using frisking equipment that, under laboratory conditions, can detect total contamination of at least the values specified in Table III-10. Use of automatic monitoring units that meet the above requirements is encouraged.

Personnel with detectable contamination on their skin or personal clothing, other than noble gases or natural background radioactivity, should be promptly decontaminated.

11.2.2 Chemical Decontamination

The decontamination of chemically-contaminated personnel will be detailed in the site decontamination plan. Subsection 11.1.3.2 provides guidance on chemical decontamination.

TABLE III-10

SUMMARY OF CONTAMINATION VALUES

NUCLIDE[a]	REMOVABLE (dpm/100 cm^2)[b,c]	TOTAL (FIXED + REMOVABLE) (dpm/100 cm^2)
Natural uranium, uranium-235, uranium-238, and associated decay products	1 000 alpha	5 000 alpha
Transuranics, radium-226, radium-228, thorium-230, thorium-228, protactinium-231, actinium-227, iodine-125, and iodine-129	20	500
Natural thorium, thorium-232, strontium-90, radium-223, radium-224, uranium-232, iodine -126, iodine-131, and iodine-133	200	1 000
Beta-gamma emitters (nuclides with decay modes other than alpha emission or spontaneous fission) except strontium-90 and others noted above (includes mixed fission products containing strontium-90)	1 000 beta-gamma	5 000 beta-gamma
Tritium organic compounds, surfaces contaminated by tritium gas, tritiated water, and metal tritide aerosols	10 000	10 000

[a] The values in this table apply to radioactive contamination deposited on but not incorporated into the interior of the contaminated item. Where contamination by both alpha- and beta-gamma-emitting nuclides exists, the limits established for the alpha- and beta-gamma-emitting nuclides apply independently.

[b] The amount of removable radioactive material per 100 cm^2 of surface area should be determined by swiping the area with dry filter or soft absorbent paper while applying moderate pressure and then assessing the amount of radioactive material on the swipe with an appropriate instrument of known efficiency. For objects with a surface area less than 100 cm^2, the entire surface should be swiped and the activity per unit area should be based on the actual surface area. Except for transuranics, radium-228, actinum-227, thorium-228, thorium-230, protactinium-231, and alpha emitters, it is not necessary to use swiping techniques to measure removable contamination levels if direct scan surveys indicate that the total residual contamination levels are below the values for removable contamination.

[c] The levels may be averaged over 1 m^2 provided the maximum activity in any area of 100 cm^2 is less than three times the guide values.

11.3 Equipment Decontamination

11.3.1 Responsibilities and Authorities

The SSO is responsible for ensuring that tools and equipment are surveyed for contamination before they are removed from the site. The SSO is also responsible for ensuring that tools and equipment are decontaminated to acceptable levels prior to release for unrestricted use.

11.3.2 Facilities

Prior to release from the site, tools and equipment contaminated with removable radioactive and chemical materials in excess of applicable limits will be manually decontaminated at the field location.

Tools and equipment that cannot be field decontaminated to below applicable limits may be appropriately packaged and removed to a decontamination facility. Transportation of contaminated tools or equipment off site must be approved by the HSPL.

11.3.3 Radiological

Decontamination of equipment must follow approved procedures. A surface shall be considered contaminated if either the removable or total radioactivity is detected above the levels in Table III-10. If an item cannot be decontaminated promptly, then it shall be posted as specified in AR 3-7. Radiological Work Permits or technical work documents shall include provisions to control contamination at the source to minimize the amount of decontamination needed. Work preplanning shall include consideration of the handling, temporary storage, and decontamination of materials, tools, and equipment.

Decontamination activities shall be controlled to prevent the spread of contamination. Water and steam are the preferred decontamination agents. Other cleaning agents should be selected based on their effectiveness, hazardous properties, amount of waste generated, and ease of disposal. Decontamination methods should be used to reduce the number of contaminated areas. Efforts should be made to reduce the level of contamination and the number and size of contaminated areas that cannot be eliminated. Line management is responsible for directing decontamination efforts.

11.3.4 Chemical

Chemical decontamination is performed in accordance with product labels. Random sampling and analysis of final rinse solutions may be performed to check the effectiveness of the decontamination procedures.

11.4 Waste Management

Fluids and materials resulting from decontamination processes will be contained, sampled, and analyzed for contaminants. Those materials determined to be contaminated in excess of appropriate limits are packaged in approved containers and disposed of in accordance with EM Division procedures.

12.0 EMERGENCIES

12.1 Introduction

Emergency response, as defined by 29 CFR 1910.120, will be handled by Laboratory personnel. ER contractors are responsible for developing and implementing their own emergency action plans as defined in 29 CFR 1910.38 (OSHA 1991, 0610). All emergency action plans must be consistent with Laboratory emergency response plans. The SSO, with assistance from the field team leader, will have the responsibility and authority for coordinating all emergency response activities until the proper authorities arrive and assume control.

12.2 Laboratory Emergency Response Plan

The Laboratory Emergency Management Office oversees and implements the full range of activities necessary for mitigating, preparing for, responding to, and recovering from emergency incidents at the Laboratory. Additional references for this section include Laboratory AR 1-1, Accident/Incident Reporting; AR 1-2, Emergency Preparedness; AR 1-8, Working Alone; and Technical Bulletin 101, Emergency Preparedness.

The Laboratory Emergency Response Plan establishes an organization capable of responding to the range of emergencies at the Laboratory. Provisions are made for rapid mobilization of the response organizations and for expanding response commensurate with the extent of the emergency.

An Emergency Manager with the authority and responsibility to initiate emergency action under the provisions of the Laboratory Emergency Response Plan is available at all times.

When an emergency occurs at the Laboratory, the Laboratory emergency response organization is responsible for all elements of response throughout the duration of the emergency. The Incident Commander is responsible for initial notification and communications and for providing protective action recommendations to buildings/areas within the emergency response zone and off site.

The Laboratory Emergency Response Plan is designed to be compatible with emergency plans developed by local, state, tribal, and federal agencies through establishment of communications channels with these agencies and by setting criteria for the notification of each agency.

12.3 Site-Specific Emergency Action Plan

An emergency action plan provides emergency information for contingencies that may arise during the course of field operations. It provides site personnel with instructions for the appropriate sequence of responses in the event of either site emergencies or off-site emergencies. The emergency action plan will be attached to the SSHSP. The following elements, at a minimum, shall be included in the written plan:

- pre-emergency planning,
- emergency escape procedures and routes/site map,
- procedures to be followed by personnel who remain to operate critical equipment before they evacuate,
- procedures to account for all employees after evacuation,
- rescue and medical duties for those who are to perform them,
- names of those who can be contacted for additional information on the OUHSP,
- emergency communications,
- types of evacuation to be used,
- dissemination of emergency action plan to employees initially and whenever the plan changes,

- agreement with local medical facilities to treat injuries/ illnesses
- emergency equipment and supplies,
- personal injuries or illnesses,
- motor vehicle accidents and property damage, and
- site security and control.

12.4 Provisions for Public Health and Safety

Emergency planning is presented in the Laboratory's ES&H Manual (LANL 1990, 0335). 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 developed by the American Industrial Hygiene Association and on the basis of the maximum concentration of toxic material that can be tolerated for up to one hour.

The 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 that involves actual or likely major failures of facility functions necessary for the protection of human health and the environment. Releases of toxic materials to areas off site may exceed the concentrations described in ERPG-2.

- **General emergency.** An event that has occurred or is in progress that substantially interferes with the functioning of facility safety systems. Releases of radioactive materials to areas off site may exceed protective response recommendations, and toxic materials may exceed ERPG-3.

12.5 Notification Requirements

Field team members will notify the SSO of emergency situations; the SSO will notify the appropriate emergency assistance personnel (e.g., fire, police, and ambulance), the OUPL, the HSPL, the Laboratory Health and Safety Division according to DOE Order 5500.2B (DOE 1991, 0736), and DOE Albuquerque Operations Office (AL) Order 5000.3 (DOE/AL 1986, 0734). The Laboratory Health and Safety Division is responsible for implementing notification and reporting requirements according to DOE Order 5484.1, Change 7 (DOE 1990, 0733).

12.6 Documentation

An unusual occurrence is any deviation from the planned or expected behavior or course of events in connection with any DOE or DOE-controlled operation if the deviation has environmental, safety, or health protection significance. Examples of unusual occurrences include any substantial degradation of a barrier designed to contain radioactive or toxic materials or any substantial release of radioactive or toxic materials.

The Laboratory principal investigator will submit a completed DOE Form F 5484.X for any of the following accidents and incidents, according to Laboratory AR 1-1:

- **Occupational injury.** An 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. Note: Conditions resulting from animal bites, such as insect or snake bites, or from one-time exposure to chemicals are considered injuries.

- **Occupational illness.** 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.** Regardless of fault, accidents that cause damage to DOE property or accidents, wherein DOE may be liable for damage to a second party, are reportable where damage is $1 000 or more, including damage to facilities, inventories, equipment, and properly parked motor vehicles but excluding damage resulting from a DOE-reported vehicle accident.

- **Government motor vehicle accidents with damages of $150 or more or involving an injury.** Unless the driver of the government vehicle is not at fault or the occupants are uninjured. Accidents are also reportable to DOE if:

    - damage to a government vehicle not properly parked is greater than or equal to $250;
    - damage to DOE property is greater than or equal to $500 and the driver of a government vehicle is at fault;
    - damage to any private property or vehicle is greater than or equal to $250 and the driver of a government vehicle is at fault; or,
    - any individual is injured and the driver of a government vehicle is at fault.

The HSPL 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 (DOE 1990, 0253), Unusual Occurrence Reporting

- DOE Form 5484.3, Supplementary Record of Occupational Injuries and Illnesses, DOE Order 5484.1, Change 7 (DOE 1990, 0733)
- DOE Form 5484.4, Tabulation of Property Damage Experience, Attachment 2, DOE Order 5484.1, Change 7 (DOE 1990, 0733)
- DOE Form 5484.5, Report of Property Damage or Loss, Attachment 4, DOE Order 5484.1, Change 7 (DOE 1990, 0733)
- DOE Form 5484.6, Annual Summary of Exposures Resulting in Internal Body Depositions of Radioactive Materials, DOE Order 5484.1, Change 7 (DOE 1990, 0733)
- DOE Form 5484.8, Termination Occupational Exposure Report, Attachment 10, DOE Order 5484.1, Change 7 (DOE 1990, 0733)
- DOE Form OSHA-200, Log of Occupational Injuries and Illnesses, Attachment 7, DOE Order 5484.1, Change 7 (DOE 1990, 0733)
- DOE Form EV-102A, Summary of DOE and DOE Contractor Occupational Injuries and Illnesses, Attachment 8, DOE Order 5484.1, Change 7 (DOE 1990, 0733)
- DOE Form F5821.1, Radioactive Effluent/On site Discharges/Unplanned Releases, Attachment 12, DOE Order 5484.1, Change 7 (DOE 1990, 0733)

Copies of these reports will be stored with the appropriate Laboratory group. Specific reporting responsibilities are given in Chapter 1, General ARs, of the Laboratory ES&H Manual (LANL 1990, 0335).

13.0 PERSONNEL TRAINING

13.1 General Employee Training and Site Orientation

All Laboratory employees and supplemental workers must successfully complete Laboratory general employee training (GET). GET training is performed by the Health and Safety Division. The OUPL is responsible for scheduling GET training for supplemental workers.

Several types of training are required, including:

- OSHA-mandated,
- facility-specific,
- site-specific or pre-entry, and
- tailgate.

Site workers will receive each type of training during the course of field activities.

13.2 OSHA Requirements

OSHA's HAZWOPER standard (29 CFR 1910.120) regulates the health and safety of employees involved in hazardous waste operations (OSHA 1991, 0610). This standard requires training commensurate with the level and function of the employee. Persons shall not participate in field activities until they have been trained to a level required by their job function and responsibility. The SSO is responsible for ensuring that all persons entering the exclusion zone are properly trained.

13.2.1 Pre-Assignment Training

At the time of job assignment, all general site workers shall receive a minimum of 40 hours of initial instruction off site and a minimum of 3 days of actual field experience under the direct supervision of a trained, experienced supervisor. Occasional site workers shall receive a minimum of 24 hours of initial instruction. Workers who may be exposed to unique or special hazards shall be provided additional training. The level of training provided shall be consistent with the employee's job function and responsibilities.

13.2.2 On-Site Management and Supervisors

On-site management and supervisors directly responsible for, or who supervise employees engaged in hazardous waste operations, shall receive at least 8 hours of additional specialized training on managing such operations at the time of job assignment.

13.2.3 Annual Refresher

All persons required to have OSHA training shall receive 8 hours of refresher training annually.

13.2.4 Site-Specific Training

Prior to granting site access, personnel must be given site-specific training. Attendance and understanding of the site-specific training must be documented. A weekly health and safety briefing and periodic training (as warranted) will be given. Daily tailgate safety meetings will be used to update workers on changing site conditions and to reinforce safe work practices. Training should include the topics indicated in Table III-11 in accordance with 29 CFR 1910.120(i)(2)(ii) (OSHA 1991, 0610).

13.3 Radiation Safety Training

Basic radiation worker training is required for all employees (radiation workers) 1) whose job assignments involve operation of radiation-producing devices, 2) who work with radioactive materials, 3) who are likely to be routinely occupationally exposed above 0.1 rem (0.001 sievert) per year, or 4) who require unescorted entry into a radiological area. This training is a 4-hour extension to GET for new employees.

Radiation protection training is required for all Laboratory employees, contractors, visiting scientists, and DOE and Department of Defense personnel. This is a one-hour presentation as part of GET.

13.4 Hazard Communication

Laboratory employees shall be trained in accordance with Health and Safety Division requirements. Contractors shall provide training to their employees in compliance with 29 CFR 1910.120 (OSHA 1991, 0610).

TABLE III-11

TRAINING TOPICS

INITIAL SITE - SPECIFIC	WEEKLY	PERIODIC AS WARRANTED	TOPIC
X		X	Site health and safety plan, 29 CFR 1910.120(e)(1)
X		X	Site characterization and analysis, 29 CFR 1910.120(i)
X		X	Chemical hazards, Table 1
X		X	Physical hazards, Table 2
X		X	Medical surveillance requirements, 29 CFR 1910.120(f)
X	X		Symptoms of overexposure to hazards, 29 CFR 1910.120(e)(1)(vi)
X		X	Site control, 29 CFR 1910.120(d)
X		X	Training requirements, 29 CFR 1910.120(e)
X	X	X	Engineering and work practice controls, 29 CFR 1910.120(g)
X	X	X	Personal protective equipment, 29 CFR 1910.120(g), 29 CFR 1910.134
X	X	X	Respiratory protection, 29 CFR 1910.120(g), 29 CFR 1910.134, ANSI Z88.2-1980
X		X	Overhead and underground utilities
X	X	X	Scaffolding, 29 CFR 1910.28(a)
X	X		Heavy machinery safety
X		X	Forklifts, 29 CFR 1910.27(d)
X		X	Tools
X		X	Backhoes, front-end loaders
X		X	Other equipment used at site
X		X	Pressurized gas cylinders, 29 CFR 1910.101(b)
X	X	X	Decontamination, 29 CFR 1910.120(k)
X		X	Air monitoring, 29 CFR 1910.120(h)
X		X	Emergency response plan, 29 CFR 1910.120(l)
X	X		Handling drums and other containers, 29 CFR 1910.120(j)
X		X	Radioactive wastes
X		X	Explosive wastes
X		X	Shock sensitive wastes
X		X	Flammable wastes
X	X	X	Confined space entry
X			Illumination, 29 CFR 1910.120(m)

Table III-11 (continued)

TRAINING TOPICS

INITIAL SITE-SPECIFIC	WEEKLY	PERIODIC AS WARRANTED	TOPIC
X	X	X	Buddy system, 29 CFR 1910.120(a)
X		X	Heat and cold stress
X		X	Animal and insect bites
X		X	Spill containment

13.5 Facility-Specific Training

Certain areas of the Laboratory (e.g., firing sites) require additional facility-specific training before personnel can enter.

13.6 Records

Records of training shall be maintained by the Health and Safety Division and in the project file to confirm that every individual assigned to a task has had adequate training for that task and that every employee's training is up-to-date. The SSO or his designee is responsible for ensuring that persons entering the site are properly trained.

REFERENCES

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DOL (US Department of Labor), Occupational Safety and Health Administration, March 1989. *Industrial Exposure and Control Technologies for OSHA-Regulated Hazardous Substances*, Volumes I and II, Washington, DC. **(DOL 1989, 0946)**

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ATTACHMENT 1

LEVELS OF PPE

LEVEL OF PROTECTION	EQUIPMENT	PROTECTION PROVIDED	SHOULD BE USED WHEN:	LIMITING CRITERIA
A	Recommended: • Pressure-demand, full-facepiece SCBA or pressure-demand supplied-air respirator with escape SCBA • Fully encapsulating, chemical-resistant suit • Inner chemical-resistant gloves • Chemical-resistant safety boots/shoes • Two-way radio communications Optional: • Cooling unit • Coveralls • Long cotton underwear • Hard hat • Disposable gloves and boot covers	The highest available level of respiratory, skin, and eye protection	• The chemical substance has been identified and requires the highest level of protection for skin, eyes, and the respiratory system based on either: — measured (or potential for) high concentration of atmospheric vapors, gases, or particulates — site operations and work functions involving a high potential for splash, immersion, or exposure to unexpected vapors, gases, or particulates of materials that are harmful to skin or capable of being absorbed through the intact skin • Substances with a high degree of hazard to the skin are known or suspected to be present, and skin contact is possible • Operations must be conducted in confined, poorly-ventilated areas until the absence of conditions requiring Level A protection is determined	• Fully encapsulating suit material must be compatible with the substances involved

ATTACHMENT 1 (continued)

LEVELS OF PPE

LEVEL OF PROTECTION	EQUIPMENT	PROTECTION PROVIDED	SHOULD BE USED WHEN:	LIMITING CRITERIA
B	Recommended: • Pressure-demand, full facepiece SCBA or pressure-demand supplied-air respirator with escape SCBA • Chemical-resistant clothing (overalls and long-sleeved jacket; hooded, one- or two-piece chemical splash suit; disposable chemical-resistant one - piece suit) • Inner and outer chemical-resistant gloves • Chemical-resistant safety boots/shoes • Hard hat • Two-way radio communications Optional: • Coveralls • Disposable boot covers • Face shield • Long cotton underwear	The same level of respiratory protection but less skin protection than Level A. It is the minimum level recommended for initial site entries until the hazards have been further identified.	• The type and atmospheric concentration of substances have been identified and require a high level of respiratory protection but less skin protection. This involves atmospheres: — with IDLH concentrations of specific substances that do not represent a severe skin hazard — that do not meet the criteria for use of air-purifying respirators • Atmosphere contains less than 19.5% oxygen • Presence of incompletely identified vapors or gases is indicated by direct-reading organic vapor detection instrument, but vapors and gases are not suspected of containing high levels of chemicals harmful to skin or capable of being absorbed through the intact skin	• Use only when the vapor or gases present are not suspected of containing high concentrations of chemicals that are harmful to skin or capable of being absorbed through the intact skin • Use only when it is highly unlikely that the work being done will generate either high concentrations of vapors, gases, or particulates or splashes of material that will affect exposed skin

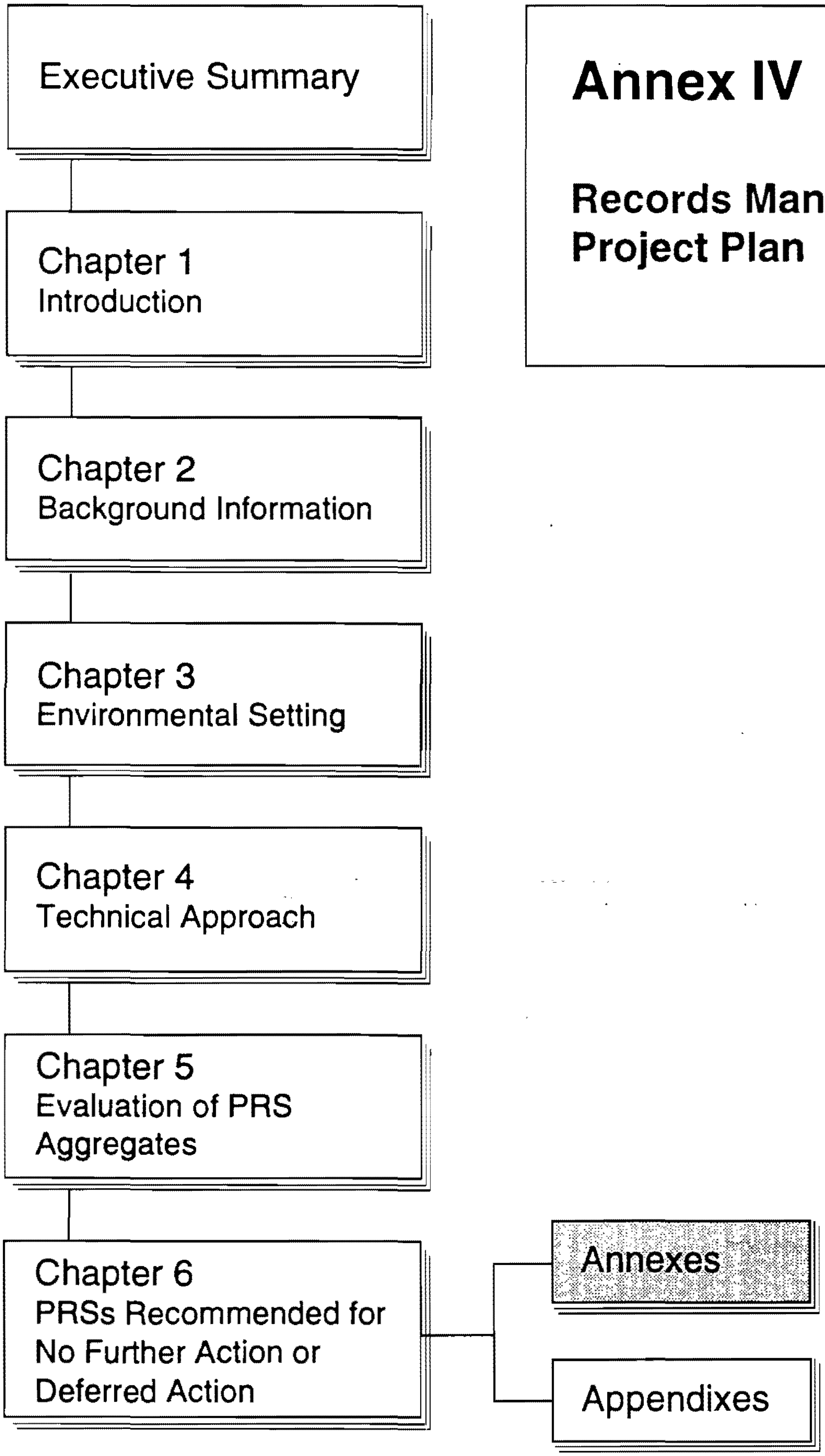
ATTACHMENT 1 (continued)

LEVELS OF PPE

LEVEL OF PROTECTION	EQUIPMENT	PROTECTION PROVIDED	SHOULD BE USED WHEN:	LIMITING CRITERIA
C	Recommended: • Full-facepiece, air-purifying, canister - equipped respirator • Chemical-resistant clothing (overalls and long-sleeved jacket; hooded, one- or two-piece chemical splash suit; disposable chemical-resistant one - piece suit) • Inner and outer chemical-resistant gloves • Chemical-resistant safety boots/shoes • Hard hat • Two-way radio communications Optional: • Coveralls • Disposable boot covers • Face shield • Escape mask • Long cotton underwear	The same level of skin protection as Level B but a lower level of respiratory protection	• The atmospheric contaminants, liquid splashes, or other direct contact will not adversely affect any exposed skin • The types of air contaminants have been identified, concentrations measured, and a canister is available that can remove the contaminant • All criteria for the use of air-purifying respirators are met	• Atmospheric concentration of chemicals must not exceed IDLH levels • The atmosphere must contain at least 19.5% oxygen
D	Recommended: • Coveralls • Safety boots/shoes • Safety glasses or chemical splash goggles • Hard hat Optional: • Gloves • Escape mask • Face shield	No respiratory protection. Minimal skin protection	• The atmosphere contains no known hazard • Work functions preclude splashes, immersion, or the potential for unexpected inhalation of or contact with hazardous levels of any chemicals	• This level should not be worn in the exclusion zone • The atmosphere must contain at least 19.5% oxygen

Annex IV

Records Management Project Plan



RECORDS MANAGEMENT PROJECT PLAN

This work plan will follow the records management program plan provided in Annex IV of Revision 2 of the Installation Work Plan (LANL 1992, 0768).

REFERENCE

LANL (Los Alamos National Laboratory), November 1992. "Installation Work Plan for Environmental Restoration," Revision 2, Los Alamos National Laboratory Report LA-UR-92-3795, Los Alamos, New Mexico. **(LANL 1992, 0768)**

Annex V

Community Relations Project Plan

COMMUNITY RELATIONS PROJECT PLAN

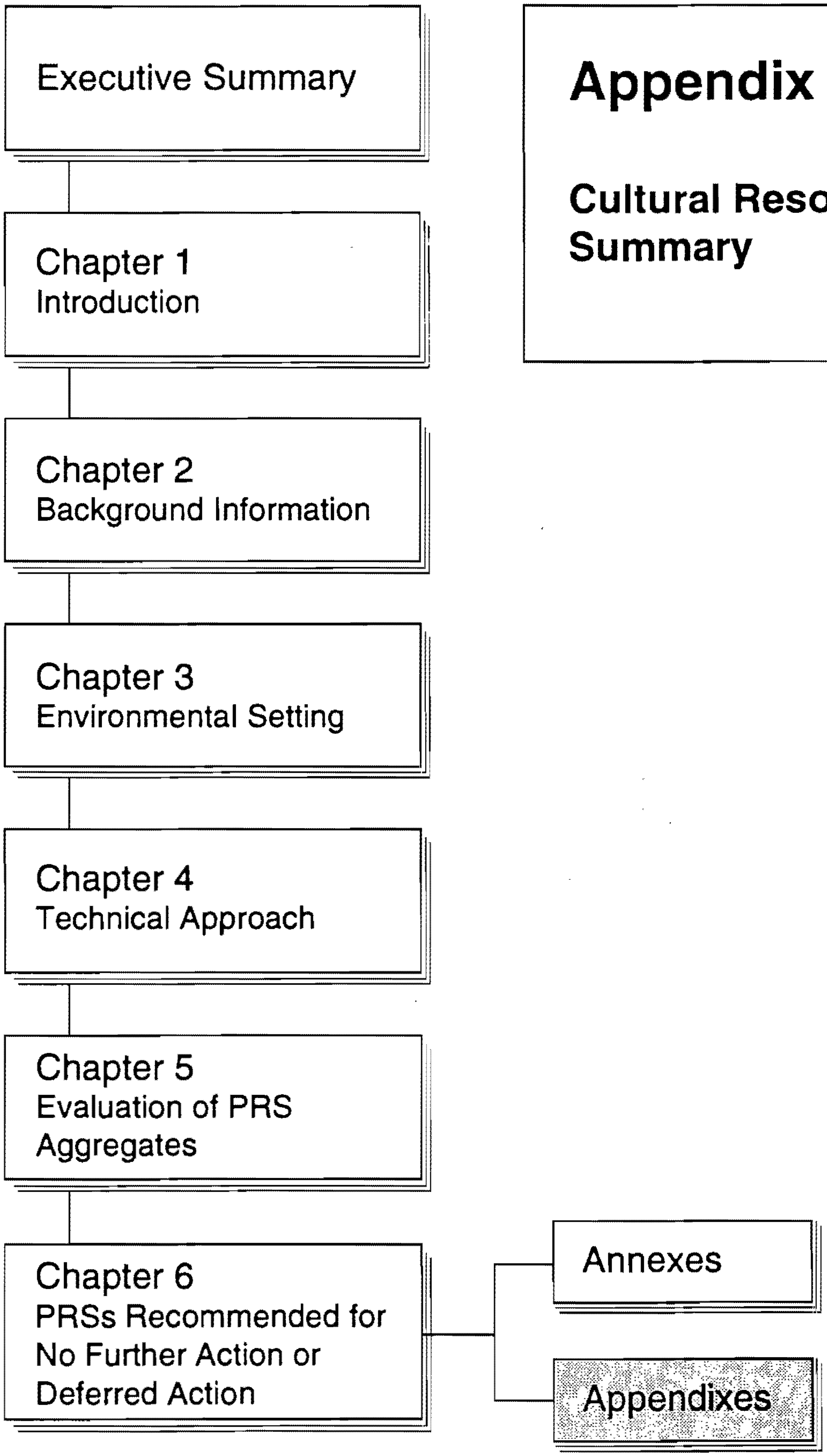
This work plan will follow the community relations program plan provided in Annex V of Revision 2 of the Installation Work Plan (LANL 1992, 0768). The Environmental Restoration (ER) Program's public reading room is located at 1450 Central Avenue, Suite 101, Los Alamos, New Mexico. The community relations project leader can be reached at (505) 665-5000 for additional information.

REFERENCE

LANL (Los Alamos National Laboratory), November 1992. "Installation Work Plan for Environmental Restoration," Revision 2, Los Alamos National Laboratory Report LA-UR-92-3795, Los Alamos, New Mexico. **(LANL 1992, 0768)**

Appendix A

Cultural Resource Summary



CULTURAL RESOURCE SUMMARY

As required by the National Historic Preservation Act of 1966 (as amended), a cultural resource survey was conducted during the summer of 1992 at Operable Unit (OU) 1140. 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 (Federal Register Vol. 48, No. 190, September 29, 1983).

Nineteen archaeological sites are located within the surveyed area. Fourteen sites are eligible for inclusion on the National Register of Historic Places under Criterion D, research potential.

The attributes of these sites which make them eligible for inclusion on the National Register will not be affected by any Environmental Restoration (ER) Program sampling activities proposed at OU 1140. A report documenting the survey area, methods, results, and monitoring recommendations, if any, will be transmitted to the New Mexico State Historic Preservation Officer for his concurrence in a "Determination of No Effect" for this project. As specified in 36 CFR 800.5(b) and following the intent of the American Indian Religious Freedom Act, a copy of this report will also be sent to the governor of San Ildefonso Pueblo and to any other interested tribal group for comment on any possible impacts to sacred and traditional places.

All monitoring and avoidance recommendations contained in the report referenced below must be followed by all personnel involved in ER sampling activities. The Environmental Protection Group (EM-8) archaeologists must be contacted 30 days prior to initiation of any ground-breaking activities so that monitoring and avoidance recommendations can be verified.

REFERENCE

Manz, Kari, et al., in preparation. "Environmental Restoration Program, Operable Unit 1140, Cultural Resource Survey Report," Los Alamos National Laboratory, Los Alamos New Mexico.

Appendix B

Biological Resource Summary

BIOLOGICAL RESOURCE SUMMARY FOR TECHNICAL AREA 46

1.0 INTRODUCTION

During 1992, field surveys were conducted by the Biological Resource Evaluations Team (BRET) of the Environmental Protection Group (EM-8) for Operable Unit (OU) 1140, Technical Area 46. The surveys were conducted to provide information on the biological components prior to site characterization. Site characterization requires surface and subsurface soil sampling within the technical area including Cañada del Buey. Further information concerning the biological field surveys for OU 1140 is contained in Subsection 5.1 of this appendix and in the full report "Biological and Floodplain/Wetland Assessment for Environmental Restoration Program, Operable Unit 1140" (Biggs in preparation, 11-248). The biological assessment contains specific information on survey methodology, results, and mitigation measures. This assessment will also contain information that may aid in defining ecological pathways of contaminant migration and site restoration. The report will be submitted to the US Fish and Wildlife Service (USFWS) for informal review. The Laboratory will request a written concurrence of report findings from the USFWS.

2.0 PERTINENT REGULATIONS

Field surveys were conducted to comply with the amended Federal Endangered Species Act of 1973 (11-252); New Mexico Wildlife Conservation Act (1974, 11-251); New Mexico Endangered Plant Species Act (New Mexico Natural Resources Department 1985, 0546); Executive Order 11990, "Protection of Wetlands" (1977, 0635); Executive Order 11988, "Floodplain Management" (1977, 0634); 10 CFR 1022, "Compliance with Floodplain/ Wetlands Environmental Review Requirements" (DOE 1979, 11-249); and, DOE Order 5400.1 (DOE 1988, 0075).

3.0 METHODOLOGY

The purpose of the surveys was three-fold. The first was to determine the presence or absence of critical habitat for any state or federal sensitive, threatened, or endangered plant or animal species potentially occurring within OU 1140 boundaries. Secondly, surveys were conducted to determine presence of sensitive areas such as flood plains and wetlands within the areas to be sampled, the extent of such areas, and their general characteristics. The third purpose was to provide additional plant and wildlife data concerning the habitat types within the operable unit. These data provide further baseline information about the biological components of the site characterization and a determination of pre-sampling conditions. This information is also necessary to support the National Environmental Policy Act (NEPA) documentation and determination of a categorical exclusion for the sampling plan for site characterization (SEN-15-90).

OU 1140 personnel propose to collect surface and subsurface sediment samples. Subsurface characterization will involve drilling holes up to or exceeding 200 ft in depth. In some locations, trenching may be necessary.

After searching the data base maintained in EM-8 containing the habitat requirements for all state and federally listed threatened, endangered, and sensitive plant and animal species known to occur within the boundaries of Los Alamos National Laboratory and surrounding areas, a habitat evaluation survey (Level 2) was conducted. A Level 2 survey is performed when there are areas that are not highly disturbed which could potentially support threatened and/or endangered species. Techniques used in a Level 2 survey are designed to gather data on the per cent cover, density, and frequency of both the understory and overstory components of the plant community.

The habitat information gathered through the field surveys was then compared to the habitat requirements for species of concern as identified in the data base search. If habitat requirements were not met, then no further surveys were conducted and the site was considered cleared for impact on state and federally listed species (pending USFWS concurrence of findings presented in the report "Biological and Floodplain/Wetland Assessment for Environmental Restoration Program, Operable Unit 1140"). If habitat requirements were met, then specific surveys for the species of concern were conducted. These surveys were done in accordance with pre-established survey protocols. These protocols often require certain meteorological and/or seasonal conditions.

In each location, all wetlands and flood plains within the survey area were noted using a National Wetlands Inventory Map (11-253) and field checks. Characteristics of wetlands, flood plains, and riparian areas are noted using criteria outlined in the Corps of Engineers Wetlands Delineation Manual (1987, 0871).

4.0 THREATENED AND ENDANGERED SPECIES

Table B-1 indicates the species of concern for this operable unit.

5.0 RESULTS AND MITIGATION

5.1 Biota Description

The dominant tree species within the overstory vegetation of the mesa top of OU 1140 are piñon pine (*Pinus edulis*) and one-seed juniper (*Juniperus monosperma*). The shrub layer is primarily composed of Gambel oak (*Quercus gambelli*) and mountain mahogany (*Cerocarpus montanus*). The dominant grass of the mesa top is blue grama (*Bouteloua gracilis*).

In the bottom of Cañada del Buey, the dominant tree species are ponderosa pine (*Pinus ponderosa*), one-seed juniper, and to a lesser degree, Douglas fir (*Pseudotsuga menziesii*). The shrub layer is primarily composed of Gambel oak and mountain mahogany with chokecherry (*Prunus virginiana*) and New Mexico olive (*Forestiera neomexicana*), found in moister areas of the canyon. The dominant grass species of the canyon bottom is little bluestem (*Andropogon scoparius*).

The following habitats were identified in the Cañada del Buey System:

- Mesa top
  - Piñon-juniper-Gambel oak
  - Piñon-juniper-mountain mahogany

- North-facing slopes/canyon bottom
  - Ponderosa pine-Gambel oak
  - Ponderosa pine-mountain mahogany

- South-facing slopes
  - Piñon-juniper-mountain mahogany

TABLE B-1

THREATENED AND ENDANGERED SPECIES POTENTIALLY OCCURRING IN OPERABLE UNIT 1140

SCIENTIFIC NAME	COMMON NAME	STATUS	HABITAT
ANIMALS			
Accipiter gentilis	Northern goshawk	FCC2	Ponderosa pine/Gambel oak, ponderosa pine/gray oak, mixed conifer
Euderma maculatum	Spotted bat	FCC2 SPG2	Ponderosa, piñon-juniper, cliffs and rock crevices
Falco peregrinus	Peregrine falcon	FE SPG1	Ponderosa-piñon, cliffs and rock outcrops on cliffs
Lymnaea caperata	Say's pond snail	SPG1	Wetlands at Cerro la Jara in the Jemez Mountains
Strix occidentalis lucida	Mexican spotted owl	FPT	Mixed conifer, mountains and canyons, uneven-aged, multi-storied forest with closed canopy
Zapus hudsonius	Meadow jumping mouse	FCC2 SPG2	Grassy areas dominated by grasses and rushes next to permanent running water
PLANTS			
Mammillaria wrightii	Wright's fishhook cactus	E2	Piñon-juniper on sand-gravel hills, plains, or slopes
Opuntia viridiflora	Santa Fe cholla	FCC2 E2	Piñon-juniper, only known location is Santa Fe
Pediocactus papyracanthus	Grama grass cactus	E2 FCC2	Piñon-juniper, commonly found associated with basalt outcrops and sandy soils

Status

FE	Federally endangered. Any species that is in danger of extinction throughout all or a significant portion of its range other than a species of class insecta determined by the Secretary of the Interior to constitute a pest whose protection under the provision of the Endangered Species Act would present an overwhelming and overriding risk to man (USFWS 1988, 11-252).
FPT	Federally proposed as threatened. Taxon that has been proposed for listing under the Endangered Species Act as threatened. These species receive the protection of the Endangered Species Act during the proposal process (USFWS 1988, 11-252).
FCC2	Federal candidate as a C2. Taxon for which information now in the possession of the USFWS indicates that proposing to the list as endangered or threatened is possibly appropriate, but for which conclusive data on biological vulnerability and threat are not currently available to support a proposed rule. Further information is needed before listing. Federal agencies are requested to evaluate C2 species in their management activities (USFWS 1988, 11-252).
SPG1	State endangered as a Group 1 species. Species whose prospects of survival or recruitment within the state are in jeopardy (State of New Mexico 1974, 11-251).
SPG2	State endangered as a Group 2 species. Species whose prospects of survival or recruitment within the state are likely to become jeopardized in the foreseeable future (State of New Mexico 1974, 11-251).
E2	State endangered plants. The taxon is so rare across its entire range and of such limited distribution and population size that unregulated collection could jeopardize its survival in New Mexico.

An estimated 155 species of plants have been identified within OU 1140. Also, 69 species of birds and 6 species of reptiles have been observed, and 40 species of mammals have been recorded within the canyon. To date, no amphibians have been found within OU 1140.

5.2 Threatened and Endangered Species

As a result of a habitat evaluation and a review of previous data of the operable unit, at least four of the previously listed species have potential for occurrence within or near the operable unit. These are the spotted bat, Wright's fishhook cactus, the grama grass cactus, and the peregrine falcon. In addition, sightings in other portions of the Laboratory of several sensitive raptors, including the northern goshawk, have been reported in similar habitat to what is found in OU 1140. These species are discussed below in more detail. The remaining species listed above are dismissed from further consideration because of the lack of more specific suitable habitat components or because they have not been located on more suitable habitat in other areas of the Laboratory.

The spotted bat is found in piñon-juniper, ponderosa, mixed conifer, and riparian habitats. The two critical requirements for the spotted bat are a source of open surface water and roost sites (caves in cliffs or rock crevices). Suitable roost sites were present in portions of Cañada del Buey. Open water sources are somewhat limited and include a small cattail pond and several small outfalls. More suitable habitat occurs along Pajarito Canyon. No surveys were conducted for spotted bats in OU 1140. However, during surveys for spotted bats in lower Pajarito Canyon (1992), none were captured. July 1992 surveys of Los Alamos Canyon also resulted in no spotted bat captures. In addition, no spotted bats were captured in similar survey attempts at TA-16, TA-36, and Bandelier National Monument. This does not necessarily suggest spotted bats do not occur in OU 1140. However, no adverse impact is expected to occur to the spotted bat (if present) if potential habitat (rock faces, cliffs) and water sources within the operable unit are not disturbed or altered.

Although habitat components are present for Wright's fishhook cactus and the grama grass cactus, none were found during the Level 2 surveys. If sampling takes place in canyon bottoms or north-facing slopes, these species are not expected to be impacted by the proposed sampling. However, sampling on mesa tops or south-facing slopes may result in impacts to these species or their habitats. If sampling is to take place in these areas or if disturbance will take place in these areas, BRET shall be contacted to determine if further mitigation measures are necessary. BRET may conduct a site investigation for these species that must be performed during certain seasonal periods.

Currently in draft form, a habitat management plan developed by Johnson (1992, 11-250) discusses the past and present status of the peregrine falcon in habitat north of this operable unit. A portion of this area has been suggested to be designated as critical habitat for the peregrine falcon as a result of meetings and memoranda with the USFWS and the DOE. The peregrine falcon has a low potential for occurrence in OU 1140. It is not expected to nest in the operable unit but may traverse the area. Sampling is not expected to impact this species.

The northern goshawk has been found on Laboratory property but not within the project area. However, because suitable habitat exists, there is potential for this species to occupy the area. Before sampling is begun, a field survey should be conducted to determine its presence or absence. Furthermore, to avoid potential impacts to this and other raptors, the following mitigation measures are required for Cañada del Buey:

1. Any machine sampling occurring between May and October within Cañada del Buey must be cleared through BRET. BRET must be contacted 60 days prior to sampling to evaluate possible nest sites in and around a specific sampling area.
2. If any area over one-tenth acre will be disturbed, contact BRET for a pre-sampling site-specific survey.
3. Any tree removal (live or snag) must be approved by BRET.

BRET is the responsible Laboratory party for biological resources and will make all necessary contacts with the USFWS and the State of New Mexico. BRET is also responsible for monitoring mitigation.

5.3 Wetlands/Flood Plains

One area within OU 1140 has been classified on USFWS National Wetlands Inventory maps (11-253) as a possible palustrine wetlands (PRS 46-005). There are also eleven NPDES-permitted outfalls within OU 1140, and at least three have wetlands vegetation associated with them [PRSs 46-004(f), 46-004(j), and 46-004(y)]. These areas may be classified as jurisdictional wetlands. However, none of the possible jurisdictional wetlands exceeds one acre, and therefore RFI activities within any of these possible jurisdictional wetlands would be permitted under the nationwide permit for such small areas. In addition, flood plain maps developed by McLin (1992, 0825) indicate that a flood plain exists within Cañada del Buey. In compliance with 10 CFR 1022, a flood plain/wetlands involvement notification will be submitted to the Federal Register for public comment. RFI sampling is anticipated in some OU 1140 wetlands that may be jurisdictional [PRSs 46-005, 46-004(f), and 46-004(y)]. However, RFI activities are not anticipated to adversely affect the flood plains and wetlands within OU 1140 as long as best management practices outlined in Section 6.0 of this appendix are adhered to.

6.0 BEST MANAGEMENT PRACTICES

Impacts to non-sensitive 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. Revegetation may be required at some sites. A list of native plants suitable for revegetation for OU 1140 will be included in the final report "Biological and Flood Plain/ Wetland Assessment for Environmental Restoration Program, Operable Unit 1140" (Biggs in preparation, 11-248). In addition, BRET may be consulted to determine suitable species for seeding.

Additional mitigation measures include the following:

- Avoid unnecessary disturbance (i.e., parking areas, equipment storage areas, off-road travel) to surrounding vegetation during the actual sampling and when traveling into the sampling sites.

- Avoid removal of vegetation along water sources, drainage systems, and stream channels.
- Avoid disturbance to vegetation along canyon slopes and especially to drainages.
- Avoid tree removal. If tree removal is required, contact BRET for evaluation.

In addition to the previously-mentioned mitigation measures, BRET requests notification of additional disturbances prior to their being conducted.

The "Biological and Flood Plain/Wetland Assessment for Environmental Restoration Program, Operable Unit 1140" (Biggs in preparation, 11-248) will be evaluated by the US Fish and Wildlife Service for compliance with the Endangered Species Act. This federal agency may have additional mitigation measures that are required and are not represented in this summary. However, the operable unit project leader will be notified of any additional required measures.

REFERENCES

Army Corps of Engineers, January 1987. "Corps of Engineers Wetlands Delineation Manual," final report, Technical REport Y-87-1, Wetlands Research Program, Waterways Experiment Station, P. O. Box 631, Vicksburg, Mississippi. **(Army Corps of Engineers 1987, 0871)**

Biggs, James, in preparation. "Biological and Flood Plain/Wetland Assessment for Environmental Restoration Program, Operable Unit 1140." **(Biggs in preparation, 11-248)**

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The White House, May 24, 1977, "Floodplain Management," Executive Order 11988, in Environment Reporter, The Bureau of National Affairs, Inc., Washington, DC. **(The White House 1977, 0634)**

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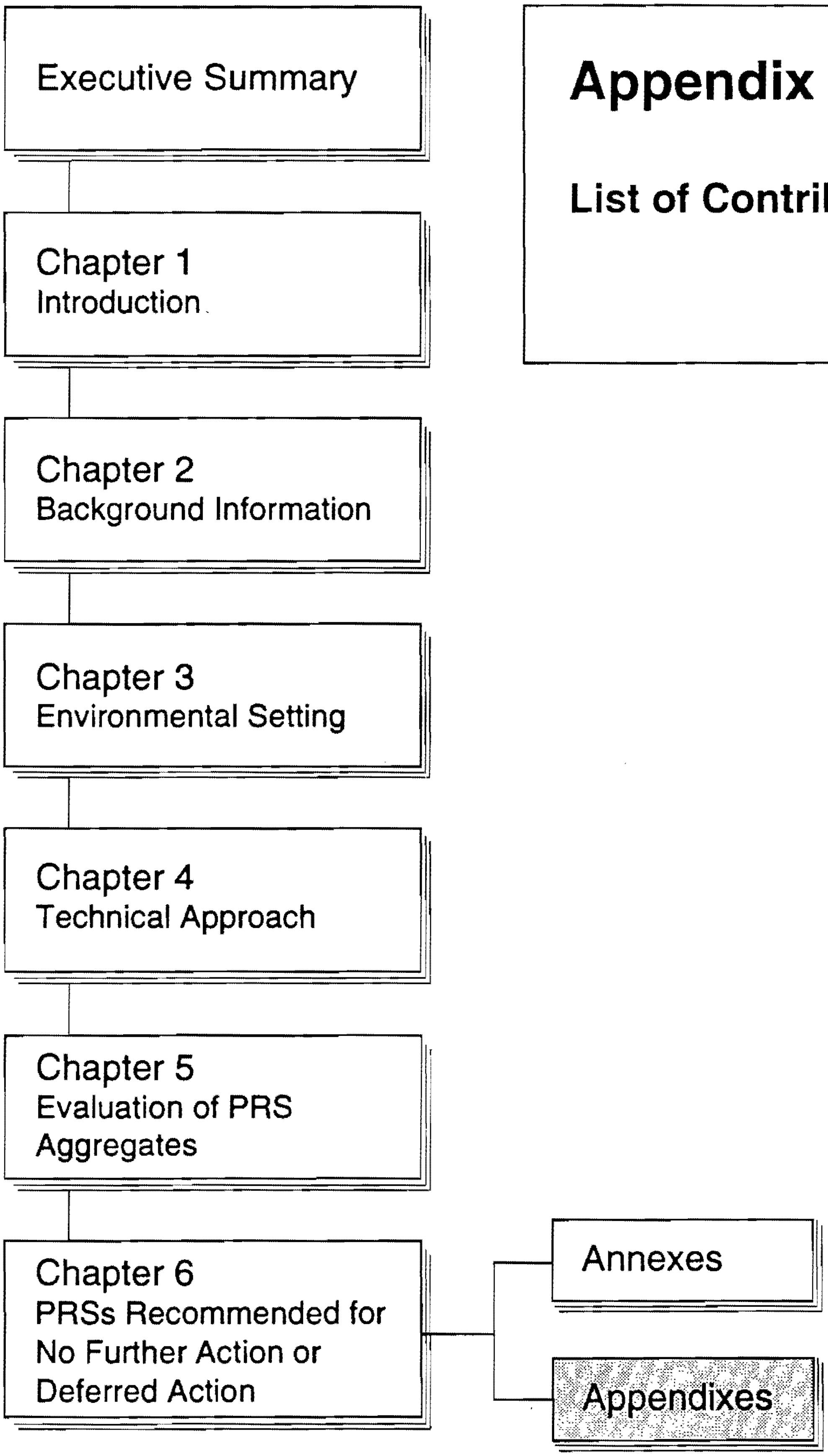
USFWS (US Fish and Wildlife Service), 1988. "Endangered Species Act of 1973 as Amended through the 100th Congress (Public Law 100-478), US Department of the Interior, Washington, DC. **(USFWS 1988, 11-252)**

USFWS (US Fish and Wildlife Service), 1990. Map No. 2-ABQ-G3, "Frijoles New Mexico Quadrant," prepared by the National Wetlands Inventory, Albuquerque, New Mexico. **(USFWS 1990, 11-253)**

Appendix C

List of Contributors



LIST OF CONTRIBUTORS

NAME AND AFFILIATION	EDUCATION/EXPERTISE	ER PROGRAM ASSIGNMENT
Roy Michelotti (CLS-DO)	M.B.A, B.S. Mechanical Engineering 13 years experience in engineering design and project management, 1 year in facility management and as health and safety officer.	Operable Unit Project Leader
Jan Beck (Radian Corp.)	B.A. Biology 4 years experience in environmental risk assessment	Work plan support for human health risk assessment
Margaret Burgess (IS-1)	B.A. English 9 years experience as a technical writer/editor, 2 years experience environmental restoration documents	Technical writer/editor
Dow Davidson (EES-4)	B.A. Anthropology 14 years experience in quality assurance/sample management	Development and incorporation of sampling plans
Alison Dorries (HS-5)	Ph.D. Chemistry, M.P.H. Public Health 5 years experience in toxicology, pulmonary health research, regulation development, and environmental health risk assessment	Technical team leader, human health risk assessment
Terry Foxx (EM-8)	M.S. Environmental Science, B.S. Biology 3 years experience in performing biological field studies under ER and other programs	Baseline data for ecological risk and natural resource damage assessments
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Elizabeth J. Kelly (A-1)	Ph.D. Biostatistics 4 years experience in devising sampling plans and data analysis techniques for environmental studies, including surface covers, site integrity, and decision analysis for ER programs	Programmatic Project Leader, Environmental Assessments Technical Teams
Gerry Kelly (ICF Kaiser Engineers)	M.S. Public Health and Environmental Management, B.A. Biological Sciences 19 years experience in environmental restoration and waste management, environmental impact assessment, policy and program development and analysis, and regulatory compliance support	Technical and regulatory review, appendix preparation, and fieldwork planning

NAME AND AFFILIATION	EDUCATION/EXPERTISE	ER PROGRAM ASSIGNMENT
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Beverly Larson (EM-8)	M.A., B.A. Anthropology 19 years experience in cultural resource management	Archeology team leader
Deborah Magid (Ray Rashkin Associates)	7 years editing experience, 12 years experience in desktop publishing	Editor/compositor
Allen McCulla (CLS-DO, undergraduate summer student)	Senior standing as architectural student, Auburn University; 3 years experience working with architectural drawings	Outfalls survey and archival search of engineering drawings
Dean Neptune (Neptune and Co., Inc.)	Ph.D. Physiology and Biochemistry 26 years experience in planning, implementation, and assessment of environmental measures used in decision making	QA/QC and development of data quality objectives (DQOs)
Linda Nonno (EM-13)	B.S. Computer Science, B.A. Anthropology 4.5 years experience in systems analysis; 2 years experience in environmental analysis, development of sampling plans for environmental contaminants, authoring and coordinating RFI work plans	Technical review and development of sampling plans
Jim Roberts (CLS-5)	A.A. Mechanical Technology 1 year experience as a data base system manager; 6 years experience in NTS field operations; 5 years experience in laser technology; 10 years experience in design and fabrication of instruments	Data base system manager, and archival research
Christian Tammi (Applied Decision Analysis, Inc.)	B.A. Applied Mathematics 4 years experience in software development and mathematical optimization techniques; 1 year experience in decision analysis for environmental restoration problems	Member of the decision analysis technical team
Jake Turin (EES-1)	Ph.D Geosciences 3 years consulting experience	Geology team leader

Appendix D

Field Investigation Approach and Methods

Executive Summary

Chapter 1
Introduction

Chapter 2
Background Information

Chapter 3
Environmental Setting

Chapter 4
Technical Approach

Chapter 5
Evaluation of PRS Aggregates

Chapter 6
PRSs Recommended for No Further Action or Deferred Action

Annexes

Appendixes

1.0 GENERAL

This appendix has been prepared to describe the common elements that apply to the conduct of field investigations at Operable Unit (OU) 1140 potential release sites (PRSs). The purpose of providing this information in a single discussion is to reduce the repetition of details that is common in each of the six sampling and analysis plans. Several general assumptions apply to all of the field investigations presented in Chapter 5 of this work plan. They include the following:

- The release and presence of hazardous constituents at some PRSs may not have been associated with the release of radioactive materials. Also, the release of radioactive materials may have occurred without simultaneous release of hazardous constituents.
- Field surveys and field screening of samples can be used to identify gross contamination and assist in sample selection for laboratory analyses.
- Field laboratory analyses will be used to more quickly provide Level II/III data to help guide field operations and identify samples for analytical laboratory analysis. Refer to Table D-1 for analytical levels appropriate to data uses.
- Analytical laboratory analysis will complete the sampling planned at each phase of site investigation.

1.1 Field Operations

The sampling and analysis plans in Chapter 5 of this work plan represent the results of research and investigation up to this point in time. These sampling and analysis plans do not present the full level of detail necessary for complete field implementation. Additional specific detail will be added to the current sampling and analysis plans prior to going to the field for sample collection.

A standard table is used in this work plan to identify screening and analysis requirements, including the number of samples and types of analyses

TABLE D-1

SUMMARY OF ANALYTICAL LEVELS APPROPRIATE TO DATA USES (EPA 1987, 0086)

DATA USES	ANALYTICAL LEVEL	TYPE OF ANALYSIS	LIMITATIONS	DATA QUALITY
• Site characterization • Monitoring during implementation	Level I	• Field screening for organic vapor and radiological detection using portable instruments • Field test kits	• Instruments respond to naturally occurring compounds	• If instruments calibrated and data interpreted correctly, can provide indication of contamination
• Site characterization • Evaluation of alternatives • Engineering design • Monitoring during implementation	Level II	• Variety of organics by GC; Inorganics by AA, XRF	• Tentative identification analyte-specific • Techniques/instruments limited mostly to volatiles, metals, some radionuclides	• Dependent of QA/QC steps employed • Data typically reported in concentration ranges • Detection limits vary from low ppm to low ppb
• Risk assessment • Site characterization • Evaluation of alternatives • Engineering design • Monitoring during implementation	Level III	• Organics/inorganics using EPA procedures other than CLP can be analyte-specific • RCRA characteristic tests • Radiological constituents	• Specific identification; tentative identification in some cases • Can provide data of same quality as Level IV	• Similar detection limits to CLP • Less rigourous QA/QC
• Risk assessment • Evaluation of alternatives • Engineering design	Level IV	• TCL/TAL organics/inorganics by GC/MS, AA, ICP	• Tentative identification of non-TCL parameters • Some time may be required for validation of packages	• Goal is data of known quality • Rigourous QA/QC • Low ppb detection limit
• Risk assessment	Level V	• Non-conventional parameters • Appendix 8 parameters	• May require method development/modification • Mechanism to obtain services requires special lead time	• Quality is method specific • Method-specific detection limits

AA: Atomic absorption
CLP: Contract laboratory program
EPA: Environmental Protection Agency
GC: Gas chromatography
ICP: Inductively coupled plasma
MS: Mass spectrometry
RCRA: Resource Conservation and Recovery Act
TAL: Target analyte list
TCL: Target compound list
XRF: X-ray fluorescence

needed (Table D-2). A step-by-step approach to the collection of sample data is used at OU 1140 and, therefore, not every sample or every analyte that is listed on the sampling and analysis summary tables will necessarily be performed. The final number of samples and laboratory analyses will vary depending on the results of the intermediate steps of field screening and field laboratory analysis

A complete readiness-review will be conducted prior to the initiation of the field investigation portion of the OU 1140 RCRA Facility Investigation (RFI). This review will ensure that archaeological and ecological evaluations will be performed in all areas where the surface is to be disturbed, vegetation removed, or invasive sampling performed.

This discussion identifies several aspects of the Laboratory's implementation of the field sampling process that are not mentioned in the specific sampling and analysis plans. Standard field operations include (see Section 2.0, Field Operations Management):

- preliminary activities and support procedures required by the Laboratory;
- identifying and documenting locations that have been sampled;
- field sample logging, handling, documentation and Environmental Restoration (ER) Program Sample Management Facility (SMF) sample management and curation procedures;
- analytical sample handling and sample coordination facility (SCF) laboratory coordination procedures;
- equipment decontamination procedures; and,
- management of wastes generated by sampling and decontamination activities.

1.2 Investigation Methods

The primary focus of this appendix is on field investigation methods, discussed in the field sampling methods subsection of the Laboratory's

Table D-2
Sample of OU 1140 Aggregates, Site Surveys, Sampling and Analysis Tables

Structure Sample Total 0
Surface Sample Total 0
Subsurface Sample Total 54

					Field Surveys			Samples				Field Screening						Field Lab.						Laboratory Analyses																
	PRS	Outfall Field ID	PRS Type Outfall Type	Phase 1 Approach	Land Survey	Geophysics	Radiation	Sampled Media	Structure	Surface	Subsurface	Gross Alpha	Gross Gamma/Beta	Organic Vapor	Combustible gas/oxygen	X-Ray Fluorescence	Lithologic Logging	Gross Alpha	Tritium	Soil Moisture	Gamma Spectroscopy	PCB	VOA	Gamma Spectroscopy	Isotopic Americium	Total Uranium	Isotopic Uranium	Isotopic Plutonium	Isotopic Thorium	Isotopic Cesium [1]	VOA (SW 8240) [2]	Semivolatiles (SW 8270)	TCLP	Metals (SW 6010)	PCB (SW 8080)	Asbestos	Mercury	Herbicides	Pesticides	Aggregate
(1)	46-009-a		Landfill	Reconn	1		1	Soil/Debris	0	0	36	1	1	1		1	1	1		1	1	1	1	1			1	1	1	1	1	1		1	1	1				5.5
(2)	46-009-a		Landfill	Reconn	1		1	Soil/Debris	0	0	12	1	1	1		1	1	1			1	1	1	1			1	1	1	1	1	1		1	1	1				5.5
(3)	46-009-a		Landfill	Reconn	1		1	Sediment/Soil	0	0	6	1	1	1		1	1	1			1	1	1	1			1	1	1	1	1	1		1	1	1				5.5

1. Suspected VOC analytes include trichloroethylene (TCE) and trichloroethane(TCA).
2. [illegible]pected SVOC analytes include polycyclic aromatic hydrocarbons (PAHs) and [illegible]rinated biphenyls (PCBs).

Installation Work Plan (IWP), Subsection 3.5.3 (LANL 1992, 0768). The methods presented here are specific examples of the options identified in the IWP. In addition, this appendix references the Laboratory's ER Program standard operating procedures (SOPs) (LANL 1993, 0875). Each brief method description given herein refers to the applicable SOPs for detailed methodology.

The method descriptions are simple and brief and provide some information on application of the method. Specific information, such as sampling location or target depth of a borehole, is provided by the individual sampling and analysis plans in Chapter 5 of this work plan. The method descriptions presented here are not intended to supplant or reduce the importance of the Quality Assurance Project Plan (Annex II) of this work plan or the governing SOPs (LANL 1993, 0875). Wherever a Laboratory ER Program SOP is referenced in this work plan, revision numbers are intentionally not listed. Most SOPs will undergo revision between the completion of this work plan and commencement of field activities. Therefore, the most current revision will be used at the time that activities requiring the implementation of the SOP are undertaken. Table D-3 lists the SOPs applicable to the OU 1140 Work Plan.

2.0 FIELD OPERATIONS MANAGEMENT

Multiple field investigation teams may be operating concurrently during the RFI. Each team will be responsible for health and safety, sample identification and traceability, and related activities. In this section, several aspects of field operations are described that will occur as a part of all field operations. Other responsibilities may be shared between field teams, such as operation of the portable sample logging facility or of an equipment decontamination facility.

2.1 Health and Safety

Annex III of this work plan is the Health and Safety Project Plan for all field activities within OU 1140. The plan gives specific information regarding known or suspected contaminants and personnel protection required for different activities. Samples acquired as part of this work plan will be screened at the point of collection to identify the presence of gross

TABLE D-3

STANDARD OPERATING PROCEDURES CITED FOR TA-46 FIELD ACTIVITIES

TITLE	NUMBER	TA-46 AGGREGATES
General Instructions for Field Investigations	LANL-ER-SOP-01.01	Subsections 5.1-5.6
Sample Containers and Preservation	LANL-ER-SOP-01.02	Subsections 5.1-5.6
Handling, Packaging, and Shipping of Samples	LANL-ER-SOP-01.03	Subsections 5.1-5.6
Sample Control and Field Documentation	LANL-ER-SOP-01.04	Subsections 5.1-5.6
Field Quality Control Samples	LANL-ER-SOP-01.05	Subsections 5.1-5.6
Management of RFI-Generated Waste	LANL-ER-SOP-01.06	Subsections 5.1-5.6
Equipment Decontamination	IN PREPARATION	Subsections 5.1-5.6
Near Surface Soil Sample Screening for Low-Energy Gamma Radiation Using the FIDLER	IN PREPARATION	Subsections 5.1-5.6
Near Surface Soil Sample Screening for Low-Energy Gamma Radiation Using the Phoswich	IN PREPARATION	Subsections 5.1-5.6
Health and Safety Monitoring of Organic Vapors with a Photoionization Detector	IN PREPARATION	Subsections 5.1-5.6
Measurement of Gamma Radiation Using Sodium Iodine (NaI) Detector	IN PREPARATION	Subsections 5.1-5.6
Surface Geophysics	IN PREPARATION	Subsections 5.1, 5.2
Geomorphologic Mapping	IN PREPARATION	Subsections 5.3, 5.4
Drilling Methods and Drill Site Management	LANL-ER-SOP-04.01	Subsections 5.1, 5.2, 5.3, 5.5
Spade and Scoop Method for Collection of Soil Samples	LANL-ER-SOP-06.09	Subsections 5.1, 5.2, 5.3, 5.6
Hand Auger and Thin-Wall Tube Sampler	LANL-ER-SOP-06.10	Subsections 5.2, 5.3, 5.4, 5.5
Stainless Steel Surface Soil Sampler	LANL-ER-SOP-06.11	Subsections 5.2, 5.3, 5.4, 5.6
Sediment Material Collection	LANL-ER-SOP-06.14	Subsections 5.2, 5.6
Collection of Near-Surface Soil Samples Beneath Pavements	IN PREPARATION	Subsection 5.3
Acceptance of Non-Borehole Samples by the SMF	IN PREPARATION	All
Transport and Receipt of Borehole Samples by the SMF	IN PREPARATION	All
Physical Processing and Storage of Borehole Samples at the SMF	IN PREPARATION	All
Field Logging, Handling, and Documentation of Borehole Materials	LANL-SOP-12.01	All
Removal of Analytical Samples From Borehole Samples by the SMF For Transfer, Shipment, and Remnant Return	IN PREPARATION	All
Examination of Samples at the SMF	IN PREPARATION	All

contamination or conditions that may pose a threat to the health and safety of field personnel. The techniques listed in Section 5.0, Field Screening, will be used.

Access, staging, and sample storage areas will be designated by the field team leader (FTL). In order to maintain sample integrity and sample documentation, all sampling sites will be included in one or several exclusion zones. Exclusion zones will be delineated by the FTL with the concurrence of the site safety officer (SSO). The boundary of an exclusion zone will be defined based on the nature, magnitude, and extent of confirmed or possible contamination; the potential for contaminant migration; hazards at the site, such as use of mechanical equipment; the presence of electrical lines or other utilities, structures, tanks, pits, or trenches; and, the presence of steep banks or cliffs.

Boundaries of exclusion zones may be changed as operations progress. All changes will be designated by the FTL, with the concurrence of the SSO.

In order to assure sample integrity, to maintain control over sampling waste, and to avoid contamination of the site office, decontamination may be required for personnel, equipment, and vehicles moving from one zone to another. Therefore, a contamination reduction zone (CRZ) will be established surrounding the exclusion zone(s). A contamination reduction corridor, the size of which will depend on the number of stations required for decontamination activities, will be established through the CRZs. The corridor should be located in a direction that is generally upwind from the exclusion zone.

2.2 Site Monitoring

Entry to, and egress from, sites will be controlled for monitoring purposes. All personnel entering the sites must use appropriate radiation monitoring badges. Locations for drinking water, rest room facilities, etc., will be identified prior to beginning on-site activities. Protective clothing requirements will be determined by the SSO assigned to the project.

Field measurements for wind-borne contaminants shall be made and documented prior to, during, and after surface sampling activities. Qualified health and safety personnel (or designees) are responsible for this monitoring. Results of monitoring will be used to evaluate possible hazards existing at the site in order to evaluate current conditions and specify personal protective equipment. In addition, all personnel will visually monitor for extreme weather conditions, lightning, or other physical or environmental hazards that may develop. Personnel will notify the SSO when unanticipated physical or environmental hazards develop. Potential site hazards are discussed in detail in Annex III of this work plan.

2.3 Archaeological and Ecological Awareness

Prior to going into the field, the OU 1140 field teams will be briefed about the cultural and ecosystem sensitivities present at OU 1140. Field teams will abide by the mitigative measures prescribed for archaeological and ecological features or systems identified for TA-46. Refer to Appendix A and Appendix B of this work plan.

2.4 Support Services

Physical services support during the field investigation will be provided by Laboratory support groups [e.g., Engineering (ENG)-3, ENG-5, Johnson Controls, or other subcontractors]. Existing job ticket procedures will be used. The services these organizations will provide include, but are not limited to, backhoe and front-end loader excavations, moving pallets of drummed auger cuttings and decontamination solutions, and setting up signs and other warning notices around the perimeter of the working area.

2.5 Excavation Permits

As part of the Environmental Safety and Health (ES&H) questionnaire process, excavation permits are required by the Laboratory prior to any excavation, drilling, or other invasive activity. Acquisition of the permits will be coordinated with the Laboratory's Safety and Risk Assessment Group (HS-3) and Johnson Controls. Acquisition of excavation permits will be scheduled as appropriate for each phase of fieldwork. All areas intended for excavation, drilling, or sampling will be marked in the field for formal clearance prior to beginning the work.

2.6 Sample Management

Regulatory requirements governing the ER Program mandate the implementation of sample controls as part of the quality assurance program. Traceability (chain-of-custody) of samples will be established by the maintenance of sample histories during collection, transportation, processing, testing, and storage activities. Appropriate processing of field samples prior to testing and analysis is necessary to ensure that data from samples are accurate; from collection in the field, to receipt at the sample management facility, to their distribution to the analytical laboratory, and to their final storage or disposal.

A sample management facility has been established by the ER Program. The ER Program Sample Management Facility has been developed to assure quality control of all geologic samples and associated records, including their physical protection and traceability. The sample management system will be described in the revised Quality Assurance Project Plan (QAPjP). Guidance for sample handling is provided in Subsection 3.5.5 and Annex IV of the IWP (LANL 1992, 0768). Sample packaging, handling, traceability, and documentation procedures are provided in ER Program SOPs. Refer to Table D-3 for a complete listing of applicable SOPs.

2.7 Sample Coordination

A sample coordination facility has been established by the ER Program in the Laboratory's Environmental Chemistry Group (EM-9) to provide consistent and cost-effective analytical methods for all investigations. The system is described in Subsection 3.5.5 and Appendix O of the IWP (LANL 1992, 0768). The applicable SOP is LANL-ER-SOP-01.04, Sample Control and Field Documentation (LANL 1993, 0875).

2.8 Quality Control Samples

Field quality assessment samples of several types are collected during the course of a field investigation. The definition for each kind of sample and the purpose it is intended to fulfill are given in Annex II of this work plan, the Quality Assurance Project Plan (QAPjP), and in LANL-ER-SOP-01.05, Field Quality Control Samples (LANL 1993, 0875). The specific number of geotechnical field duplicate samples that are to be collected are detailed in the sampling plans in Appendix E, Table E-1 of this work plan.

2.9 Equipment Decontamination

Decontamination is performed as a quality assurance measure, an environmental protection activity, and a safety precaution. It prevents cross-contamination among samples and helps maintain a clean working environment for the safety of personnel. Sampling tools are decontaminated by washing, rinsing, and drying. The effectiveness of the decontamination process is documented through rinsate blanks submitted for laboratory analysis. Steam cleaning is used for large machinery, vehicles, auger flights, and coring tools used in borehole sampling. Decontamination waste waters, including steam-cleaning fluids, must be collected and contained for proper disposal. The applicable SOP is Equipment Decontamination (in preparation).

2.10 Waste Management

This discussion is based on the guidance provided in Subsection 3.5.4 and Appendix B of the IWP (LANL 1992, 0768). Wastes produced during sampling activities may include borehole auger cuttings, excess sample, excavated soil from trenching, decontamination waste waters and steam-cleaning fluids, and disposable materials such as wipes, protective clothing, and sample bottles. In different areas of OU 1140, several of the following waste categories may be encountered: hazardous waste, low-level radioactive waste, and mixed waste. Requirements for segregating, containing, characterizing, treating, and disposing of each type and category of waste are provided in the applicable SOP, LANL-ER-SOP-01.06, Management of RFI-Generated Waste (LANL 1993, 0875).

3.0 FIELD SURVEYS

Field surveys will primarily consist of walking scans of the land surface using direct reading or recording instruments. Field survey data such as radioactivity or organic vapor measurements are used to identify the presence of contaminants or structures in the field and to modify health and safety plans. While negative results from field surveys are not conclusive evidence of the absence of contaminants, positive results obtained at an early stage can allow timely redirection of sampling activities.

3.1 Land Surveys

Land surveys will include engineering and geomorphologic mapping activities.

3.1.1 Engineering Mapping

Geodetic engineering mapping is required to accurately record the location of PRSs and surface and subsurface sampling points. In the field the engineering survey will locate, stake, and document all PRS locations (that can be ascertained before sampling) and all surface engineering features and structures. The assumed locations of subsurface structures will be surveyed based upon existing engineering drawings before geophysical surveys. These data will be recorded on a base map. If repositioning a sample location becomes necessary during sample collection, this new position will be resurveyed and the revised location will be indicated on the base map. The engineering survey will be performed by a licensed professional working to "Minimum Standards for Land Surveying In New Mexico" (New Mexico Board of Registration for Professional Engineers and Surveyors, 11-236) with oversight by the field team leader.

3.1.2 Geomorphologic Mapping

Field or geomorphologic mapping will be required for OU 1140 to assist in the location of certain sampling points. In order to sample drainages judged most likely to contain potential contamination, several of the individual sampling plans in Chapter 5 have required the identification of watercourses or drainages. Mapping of OU 1140 drainages from outfalls has been completed during preliminary fieldwork. See Table D-3 for information on the applicable SOPs.

3.2 Geophysical Surveys

Various geophysical methods are available to detect the location of buried structures (e.g., septic systems) and to trace the path of buried material such as piping. The ER Program technical team that maintains expertise in these techniques will be consulted for the most appropriate method(s). The use of EM (electromagnetic induction) and GPR (ground-penetrating radar) surveys are planned to locate subsurface engineering artifacts at OU 1140.

Initially, general locations of the buried components will be determined from examination of dated aerial photographs and engineering drawings, land surveys, and from on-site visual inspection. The geophysical surveys will be conducted to determine the precise boundaries of subsurface structures. Once located, the sites will be surveyed in and permanently marked in the field, and the data recorded on a base map. See Table D-3 for information on the applicable SOPs.

3.3 Radiological Surveys

3.3.1 Gross Gamma Survey

Several instruments are available that are suitable for these surveys: micro R meters, sodium-iodide (NaI) detectors of various sizes with ratemeters or scalers, and Geiger-Müeller detectors. The preferred instruments are micro R meters with the ability to measure to 5 µR/hr, and 2-in. by 2-in. NaI detectors with a ratemeter capable of displaying 100 counts per minute (cpm). Some discrete-measurement or continuous-measurement recording instruments are also available using the same detectors. Surveys are conducted by carrying the instrument at waist height at a slow walking pace and observing and recording the ratemeter response. Measurements may also be made at the ground surface to aid in identifying the presence of localized contamination. See Table D-3 for information on the applicable SOPs.

3.3.2 Low-Energy Gamma Survey

Two instruments are commonly used for these surveys, the FIDLER and the Phoswich. Both are optimized for the detection of low-energy photons, such as the 60 keV gamma emission from americium-241 or the x-rays that accompany the decay of most heavy radionuclides, such as uranium, thorium, plutonium, and other transuranic radionuclides. Either instrument may be used for this work plan. Discrete- or continuous-measurement recording options are available. Surveys are conducted by carrying the instrument close to the ground surface and observing the ratemeter or scaler. Measurements may also be made at the ground surface to aid in identifying the presence of localized contamination. See Table D-3 for information on the applicable SOPs.

4.0 SOIL SAMPLING

Soil samples, taken as described below, will be used for field screening, field laboratory, and analytical laboratory measurements and analyses. The following table, Table D-4, correlates sample collection techniques with soil sampling categories.

TABLE D-4

DRY MEDIA SAMPLING TECHNIQUES USED FOR OU 1140 [1,2]

TECHNIQUE	SURFACE SOILS 0 to 6 in. (no VOCs [3] or at VCA [4])	SURFACE SOILS 0 to 12 in. (VOCs)	NEAR SURFACE SOILS 6 to 36 in.	SUBSURFACE SOILS AND ROCK 36 in. and deeper
Spade and scoop	X			
Ring sampler	X	X		
Near-surface beneath pavement			X	
Hand-auger and thin-wall tube	X	X	X	X
Vertical borehole			X	X
Angled borehole			X	X

[1] Table D-4 presents the choice of sampling techniques that may be used for sampling dry media for various spatial boundaries. Techniques are also dependent upon the need to test for volatile organic compounds.

[2] See Table D-3 for a complete listing of applicable SOPs.

[3] VOCs = volatile organic compounds.

[4] VCA = voluntary corrective action.

4.1 Surface Soils

Depths of surface soil samples and the techniques used for their collection vary depending upon whether they will be analyzed for volatile organic compounds (VOCs) or whether the samples are being gathered at the site of a voluntary corrective action (VCA) (newly excavated).

If the samples are to be analyzed for VOCs and are not at the site of a VCA excavation, then they will be taken from 0 to 12 in. with the bottom 6 in. (6 to 12 in.) being analyzed for VOCs. These samples must be collected using a stainless steel ring sampler to ensure the maximum retention of organic constituents.

If the samples are not to be analyzed for VOCs, then they will be taken from 0 to 6 in., collected either with the spade and scoop method or ring sampler techniques.

The spade and scoop method uses a stainless steel or Teflon scoop. Care should be taken to ensure that for each sample the hole goes the full required depth and the sides are cut vertically to obtain equal volumes over the entire interval.

The ring sampler method is a 4-in.-diameter stainless steel tube that is driven vertically into the area to be sampled. Once driven in place, the soil around the sampler is then excavated and the tube is removed.

The applicable SOPs are LANL-ER-SOP-06.09, Spade and Scoop Method for Collection of Soil Samples, and LANL-ER-SOP-06.11, Stainless Steel Surface Soil Sampler (LANL 1993, 0875).

4.2 Near-Surface Soils

One PRS aggregate at OU 1140 (surface releases) requires the collection of near-surface samples of soil from 0 to 6 in. beneath asphalt pavements. Boreholes will be drilled with a small (≤ 2 in. diameter) diamond coring drill through the asphalt pavement, allowing a 6 in. core of the subsoil to be collected. The applicable SOP is Collection of Near-surface Soil Samples Beneath Pavements (in preparation).

Small-volume soil samples can be recovered from depths approaching 10 ft with a hand auger or with a thin-wall tube sampler. The thin-wall tube sampler provides a less disturbed sample than that obtained with a hand auger. However, it may not be possible to force the thin-wall tube sampler through some soil or tuff, and sampling with the hand auger may be the more viable alternative. It is usually not practical to use a hand auger or thin-wall tube sampler at depths below 10 ft. The applicable SOP is LANL-ER-SOP-06.10, Hand Auger and Thin-Wall Tube Sampler (LANL 1993, 0875).

4.3 Subsurface Soils and Rock

Subsurface soils and rocks are sampled with vertical and angled boreholes.

4.3.1 Vertical Cored Boreholes

Drilling at OU 1140 will be accomplished through the use of the most efficient and applicable methods available. Generally, core sampling will be accomplished using an auger rig that drives hollow-stem augers and is fitted with a continuous sampler system. However, in an effort to minimize the generation of waste (cuttings from augering), mechanical drive core drilling systems are also being considered for those specific sites where the management of hazardous or radioactive wastes are likely.

Core samples will be collected using a 5 ft-long continuous sampler with an inner liner. Auger and sampler diameters may vary depending on the media to be drilled and the specific sample that is required. Each sampling plan gives a nominal depth for each borehole; the borehole will be sampled to at least that depth, at 5-ft intervals. If contamination is detected by field screening or field laboratory measurements in the last interval above the nominal depth, sampling will continue at 5-ft intervals until contamination has dropped to at least background levels or twice the planned nominal depth of the borehole has been reached. The investigation will proceed to Phase II if contamination above background is still detected at twice the planned depth of the borehole. This stop criterion will be used for all boreholes sampled to ensure complete information on contaminant depth. In addition, the analytical set specified in each sampling plan will be followed for the complete depth of the borehole.

The applicable SOPs are LANL-ER-SOP-04.01, Drilling Methods and Drill Site Management, and Field Logging, Handling, and Documentation of Borehole Materials (in preparation) (LANL 1993, 0875). Also refer to Table D-3 for additional sample handling SOPs that are applicable to core sample management.

4.3.2 Angled Boreholes

Angle drilling is employed to access contaminant locations when placement of the rig directly over the point of interest is not feasible. As for vertical core sampling, a 5-ft core interval is specified as the standard sample with the same stop criterion as for vertical boreholes. The air rotary drilling system will be utilized for the angled holes at OU 1140. In setting up for angle drilling, the drill rig will begin a borehole at a location specified in the sampling plan. The drilling angle and direction specified in the sampling plan will direct the drill string beneath the area to be investigated at the desired depth. The applicable SOP is LANL-ER-SOP-04.01, Drilling Methods and Drill Site Management, and LANL-ER-SOP-12.01, Field Logging, Handling, and Documentation of Borehole Materials. Also refer to Table D-3 for additional sample handling SOPs that are applicable to core sample management.

4.4 Sludge or Sediment

Sludge or sediment samples will be collected from sewage lagoons and a natural pond at TA-46. Several techniques are available for the collection of sludge and sediment samples, such as a hand corer, spade and scoop, or Ponar grab. The most appropriate method will be selected by the field team at each PRS sampled for sludge. The applicable SOP is LANL-ER-SOP-06.14, Sediment Material Collection.

5.0 FIELD SCREENING

Field screening measurements are applied at the point of sample collection, in borehole headspace, and in excavations to identify gross contamination and to assess conditions affecting the health or safety of field personnel. Application of screening for personnel health and safety is detailed in Annex III of this work plan. Individual sampling plans may not explicitly identify the use or role of sample screening measurements; however, the standard analytical table for each investigation will show the methods to be used (see Section 8.0 of this appendix).

In general, every sample taken at TA-46 will be screened for gamma, beta, and alpha radioactivity; and organic vapors. In addition, a non-instrument form of sample screening, lithologic logging, will be performed for all borehole and some near-surface samples. In addition to the role of sample screening to identify gross contamination or situations of concern for health and safety, field screening information (Level I data) will be used to direct sampling and to guide in the selection of analysis activities.

5.1 Radiological Screening

5.1.1 Gross-Gamma Radiological Screening

Field screening of samples for gross-gamma radioactivity will be done using a hand-held NaI detector probe and ratemeter. The detector is held close to the sample or core and is capable of identifying elevated concentrations of certain radionuclides as an increased ratemeter reading above instrument background levels. Quantification of the response is difficult and is best interpreted as a gross indicator of potential contamination.

5.1.2 Gross-Alpha Radiological Screening

Field screening of samples for gross-alpha radioactivity is conducted using a hand-held alpha scintillation detector and a ratemeter. The detector is held close to contact with the sample or core and is capable of detecting on the order of approximately 100-200 pCi/g for a damp soil sample. The instrument cannot identify specific radionuclides.

5.1.3 Gross-Beta Radiological Screening

Field screening of samples for gross beta radioactivity is conducted using a hand-held detector. A typical beta detector consists of a Geiger-Müeller tube with a thin mica window protected by a sturdy wire screen. The mica window thickness may vary from 1.4 to 2 mg/cm^2. The detector is held close to contact with the sample or core and is capable of detecting gross beta activity down to 40 keV. The gamma sensitivity of such a detector is approximately 3 600 cpm/mR/h. The beta efficiency with screen in place is 45% for strontium-90 and 10% for carbon-14. Screen removal will increase efficiency by 45%. The efficiencies are determined as percentage of 2π emission rate, from a 1 in. diameter source. This beta detector is alpha sensitive above 3 MeV.

5.2 Nonradioactive Screening

5.2.1 Organic Vapor Detectors

Organic vapor detectors will be used to screen borehole cores and soil samples at the point of collection to identify grossly contaminated samples. Two types of detectors, photoionization detector (PID) and flame ionization detector (FID), will be used to improve the probability of detecting a wide range of vapors and are described in Subsection 4.2 of this appendix.

Organic vapor detectors will be used to monitor breathing zones for personnel safety in sample collection and handling areas at OU 1140 sites. PID and FID detectors will be used to survey a wide range of organic vapors as described below:

- **PID.** A Model PI 101 PID, or its equivalent, will be used. It is a general survey instrument capable of detecting real-time concentrations of many complex organic compounds and some inorganic compounds in air. The instrument can be calibrated to a particular compound; however, it cannot distinguish between detectable compounds in a mixture of gases. See Table D-3 for information on the applicable SOP.

- **FID.** A Foxboro Model OVA-128, or its equivalent, will be used. It is a flame ionization detector that can be used as a general screening instrument to detect the presence of many organic vapors. Its response to an unknown sample is relative to the response to a gas of known composition to which the instrument has been calibrated. See Table D-3 for information on the applicable SOP.

- **Combustible Gas/Oxygen Detector.** A Gastech Model 1314 or its equivalent will be used to determine the potential for combustion or explosion of unknown atmospheres during drilling and intrusive activities. A typical combustible gas indicator (CGI) determines the level of organic vapors and gases present in an atmosphere as a percentage of the lower explosive limit or lower flammability limit. The Gastech Model 1314 also contains an oxygen detector to determine atmospheres that are deficient or enriched in oxygen. For health and safety purposes, the CGI will be used (if appropriate) to monitor atmospheres during some intrusive activities. See Table D-3 for information on the applicable SOP.

5.2.2 X-Ray Fluorescence Probe for Metals

X-ray fluorescence (XRF) is a technique for analyzing elements only; it cannot distinguish chemical form (i.e., metallic, salt, organic compound, oxide). It is useful for quick identification of many elements above atomic number 15. The instrument consists of a source for sample excitation, a detector or proportional counter, a sample chamber, and an energy analyzer. In operation, dried soil or crushed debris samples are placed in the sample chamber, excited, and counted for a defined period, usually 200 seconds. Detection limits are dependent upon the analyte, choice of excitation source, and sample preparation, principally homogeneity.

In this sampling plan, field XRF will be used to screen for target analyte list (TAL) elements in solid samples to facilitate choice of samples to send for fixed-laboratory analysis. Field XRF for elemental screening has limitations as follows: of TAL elements XRF cannot detect beryllium, and detection limits on mercury and arsenic are below SALs. Some detectors have a cadmium interference. Nonetheless, XRF screening is valuable for many PCOCs, such as lead, silver, and chromium. At this time, the Laboratory ER Program is investigating other field screening methods, such as laser-induced breakdown spectroscopy (LIBS), for a variety of metals; and field spot tests for beryllium and mercury.

5.2.3 PCBs

Portable enzyme-linked immunosorbent assay kits will be used to identify areas of polychlorinated biphenyl (PCB) contamination in the field. The technique will use PCB-RISc kits following the manufacturer's instructions and the draft SW-846 Method 4020. The method is designed to provide indication of PCB contamination above 5 ppm. Selected confirmation samples for laboratory analysis will be collected from areas to confirm the results of the PCB screening kits.

5.2.4 Lithological Logging

Lithological logging of drill core will be performed to describe the physical nature of near-surface and subsurface samples. Lithological logging will be performed by a geologist capable of describing subsurface lithologies and differentiating the various strata of the Bandelier Tuff. A complete soil log will be generated for those samples collected in the potential wetlands area at the lower sections of the canyon bottoms. These hand auger and thin-wall tube sampler samples must be logged to determine if they are representative of hydric soils. This logging of the soils will be conducted in conformance with the lithologic logging SOP (see Table D-3).

6.0 FIELD LABORATORY ANALYSIS

Field laboratory methods result primarily in Level II data, although some are Level I (more qualitative) or near Level III (more quantitative). These techniques generally provide better quality information, including lower detection limits, than can be obtained with field screening.

The three major uses of field laboratory data are:

- To aid in the course of fieldwork, thereby increasing the efficiency of field operations. As an example, field laboratory measurements can be used to determine when to cease drilling a borehole.

- To focus more quantitative analytical efforts on the key samples. Depending on the goals of the investigation, samples having particular characteristics can be selected; for example, those with no detectable contaminants to assess the edge of a plume; those with the highest levels of contaminants to ascertain sources.

- To quickly and cost-effectively analyze a large number of samples for easily detectable contaminants. This can reduce the number of samples that must be sent for more costly analysis by the analytical laboratory. The large number of lower-quality measurements provides a broad base of comparison for the few high-quality measurements, which helps determine if the latter are representative and sufficient for decision making.

6.1 Radiological Measurements

6.1.1 Gross Alpha

Measurements of gross alpha radioactivity can be used to ascertain the presence of plutonium, uranium, and thorium in samples, but not to identify individual radionuclides. A typical method uses dried soil samples in a fixed geometry. Level II measurements can detect alpha-emitting radionuclides at concentrations on the order of 25 to 40 pCi/g, sufficient for guiding field operations or selection of samples for further analysis. Typical measurement times are 15 to 20 minutes per sample using large-area, zinc-sulfide, alpha scintillation detectors and a scaler. A Model 43-10 alpha scintillation detector, or the equivalent, and a Ludlum Model 2200 scaler, are appropriate.

6.1.2 Gamma Spectrometry

Gamma-ray spectrometry can be used to quantify particular radionuclides present in soil samples, such as cesium-137, cobalt-60, and uranium-234, -235, and -238. It can also detect the 60-keV gamma ray from americium-241. Rapid-turnaround analysis can be Level II or close to Level III quality, using personal-computer-based, multi-channel analyzers (MCA) and NaI or germanium photon detectors; for example, a Canberra MCA with a Ludlum 44-10 NaI detector. Many equivalent instruments are available. Dried soil samples in fixed geometries can be analyzed in 20 to 30 minutes with detection limits on the order of 5 pCi/g for radionuclides such as cesium-137.

6.2 Organic Chemical Measurements

6.2.1 Volatile Organic Compounds

Rapid-turnaround analysis for volatile organic compounds at Level II quality is needed to guide field operations such as drilling. An instrument that can distinguish between compounds, such as the Laboratory's transportable purge-and-trap gas chromatograph/mass spectrometer (GC/MS), is preferred because it can provide qualitative and quantitative analyses of most volatile organic compounds with low or slight solubility in water (boiling points below

200°C). Volatile water-soluble compounds can also be detected, with higher detection limits.

6.2.2 PCBs

An inexpensive, fast-turnaround technique that can measure PCB levels less than the regulatory limit (25 ppm), using numerous Level II analyses to minimize the need for Level III data from an analytical laboratory, will be needed to establish the presence of contamination. Field laboratory techniques are available that provide quick turnaround and detection down to 10 ppm. Instruments use a chloride-specific electrode to quantify PCBs in oil or soils. Samples are prepared by extracting the PCBs from the soil and reacting the sample with a sodium reagent; this transforms the PCBs into chloride, which can be quantified by the instrument. Oil samples take about 5 minutes to prepare, soil samples about 10 minutes. Documented field laboratory procedures for measurement of PCBs will be used.

6.3 Soil Moisture Measurement

The water content of undisturbed core is measured by weighing the moisture lost during oven drying. Bulk density, dry density, and porosity values may also be calculated from gravimetric water content data. It should be noted that this analysis is presently planned to be performed in the field laboratory; however this capability is not currently available in that lab. We assume that the capability will be developed prior to collecting samples from the field. Technique to be followed is given in LANL-ER-SOP-11.01. Measurement of Bulk Density, Dry Density, Water Content, and Porosity in Soil.

6.4 Downhole Geophysical Measurements

Downhole geophysical logging may be performed in both vertical and shallow-angle boreholes to enhance information obtained from geologic descriptions. The logs will help identify and map the orientation of the fractures and joints and define the relative variation in moisture and bulk density. All geophysical logging will be performed in accordance with either LANL-ER-SOPs or standard field practices. The following geophysical logging may be performed at OU 1140:

- neutron moisture log

- caliper log
- spectral gamma log
- televiewer log
- deviation log
- gamma gamma density log

7.0 LABORATORY ANALYSIS

As described in Section 2.0 of this appendix, samples to be submitted to an analytical laboratory will be coordinated, handled, and tracked by the ER Program Sample Coordination Facility.

The following list provides references for methods and analytical levels for the parameters which appear in the laboratory analysis columns of the screening and analysis summary tables for each aggregate (see Section 8.0).

Gamma spectroscopy. Radionuclides will be quantified by measurement of photon emissions. Quantitation limits are given in LANL-ER-QAPjP, Table V.8 (LANL 1991, 0553).

Isotopic uranium. Chemical separation of plutonium from soil is followed by alpha spectrometry to quantify each isotope of uranium. Quantitation limits are given in LANL-ER-QAPjP, Table V.8 (LANL 1991, 0553).

Isotopic plutonium. Chemical separation of plutonium from soil is followed by alpha spectrometry to quantify each isotope of plutonium. Quantitation limits are given in LANL-ER-QAPjP, Table V.8 (LANL 1991, 0553).

Isotopic thorium. Chemical separation of thorium from soil is followed by alpha spectrometry to quantify each isotope of thorium. Quantitation limits are given in LANL-ER-QAPjP, Table V.8 (LANL 1991, 0553).

Volatile organic compounds (SW-846 Method 8240). EPA standard method for quantification of volatile organic compounds. The standard list of analytes and quantitation limits is given in LANL-ER-QAPjP, Table V.4 (LANL 1991, 0553).

Semivolatile organic compounds (SW-846 Method 8270). EPA standard method for quantification of semivolatile organic compounds. The standard list of analytes and quantitation limits is given in LANL-ER-QAPjP, Table V.4 (LANL 1991, 0553).

PCBs and Organochloride Pesticides (SW-846 Method 8080 A). Method 8080 A is the standard EPA method for quantification of organochlorine pesticides and PCBs. Quantitation limits are given in Tables 1 and 2 of Method 8080 A (EPA 1990, 11-240).

Metals (SW-846 Method 6010). EPA standard method for quantification of metals. The standard suite of metals to be analyzed for at OU 1140 unless otherwise stated is: beryllium, cadmium, lead, chromium, and silver. Mercury is analyzed by Method 7471 [mercury in solid or semisolid waste (manual cold-vapor technique)]. Mercury analysis is specified at those PRSs where spills are documented in the archival record. Quantitation limits are given in LANL-ER-QAPjP, Table V.7 (LANL 1991, 0553).

TCLP (SW-843 Method 1311). Procedure for determining the potential mobility of inorganics and organics in liquid, solid, and multi-phase wastes. Maximum concentrations of contaminants for the toxicity characteristic are listed in 40 CFR 261.24. Methods for analyzing extracts and quantitation limits are given in LANL-ER-QAPjP, Tables V.4, V.5, and V.7 (LANL 1991, 0553).

Asbestos. EPA standard method for quantification of asbestos in soil, Method (EPA-600/M4-82-020).

8.0 SCREENING AND ANALYSIS SUMMARY TABLE

A standard table is used in this work plan to identify screening and analysis requirements, including the number of samples and types of analyses needed. Table D-2 is an example of a screening and analysis summary table, referred to in several sections of this annex.

The table is a single view of an electronic data base that has been developed to accumulate a prodigious amount of sample collection information. The summary tables that appear in each sampling plan are augmented by detailed sample data sheets that reflect specific field sample collection methods, field sample to analytical sample ratios, and estimated laboratory analysis costs. These sample data base summary sheets may be found in Appendix E.

8.1 PRS and Investigation Approach

The three columns on the left side of Table D-2 identify, by PRS (SWMU, area of concern, aggregate, or other logical sampling unit such as outfall identifier), the PRS type (a brief description of the PRS) and the investigative approach at this PRS (reconnaissance or VCA).

8.2 Field Surveys

The fourth through sixth columns of Table D-2 identify field surveys. These are primarily engineering mapping activities or walking surveys of the land surface, using direct reading or recording instruments. For OU 1140 these surveys will include geodetic and geomorphologic surveys, radiation surveys, and geophysical surveys. The radiation surveys will consist of the evaluation of low-level gamma radiation. Geophysical surveys will include electromagnetic and ground penetrating radar.

8.3 Samples

The seventh through fourteenth columns of Table D-2 identify samples and duplicate samples (see Subsection 2.8, Quality Control Samples). Individual columns indicate whether samples are to be collected from structures, surface, or subsurface domains. All sampling techniques are associated with a primary domain but may yield samples from multiple domains. Hand auger samples, for example, will always yield a surface component in addition to the near-surface and subsurface component. Single or multiple specimens may be created from a sample. For example, a soil sample collected in the field will normally represent only one specimen, whereas a subsurface core will provide many specimens. This section of the table includes a column to identify the sampled media (i.e., soil, tuff, sludge) and the numbers of samples and quality duplicates collected for each PRS or sampling unit.

8.4 Field Screening

Columns fifteen through twenty-one of Table D-2 indicate which field screening is to be performed. Field screening measurements are taken at the point of sample collection, in borehole headspace, and in excavations to identify gross contamination and to assess conditions affecting health and safety of field personnel. Specific field screening categories at OU 1140 include; gross alpha and gamma, organic vapors, combustible gas/oxygen, XRF, explosives, and lithologic logging.

8.5 Field Laboratory Measurements

Table columns twenty-two through twenty-seven of Table D-2 designate field laboratory analyses to be performed. The field laboratory is to obtain rapid-turnaround analysis of samples, using a limited number of relatively simple analytical methods. Specific field laboratory categories applicable to work at OU 1140 include; gross alpha, volatile organic compounds by gas chromatography/mass spectrometry, polychlorinated biphenyls, and gamma spectrometry.

8.6 Laboratory Analysis

Columns twenty-eight through forty-three of Table D-2 designate full laboratory analyses that are to be performed on specimens. The lack of existing data from a PRS creates the need to verify the presence of a wide spectrum of possible contaminants. Analytical laboratories that are not located in the field provide the highest quality (Level III/IV) data; all samples submitted to an analytical laboratory will be handled and tracked by the ER Program Sample Coordination Facility. See Section 7.0 for a complete list of the laboratory analysis methods that will be performed at OU 1140.

REFERENCES

EPA (US Environmental Protection Agency), January 1990. "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," SW-846, Revision 1, Third Edition, Washington, D.C. **(EPA 1990, 11-240)**

EPA (US Environmental Protection Agency), March 1987. "Data Quality Objectives for Remedial Response Activities, Development Process," EPA 540/G-87/003, OSWER Directive No. 9355.0-7B, prepared by CDM Federal Programs Corporation, Washington, DC. **(EPA 1987, 0086)**

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), November 1992. "Installation Work Plan for Environmental Restoration," Revision 2, Los Alamos National Laboratory Report LA-UR-92-3795, Los Alamos, New Mexico. **(LANL 1992, 0768)**

LANL (Los Alamos National Laboratory), January 1993. "Environmental Restoration Standard Operating Procedures," Los Alamos, New Mexico. **(LANL 1993, 0875)**

New Mexico Board of Registration for Professional Engineers and Surveyors, November 1, 1989. "Minimum Standards for Land Surveying in New Mexico." **(New Mexico Board of Registration for Professional Engineers and Surveyors, 1989, 11-236)**

Appendix E

Sample Data Base

SAMPLE DATA BASE

During the preparation of the Operable Unit (OU) 1140 Work Plan, a data base was developed to manage information collected and generated on individual potential release sites (PRSs). This data base includes information on historic operations, engineering design, potential contaminants of concern (PCOCs), and sampling parameters (e.g., numbers and analytes). Additional detailed information that will be of use later in the Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) is being added to the data base, a living document that will evolve throughout the duration of this RFI. This appendix features portions of the data base relevant to sampling decisions.

During development of the work plan for OU 1140, PRSs were aggregated by similar risk scenarios and sampling approaches. Sampling plans were developed with the recognition that sample points would overlap between aggregates. Only after all the sample plans were developed and sample locations shown on a single map (Map H-2) could the overlapping samples be known.

An important sampling objective is to minimize both the number of samples taken and analyses performed without reducing either the quality or number of data points available for a PRS. This objective will be accomplished by evaluating each sample-location point to determine if an adjacent point, or points, can be eliminated. When sample locations from multiple PRSs are consolidated, the analyte suite must include all appropriate PCOCs to support a decision for all relevant PRSs.

Some adjacent or overlapping sample locations will be identified that cannot be eliminated without violating the data quality objectives. Wherever possible, data generated from such points will be utilized for making decisions for multiple PRSs at little or no additional cost. In such instances, the analyte suite for a particular sample location will include the appropriate PCOCs to support a decision for all relevant PRSs.

Because samples for some PRSs will be collected within several aggregates, a decision made for a specific PRS may need to incorporate data from multiple sampling plans. Table E-1 illustrates the sample domain summary for PRSs. Table E-2 correlates sample-location points with overlapping PRSs. Table E-3 lists all sample points that may be used to make a PRS decision. Table E-4 illustrates the selection of analyte suites for sample locations. Tables E-1, E-3, and E-4 are examples and are not complete listings for all PRSs because a complete compilation would be too long. A description of each data base table is included below.

Table E-1, OU 1140 PRS-Specific Site Survey and Sampling Summary

This table presents site survey and sampling information for each PRS based on Chapter 5 sampling requirements. For purposes of this appendix, Table E-1 contains only examples of the data base, because a complete compilation would be too long. The following explanations are arranged by the order of headers (left to right) in Table E-1.

PRS: The table is first arranged by PRS number and then by the PRS sample group. Each PRS may have several associated sampling events. The purpose of having the PRS number is to allow for a compilation, by PRS, of sample locations and number of samples.

PRS/Samp. Group: The PRS sample group is identified by the PRS number followed by a hyphen and a number. For example, the first PRS sample group for PRS 46-002 is 46-002-1. However, if the sampling is for waste characterization, a sample group number is not designated. The PRS sample group allows for differentiation between sampling events at a particular PRS.

Outfall Field ID: Outfall field identification letters are given for those PRS sample groups that have outfalls associated with sampling, e.g., Outfalls II and JJ are associated with PRS sample group 46-002-1. The outfall field identification letters have been designated in the work plan and the outfalls are located on the site map.

SWMU/Outfall Type, Sample Notes: This column lists the type of sampling and general location of the PRS sample group. It also details the number and type of samples. For example, sampling at PRS sample group 46-002-1 will be conducted at the outfall pipe. Ten sample holes will be hand-augered and three samples will be taken from each hole.

Phase I Approach: This column identifies the purpose of conducting the sampling. These approaches are described in Chapter 4 of this work plan and are summarized here. For OU 1140, the Phase I approaches are reconnaissance sampling and voluntary corrective action (VCA). Reconnaissance sampling provides the type and quality of data needed to distinguish PRSs that merit further investigations from PRSs that are appropriate candidates for no further action (NFA). When VCAs are implemented, sufficient data will be collected to determine whether contaminant levels at the excavation site are below an acceptable risk-based limit in order to qualify for NFA.

Field Surveys: The three types of field surveys that may be performed at OU 1140 are land, geophysics, and radiation surveys. This column is divided into three sections and, if there is a number 1 in a column, then that type of survey will be performed. At the PRS sample group 46-002-1, land and radiation surveys will be performed.

Sampling-Group Information: This section is divided into nine subheadings, summarized below.

Sampled Media: The media to be sampled are identified. These media are sediments, sludge, soil, tuff, debris, or liquids.

Structure, Surface, Subsurface: These headings indicate where sampling will be conducted and the number of locations that will be sampled. A structure can include lagoons, septic tanks, and dry wells. Surface and subsurface indicate that the samples will be taken either at the surface (0 to 6 in.) or below the surface (below 6 in.). The number of sample locations corresponds with the information in the SWMU/Outfall Type, Sample Notes column except for waste characterization samples. At PRS sample group 46-002-1, ten subsurface locations will be sampled.

Sample Type: Sample types are indicated by the following:

H	Hand auger location
NS	Near surface samples
SS	Sediment samples
SAB	Shallow angle borehole

S	Surface soil samples
V	Vertical borehole
WC	Waste characterization

Sample Location ID: The sample location identification number is an alpha-numeric identifier. The letters correspond to the sample type and the numbers correspond to locations. The sample location identification numbers are indicated on the site map (Map H-2). PRS sample group 46-002-1 has ten sample location identification numbers that correspond to the ten hand-augered sample holes.

Samples per Location: This column identifies the number of samples that will be taken per location. This number corresponds with the information in the SWMU/Outfall Type, Sample Notes column except for waste characterization samples. PRS sample group 46-002-1 has ten sample locations and three samples will be taken per location.

Number of Samples: This column identifies the total number of samples that will be taken. It is the product of the number of sample locations and the number of samples taken per sample location.

Sample Dup.: A sample duplicate is taken for every 20 samples. For PRS sample group 46-002-1, there are 30 samples and 1 duplicate sample.

Sampling Totals for PRS: This section gives the total number of sample locations, samples, duplicates by sample location, and duplicates by PRS for each PRS.

Aggregate: This column gives the work plan location of the PRS sample group description.

Table E-2, OU 1140 Sample Locations

Table E-2 correlates sample locations with all associated PRSs and outfalls. This is important at OU 1140 because of the congested nature of the area. Also, as the work plan was developed, each PRS was considered separately. This data base serves to compile all of the information in one table and eliminate the possibility of sampling overlap. A sample point may have up to 14 different PRSs associated with it. Most sample points have more than one associated PRS. This data base provides a quick reference guide to sample locations, PRSs, outfalls, aggregates, and corresponding work plan section(s). This table is a complete listing of all sample locations.

The sample locations are identified with an alpha-numeric indicator. The letters correspond to the sample type, which are defined above in the description for sample type in Table E-1 and on the site map (Map H-2). The numbers correspond to locations. The sample location identification numbers are indicated on the site map. The work plan section in which the sample location is discussed is listed to provide the reader an easy access to information. All PRSs associated with a sample location are in the Overlapping PRSs column. The first PRS listed in association with a sample location is considered the primary PRS because the sample location will be listed with only that PRS in Table E-1. The other PRSs need to be considered for laboratory analyses, field surveys, and field screening purposes. If sample locations overlap, then one location will be deleted. In other cases, sample locations may have been deleted for reasons explained in Chapter 5. There are 352 proposed sample locations; however, Table E-2 indicates that 52 locations do not need to be sampled due to overlap or another reason, so there are 350 sample locations.

Table E-3, OU 1140 PRS Sample Locations Summary

Table E-3 lists all sample locations that may be used to make a PRS decision. Table E-3 is directly related to Table E-2, but is arranged differently. This table is presented with examples only, because a complete compilation would be too lengthy.

Table E-4, OU 1140 Sample Locations, Surveys, and Analyses

Table E-4 identifies PRSs, field surveys, field screening, field analyses, and laboratory analyses associated with each sample location. This table ensures that all PCOCs for each PRS associated with a sample location are analyzed. It also ensures that the proper field surveys, field screening, and field analyses are performed.

The table is divided into six sections: Sample Location, PRS, Field Surveys, Field Screening, Field Laboratory, and Laboratory Analyses. If a number one is indicated in the top field of any of the latter four sections, then that activity must be performed for the sample location. All activities for a PRS are indicated by a number one horizontally from the PRS number. The field surveys, field screening, field analyses, and laboratory analyses for each PRS are rolled up at the top of the table to concisely present the activities associated with each sample location.

Table E-1
OU 1140 PRS Specific Site Survey and Sampling Summary

Sampling Totals for PRS: 46-002

Total Sample Locations	37
Total Number Of Samples	87
Sample dups by Sample Location	2
Sample dups by PRS	4

	PRS	PRS/ Samp. Group	Outfall Field ID	SWMU/Outfall Type, Sample Notes	Phase 1 Approach	Field Surveys			Sampled Media	Sampling-Group Information								Aggregate
						Land Survey	Geophysics	Radiation		Structure	Surface	Subsurface	Sample Type	Sample Location I. D.	Samples Per Location	Number of Samples	Sample dup	
(1)	46-002			Sewage Lagoon Liner Samples from excavated material.	VCA-WC			1	Sludge	10	☐	☐	WC		1	10	0	5.2
(2)	46-002	46-002-1	II JJ	Outfall-pipe 10 hand-augered sample holes x (3) specimens	Reconn	1		1	Sediments	☐	☐	10	H	H-133 H-134 H-135 H-136 H-137 H-138 H-139 H-140 H-141 H-142	3	30	1	5.4
(3)	46-002	46-002-2		Sewage lagoon Two Sludge samples from center of lagoon.	Reconn	1	1	1	Sludge/Sediment	2	☐	☐	SS	SS-8 SS-9	1	2	0	5.2
(4)	46-002	46-002-3		Sand Filters Three surface samples from three sections of sand filter.	Reconn	1	1	1	Soil/Sediment	3	☐	☐	SU	S-77 S-78 S-79	1	3	0	5.2

Table E-1
OU 1140 PRS Specific Site Survey and Sampling Summary

Sampling Totals for PRS: 46-002

Total Sample Locations	37
Total Number Of Samples	87
Sample dups by Sample Location	2
Sample dups by PRS	4

	PRS	PRS/ Samp. Group	Outfall Field ID	SWMU/Outfall Type, Sample Notes	Phase 1 Approach	Field Surveys			Sampling-Group Information										Aggregate
						Land Survey	Geophysics	Radiation	Sampled Media	Structure	Surface	Subsurface		Sample Type	Sample Location I. D.	Samples Per Location	Number of Samples	Sample dup	
(5)	46-002	46-002-4		Lagoon Syst. Perimeter Six surface soil samples from perimenter of sand filters.	Reconn	1	1	1	Soil/Tuff	☐	6	☐		SU	S-57 S-58 S-60 S-64 S-85 S-66	1	6	0	5.2
(6)	46-002	46-002-5		Sewage Lagoon 150 ft shallow angle borehole (1 specimen / 5 ft run, and one at TD)	Reconn	1	1	1	Tuff /Corehole	☐	☐	1		SAB	SAB-1 SAB-1a	31	31	1	5.2
(7)	46-002	46-002-6		Siphon Tank One sludge sample from center of siphon tank.	Reconn	1	1	1	Sludge/Sediment	1	☐	☐		SS	SS-11	1	1	0	5.2
(8)	46-002	46-002-7		Lagoon Syst. Perimeter Four surface soil samples into exposed surface beineath removed lagoon liner.	Reconn	1	1	1	Soil/Tuff	4	☐	☐		SU	S-53 S-54 S-55 S-56	1	4	0	5.2

Table E-1
OU 1140 PRS Specific Site Survey and Sampling Summary

Sampling Totals for PRS: 46-003-a

Total Sample Locations 16
Total Number Of Samples 44
Sample dups by Sample Location 1
Sample dups by PRS 2

						Field Surveys			Sampling-Group Information										
	PRS	PRS/ Samp. Group	Outfall Field ID	SWMU/Outfall Type, Sample Notes	Phase 1 Approach	Land Survey	Geophysics	Radiation	Sampled Media	Structure	Surface	Subsurface		Sample Type	Sample Location I. D.	Samples Per Location	Number of Samples	Sample dup	Aggregate
(1)	46-003-a	46-003-a-1	HH	Outfall-pipe	Reconn	1		1	Sediments	☐	☐	7		H	H-103 H-104 H-105 H-106 H-107 H-108 H-109	3	21	1	5.4
				7 hand-augered sample hole x (3) specimens.															
(2)	46-003-a	46-003-a-2		Septic Sys./Tank	Reconn	1	1	1	Sludge/Tuff	1	☐	☐		V	V-26	3	3	0	5.1
				One borehole thru center of tank (TA-46-8) collect continuous core in 5 ft runs to 15 ft TD. One VOA per 5 ft, one homogenized sample per 5 ft for metals, rad, semi-VOA.															
(3)	46-003-a	46-003-a-3		Septic Sys./Manhole	Reconn	1	1	1	Sludge/ Sediment	2	☐	☐		SS	SS-3 SS-14	1	2	0	5.1
				Collect two 500 ml sludge/sediment samples from opposite sides of interior of manhole (TA-46-6).															
(4)	46-003-a	46-003-a-4		Septic Sys./Dist. Box	Reconn	1	1	1	Sludge/Tuff	1	☐	☐		V	V-29	3	3	0	5.1
				One borehole thru center of box (TA-46-9) collect continuous core in 5 ft runs to 15 ft TD. One VOA per 5 ft, one homogenized sample per 5 ft for metals, rad, semi-VOA.															

Table E-1
OU 1140 PRS Specific Site Survey and Sampling Summary

Sampling Totals for PRS: 46-003-a

Total Sample Locations	16
Total Number Of Samples	44
Sample dups by Sample Location	1
Sample dups by PRS	2

					Field Surveys			Sampling-Group Information									
	PRS	PRS/ Samp. Group	Outfall Field ID	SWMU/Outfall Type, Sample Notes	Phase 1 Approach	Land Survey	Geophysics	Radiation	Sampled Media	Structure	Surface	Subsurface	Sample Type	Sample Location I. D.	Samples Per Location	Number of Samples	Sample dup	Aggregate
(5)	46-003-a	46-003-a-5		Septic Sys./Dist. Box	Reconn	1	1	1	Sludge/Tuff	1	☐	☐	V	V-32	3	3	0	5.1
				One borehole thru center of box (TA-46-10) collect continuous core in 5 ft runs to 15 ft TD. One VOA per 5 ft, one homogenized sample per 5 ft for metals, rad, semi-VOA.														
(6)	46-003-a	46-003-a-6		Septic Drain field	Reconn	1	1	1	Soil/Tuff	☐	☐	4	V	V-28 V-30 V-31 V-33	3	12	0	5.1
				Four boreholes into drain field branches, collect continuous core in 5 ft runs to 15 ft TD. One VOA per 5 ft, one homogenized sample per 5 ft for metals, rad, semi-VOA.														

Table E-1
OU 1140 PRS Specific Site Survey and Sampling Summary

Sampling Totals for PRS: 46-003-d

Total Sample Locations 39
Total Number Of Samples 39
Sample dups by Sample Location 1
Sample dups by PRS 2

						Field Surveys				Sampling-Group Information								
	PRS	PRS/ Samp. Group	Outfall Field ID	SWMU/Outfall Type, Sample Notes	Phase 1 Approach	Land Survey	Geophysics	Radiation	Sampled Media	Structure	Surface	Subsurface	Sample Type	Sample Location I. D.	Samples Per Location	Number of Samples	Sample dup	Aggregate
(1)	46-003-d			Septic System-WC Samples from excavated material and structure(s).	VCA-WC			1	Soil/Tuff	30			WC		1	30	1	5.1
(2)	46-003-d	46-003-d-1		Septic Sys./Tank Two surface samples beneath septic tank, one bebeath distribution box, one adjacent to tank-box drainline.	VCA	1	1	1	Soil/Tuff		4		SU	S-21 S-23 S-80 S-81	1	4	0	5.1
(3)	46-003-d	46-003-d-2		Septic Drain field Five surface soil samples at drain field excavation.	VCA	1	1	1	Soil/Tuff		5		SU	S-18 S-19 S-20 S-22 S-24	1	5	0	5.1

Table E-1
OU 1140 PRS Specific Site Survey and Sampling Summary

Sampling Totals for PRS: 46-003-f

Total Sample Locations	15
Total Number Of Samples	36
Sample dups by Sample Location	0
Sample dups by PRS	2

						Field Surveys				Sampling-Group Information									
	PRS	PRS/ Samp. Group	Outfall Field ID	SWMU/Outfall Type, Sample Notes	Phase 1 Approach	Land Survey	Geophysics	Radiation	Sampled Media	Structure	Surface	Subsurface	Sample Type	Sample Location I. D.	Samples Per Location	Number of Samples	Sample dup	Aggregate
(1)	46-003-f	46-003-f-1	FF	Outfall-pipe 6 hand-augered sample hole x (3)specimens .	Reconn	1		1	Sediments			6	H	H-117 H-118 H-119 H-120 H-121 H-122	3	18	0	5.4
(2)	46-003-f	46-003-f-2		Septic Sys./Tank One borehole thru center of tank (TA-46-94) collect continuous core in 5 ft runs to 15 ft TD. One VOA per 5 ft, one homogenized sample per 5 ft for metals, rad, semi-VOA.	Reconn	1	1	1	Sludge/Tuff	1			V	V-45	3	3	0	5.1
(3)	46-003-f	46-003-f-3		Septic Sys./Manhole One borehole thru center of manhole (TA-46-95) collect continuous core in 5 ft runs to 15 ft TD. One VOA per 5 ft, one homogenized sample per 5 ft for metals, rad, semi-VOA	Reconn	1	1	1	Sludge/Tuff	1			V	V-50	3	3	0	5.1
(4)	46-003-f	46-003-f-4		Septic Sys./Dist. Box One borehole thru center of distribution box (TA-46-97)collect continuous core in 5 ft runs to 15 ft TD. One VOA per 5 ft, one homogenized sample per 5 ft for metals, rad, semi-VOA.	Reconn	1	1	1	Sludge/Tuff	1			V	V-52	3	3	0	5.1

Table E-1
OU 1140 PRS Specific Site Survey and Sampling Summary

Sampling Totals for PRS: 46-003-f

Total Sample Locations	15
Total Number Of Samples	36
Sample dups by Sample Location	0
Sample dups by PRS	2

	PRS	PRS/ Samp. Group	Outfall Field ID	SWMU/Outfall Type, Sample Notes	Phase 1 Approach	Field Surveys			Sampling-Group Information									Aggregate
						Land Survey	Geophysics	Radiation	Sampled Media	Structure	Surface	Subsurface	Sample Type	Sample Location I. D.	Samples Per Location	Number of Samples	Sample dup	
(5)	46-003-f	46-003-f-5		Sand filter Three boreholes to 5 ft into tuff, one specimen from highest field screening reading one from TD.	Reconn	1		1	Soil/Tuff	☐	☐	3	V	V-21 V-22 V-24	2	6	0	5.1
(6)	46-003-f	46-003-f-6		Sand filter Three surface soil samples, locations based upon field screening.	Reconn	1		1	Soil	☐	3	☐	SU	S-71 S-72 S-73	1	3	0	5.3

Table E-1
OU 1140 PRS Specific Site Survey and Sampling Summary

					Field Surveys			Sampling Group Information									
	PRS	PRS/ Samp. Group	Outfall Field ID	SWMU/Outfall Type, Sample Notes	Phase 1 Approach	Land Survey	Geophysics	Radiation	Sampled Media	Structure	Surface	Subsurface	Sample Type	Sample Location I. D.	Samples Per Location	Number of Samples	Sample dup	Aggregate
(1)	46-007	46-007-1		Surface Disposal	Reconn	1		1	Soil		2		SU	S-14 S-15	1	2	0	5.3

Two surface soil samples, 0 to 6 in. in ditch south of TA-46-1.

Sampling Totals for PRS: 46-007

Total Sample Locations	2
Total Number Of Samples	2
Sample dups by Sample Location	0
Sample dups by PRS	0

Table E-1
OU 1140 PRS Specific Site Survey and Sampling Summary

Sampling Totals for PRS: 46-009-a

Total Sample Locations	12
Total Number Of Samples	54
Sample dups by Sample Location	1
Sample dups by PRS	3

						Field Surveys			Sampling-Group Information									
	PRS	PRS/ Samp. Group	Outfall Field ID	SWMU/Outfall Type, Sample Notes	Phase 1 Approach	Land Survey	Geophysics	Radiation	Sampled Media	Structure	Surface	Subsurface	Sample Type	Sample Location I. D.	Samples Per Location	Number of Samples	Sample dup	Aggregate
(1)	46-009-a	46-009-a-1		Landfill Six boreholes, assume 25 ft deep, 6 specimens per hole.	Reconn	1		1	Soil/Debris	☐	☐	6	V	V-16 V-18 V-19 V-20 V-15 V-17	6	36	1	5.5
(2)	46-009-a	46-009-a-2		Landfill Four hand augered holes, assume 3 specimens per hole.	Reconn	1		1	Soil/Debris	☐	☐	4	H	H-95 H-125 H-167 H-168	3	12	0	5.5
(3)	46-009-a	46-009-a-3		Landfill Two hand augered holes, assume 3 specimens per hole.	Reconn	1		1	Sediment/Soil	☐	☐	2	H	H-165 H-166	3	6	0	5.5

Table E-2
OU 1140 Sample Locations

	Sample Location	Section	Overlapping PRSs	Outfall
(1.)	H-1	5.3	not needed overlap w H-48	
(2.)	H-2	5.3	46-006-a	
			46-004-c2	S
(3.)	H-3	5.3	46-006-a	
			46-004-c2	S
(4.)	H-4	5.4	46-004-c2	P
			46-006-a	P
			Agg 5.6	P,AL
			46-007	AL
(5.)	H-5	5.4	46-004-c2	P
			46-006-a	P
			Agg 5.6	P,AL
			46-007	AL
(6.)	H-6	5.4	46-004-c2	P
			46-006-a	P
			Agg 5.6	P,AL
			46-007	AL
(7.)	H-7	5.4	46-004-c2	P,
			46-006-a	P
			Agg 5.6	P,AL
			46-007	AL
(8.)	H-8	5.4	46-004-g	N
			46-007	AN
			Agg 5.6	AN
			46-004-m	AN
(9.)	H-9	5.4	46-004-g	N
			46-007	AN
			Agg 5.6	AN
			46-004-m	AN
(10.)	H-10	5.4	46-004-m	M
			46-004-s	M
			46-004-b2	M
			46-006-f	M
			46-007	M
			46-008-b	M
			Agg 5.6	M
(11.)	H-11	5.4	46-004-m	CC,M
			46-004-s	X,M
			46-004-b2	U,M
			46-006-f	
			46-007	
			46-008-b	
			Agg 5.6	
(12.)	H-12	5.4	Agg 5.6	TT
(13.)	H-13	5.4	Agg 5.6	TT
(14.)	H-14	5.4	46-004-c2	P
			46-006-a	P
			Agg 5.6	P,AL
			46-007	AL
(15.)	H-15	5.4	46-004-c2	P
			46-006-a	P
			Agg 5.6	P,AL
			46-007	AL
(16.)	H-16	5.4	46-004-c2	P
			46-006-a	P
			Agg 5.6	P,AL
			46-007	AL
(17.)	H-17	5.4	46-004-c2	P
			46-006-a	P
			Agg 5.6	P,AL
			46-007	AL
(18.)	H-18	5.4	46-004-c2	P
			46-006-a	P
			Agg 5.6	P
			46-007	P
(19.)	H-19	5.4	46-004-c2	P
			46-006-a	P
			Agg 5.6	P
			46-007	P
(20.)	H-20	5.4	46-004-g	N
			46-007	AN
			Agg 5.6	AN
			46-004-m	AN
(21.)	H-21	5.4	46-004-g	N
			46-007	AN
			Agg 5.6	AN
			46-004-m	AN
(22.)	H-22	5.4	46-004-g	N
			46-007	AN
			Agg 5.6	AN
			46-004-m	AN
(23.)	H-23	5.4	46-004-g	N
			46-007	AN
			Agg 5.6	AN
			46-004-m	AN
(24.)	H-24	5.4	46-004-z	L
			46-006-d	L
			46-006-g	L

Table E-2
OU 1140 Sample Locations

	Sample Location	Section	Overlapping PRSs	Outfall
(25.)	H-25	5.4	46-004-z 46-006-d 46-006-g	L L L
(26.)	H-26	5.4	46-004-z 46-006-d 46-006-g	L L L
(27.)	H-27	5.4	46-004-z 46-006-d 46-006-g	L L L
(28.)	H-28	5.4	46-004-z 46-006-d 46-006-g	L L L
(29.)	H-29	5.4	46-004-z 46-006-d 46-006-g	L L L
(30.)	H-30	5.4	46-004-z 46-006-d 46-006-g	L L L
(31.)	H-31	5.4	46-004-z 46-006-d 46-006-g	L L L
(32.)	H-32	5.4	46-006-d 46-006-g Agg 5.6	AI AI AI
(33.)	H-33	5.4	46-006-d 46-006-g Agg 5.6	AI AI AI
(34.)	H-34	5.4	46-006-d Agg 5.6	AH AH
(35.)	H-35	5.4	46-006-d Agg 5.6	AG AG
(36.)	H-36	5.4	46-006-d Agg 5.6	AG AG
(37.)	H-37	5.4	46-006-d Agg 5.6	AH AH
(38.)	H-38	5.4	46-004-y 46-006-d	K
(39.)	H-39	5.4	46-004-y 46-006-d	K
(40.)	H-40	5.4	46-004-y 46-006-d	K
(41.)	H-41	5.4	not needed ID & SR	
(42.)	H-42	5.4	not needed ID & SR	
(43.)	H-43	5.4	not needed ID & SR	
(44.)	H-44	5.4	46-004-g	N
(45.)	H-45	5.4	46-004-g	N
(46.)	H-46	5.4	46-004-g	N
(47.)	H-47	5.4	not needed SR	
(48.)	H-48	5.4	46-004-c2 46-006-a	S
(49.)	H-49	5.4	46-004-c2 46-006-a	S
(50.)	H-50	5.4	46-004-c2 46-006-a	S
(51.)	H-51	5.4	46-004-m	CC
(52.)	H-52	5.4	46-004-m	CC
(53.)	H-53	5.4	46-004-m	CC
(54.)	H-54	5.4	46-004-b2 46-008-b 46-007	
(55.)	H-55	5.4	46-004-b2	U
(56.)	H-56	5.4	46-004-b2	U
(57.)	H-57	5.4	46-004-b2	U
(58.)	H-58	5.4	not needed outfall W not PRS	W
(59.)	H-59	5.4	not needed outfall W not PRS	W
(60.)	H-60	5.4	46-004-s 46-007	X
(61.)	H-61	5.4	46-004-s 46-007	X
(62.)	H-62	5.4	46-004-s 46-007	X
(63.)	H-63	5.4	46-004-y 46-006-d	K
(64.)	H-64	5.4	46-004-y 46-006-d	K
(65.)	H-65	5.4	46-004-x 46-006-d	J

Table E-2
OU 1140 Sample Locations

	Sample Location	Section	Overlapping PRSs	Outfall
(66.)	H-66	5.4	46-004-x	J
			46-006-d	
(67.)	H-67	5.4	46-004-x	J
			46-006-d	
(68.)	H-68	5.4	46-004-x	J
			46-006-d	
(69.)	H-69	5.4	46-004-x	J
			46-006-d	
(70.)	H-70	5.4	46-004-x	J
			46-006-d	
(71.)	H-71	5.4	46-004-x	J
			46-006-d	
(72.)	H-72	5.4	46-004-h	A
			46-004-q	B
			Agg 5.6	
(73.)	H-73	5.4	46-004-h	A
			46-004-q	B
			Agg 5.6	
(74.)	H-74	5.4	46-004-a2	I
			46-006-d	I
			Agg 5.6	I
			46-004-u	F
			46-004-v	G
(75.)	H-75	5.4	46-004-a2	I
			46-006-d	I
			Agg 5.6	I
			46-004-u	F
			46-004-v	G
(76.)	H-76	5.4	46-004-a2	I
			46-006-d	I
			Agg 5.6	I
			46-004-u	F
			46-004-v	G
(77.)	H-77	5.4	46-004-a2	I
			46-006-d	I
			Agg 5.6	I
			46-004-u	F
			46-004-v	G
(78.)	H-78	5.4	46-004-a2	I
			46-006-d	I
			Agg 5.6	I
			46-004-u	F
			46-004-v	G
(79.)	H-79	5.4	46-004-a2	I
			46-006-d	I
			Agg 5.6	I
			46-004-u	F
			46-004-v	G
(80.)	H-80	5.4	46-004-u	F
			Agg 5.6	F
(81.)	H-81	5.4	46-004-v	G
			Agg 5.6	G
(82.)	H-82	5.4	46-004-a2	MM
(83.)	H-83	5.4	46-004-a2	MM
(84.)	H-84	5.4	46-004-a2	MM
(85.)	H-85	5.4	46-008-e	RR
			Agg 5.6	RR
			46-008-f	RR
(86.)	H-86	5.4	46-008-e	RR
			Agg 5.6	RR
			46-008-f	RR
(87.)	H-87	5.4	46-004-h	A
			46-004-q	B
			Agg 5.6	
(88.)	H-88	5.4	46-004-h	A
			46-004-q	B
			Agg 5.6	
(89.)	H-89	5.4	46-004-h	A
			Agg 5.6	
(90.)	H-90	5.4	46-004-q	B
			Agg 5.6	
(91.)	H-91	5.4	46-004-h	AF
			Agg 5.6	AF
(92.)	H-92	5.4	46-004-h	AF
			Agg 5.6	AF
(93.)	H-93	5.4	46-004-h	AE
			Agg 5.6	AE
(94.)	H-94	5.4	46-004-h	AE
			Agg 5.6	AE
(95.)	H-95	5.5	46-009-a	
(96.)	H-96	5.3	46-008-g	
			46-aoc-1	
(97.)	H-97	5.3	46-008-g	
			46-aoc-1	
(98.)	H-98	5.3	46-008-g	
			46-aoc-1	

Table E-2
OU 1140 Sample Locations

	Sample Location	Section	Overlapping PRSs	Outfall
(99.)	H-99	5.4	46-006-b	QQ
			Agg 5.6	QQ
(100.)	H-100	5.4	46-006-b	QQ
			Agg 5.6	QQ
(101.)	H-101	5.4	46-004-n	OO
			46-006-b	OO
			Agg 5.6	OO
(102.)	H-102	5.4	46-004-n	OO
			46-006-b	OO
			Agg 5.6	OO
(103.)	H-103	5.4	46-003-a	HH
			46-009-a	
(104.)	H-104	5.4	46-003-a	HH
			46-009-a	
(105.)	H-105	5.4	46-003-a	HH
			46-009-a	
(106.)	H-106	5.4	46-003-a	HH
			46-009-a	
(107.)	H-107	5.4	46-003-a	HH
			46-009-a	
(108.)	H-108	5.4	46-003-a	HH
			46-009-a	
(109.)	H-109	5.4	46-003-a	HH
			46-009-a	
(110.)	H-110	5.4	not needed	
			not PRS specific	
(111.)	H-111	5.4	46-004-f	NN
			46-004-r	NN
			46-004-w	NN
			46-008-d	NN
			46-aoc-1	NN
			Agg 5.6	NN
(112.)	H-112	5.4	46-004-f	NN
			46-004-r	NN
			46-004-w	NN
			46-008-d	NN
			46-aoc-1	NN
			Agg 5.6	NN
(113.)	H-113	5.4	46-004-f	NN
			46-004-r	NN
			46-004-w	NN
			46-008-d	NN
			46-aoc-1	NN
			Agg 5.6	NN
(114.)	H-114	5.4	46-004-f	NN
			46-004-r	NN
			46-004-w	NN
			46-008-d	NN
			46-aoc-1	NN
			46-004-t	BB
			46-008-g	BB
			46-010-b	BB
			Agg 5.6	
(115.)	H-115	5.4	46-004-f	NN
			46-004-r	NN
			46-004-w	NN
			46-008-d	NN
			46-aoc-1	NN
			46-004-t	BB
			46-008-g	BB
			46-010-b	BB
			Agg 5.6	
(116.)	H-116	5.4	46-004-t	YY
			46-aoc-01	YY
(117.)	H-117	5.4	46-003-f	FF
			46-008-a	ZZ
			46-008-g	ZZ
(118.)	H-118	5.4	46-003-f	FF
			46-008-a	ZZ
			46-008-g	ZZ
(119.)	H-119	5.4	46-003-f	FF
			46-008-a	ZZ
			46-008-g	ZZ
(120.)	H-120	5.4	46-003-f	FF
			46-008-a	ZZ
			46-008-g	ZZ
(121.)	H-121	5.4	46-003-f	FF
			46-008-a	ZZ
			46-008-g	ZZ
(122.)	H-122	5.4	46-003-f	FF
			46-008-a	ZZ
			46-008-g	ZZ
(123.)	H-123	5.4	46-008-a	ZZ
			46-008-g	ZZ
(124.)	H-124	5.4	46-008-a	ZZ
			46-008-g	ZZ
(125.)	H-125	5.5	46-009-a	
(126.)	H-126	5.5	46-009-b	
(127.)	H-127	5.5	46-009-b	

Table E-2
OU 1140 Sample Locations

	Sample Location	Section	Overlapping PRSs	Outfall
(128.)	H-128	5.5	46-009-b	
(129.)	H-129	5.5	not needed	
			not historic flow	
(130.)	H-130	5.5	not needed	
			not historic flow	
(131.)	H-131	5.4	46-008-e	AB
			Agg 5.6	AB
			46-008-f	AB
(132.)	H-132	5.4	46-008-e	AB
			Agg 5.6	AB
			46-008-f	AB
(133.)	H-133	5.4	46-002	JJ
(134.)	H-134	5.4	46-002	JJ
			46-009-b	
(135.)	H-135	5.4	46-002	JJ
			46-009-b	
(136.)	H-136	5.4	46-002	JJ
			46-009-b	
(137.)	H-137	5.4	46-002	JJ
			46-009-b	
(138.)	H-138	5.4	46-002	II
			46-009-b	
(139.)	H-139	5.4	46-002	II
			46-009-b	
(140.)	H-140	5.4	46-002	II
			46-009-b	
(141.)	H-141	5.4	46-002	II
			46-009-b	
(142.)	H-142	5.4	46-002	II
			46-009-b	
(143.)	H-143	5.4	not needed	
			not historic flow	
(144.)	H-144	5.4	not needed	
			not historic flow	
(145.)	H-145	5.4	not needed	
			not historic flow	
(146.)	H-146	5.4	46-004-c	PP
			Agg 5.6	PP
(147.)	H-147	5.4	46-004-c	PP
			Agg 5.6	PP
(148.)	H-148	5.4	46-003-g	KK
			Agg 5.6	KK
(149.)	H-149	5.4	46-003-g	KK
			Agg 5.6	KK
(150.)	H-150	5.4	46-003-g	KK
			Agg 5.6	KK
(151.)	H-151	5.4	46-003-g	KK
			Agg 5.6	KK
(152.)	H-152	5.4	46-003-g	KK
			Agg 5.6	KK
(153.)	H-153	5.4	46-003-g	KK
			Agg 5.6	KK
(154.)	H-154	5.4	46-003-g	KK
			Agg 5.6	KK
(155.)	H-155	5.4	46-003-g	KK
			Agg 5.6	KK
(156.)	H-156	5.4	46-003-g	KK
			Agg 5.6	KK
(157.)	H-157	5.4	46-005	LL
			Agg 5.6	LL
(158.)	H-158	5.4	46-005	LL
			Agg 5.6	LL
(159.)	H-159	5.4	46-005	LL
			Agg 5.6	LL
(160.)	H-160	5.4	46-005	LL
			Agg 5.6	LL
(161.)	H-161	5.4	46-005	LL
			Agg 5.6	LL
(162.)	H-162	5.4	Agg 5.6	Q
(163.)	H-163	5.4	Agg 5.6	Q
(164.)	H-164	5.5	46-009-b	
(165.)	H-165	5.5	46-009-a	
			46-003-f	FF
			46-008-a	ZZ
			46-008-g	ZZ
			46-004-t	YY
			46-010-b	BB
			AOC-001	BB
			46-004-f	BB
			46-004-r	BB
			46-004-w	NN
			46-008-d	NN
			46-004-n	OO
			46-006-b	OO
			Agg 5.6	

Table E-2
OU 1140 Sample Locations

	Sample Location	Section	Overlapping PRSs	Outfall
(166.)	H-166	5.5	46-009-a	
			46-003-f	FF
			46-008-a	ZZ
			46-008-g	ZZ
			46-004-t	YY
			46-010-b	BB
			AOC-001	BB
			46-004-f	BB
			46-004-r	BB
			46-004-w	NN
			46-008-d	NN
			46-004-n	OO
			46-006-b	OO
			Agg 5.6	
(167.)	H-167	5.5	not needed overlap w H-108	
(168.)	H-168	5.5	46-009-a	
			46-006-b	
			Agg 5.6	
(169.)	NS-1	5.3	46-006-g	
(170.)	NS-2	5.3	46-006-g	
(171.)	NS-3	5.3	46-006-b	
(172.)	S-1	5.3	46-006-d	
			46-006-g	
(173.)	S-2	5.3	46-006-d	
			46-006-g	
(174.)	S-3	5.3	46-006-d	
(175.)	S-4	5.3	46-006-f	
(176.)	S-5	5.3	46-006-f	
(177.)	S-6	5.3	46-006-f	
(178.)	S-7	5.3	46-008-b	
			46-007	
			46-004-b2	U
(179.)	S-8	5.3	46-008-b	
(180.)	S-9	5.3	not needed overlap w H-54	U
(181.)	S-10	5.3	46-008-e	
(182.)	S-11	5.3	46-008-e	
(183.)	S-12	5.3	46-008-e	
(184.)	S-13	5.3	46-008-e	
(185.)	S-14	5.3	46-007	
			46-004-s	X
(186.)	S-15	5.3	46-007	
			46-004-s	X
(187.)	S-16	5.6	Agg 5.6	
(188.)	S-17	5.6	Agg 5.6	
(189.)	S-18	5.1	46-003-d	
(190.)	S-19	5.1	46-003-d	
(191.)	S-20	5.1	46-003-d	
(192.)	S-21	5.1	46-003-d	
(193.)	S-22	5.1	46-003-d	
(194.)	S-23	5.1	46-003-d	
(195.)	S-24	5.1	46-003-d	
(196.)	S-25	5.1	46-004-p	
(197.)	S-26	5.1	46-004-p	
(198.)	S-27	5.3	46-006-d	
(199.)	S-28	5.3	46-006-d	
(200.)	S-29	5.3	46-008-f	
(201.)	S-30	5.3	46-003-h	GG
(202.)	S-31	5.3	46-003-h	GG
(203.)	S-32	5.6	Agg 5.6	
(204.)	S-33	5.6	Agg 5.6	
(205.)	S-34	5.1	46-004-d	
(206.)	S-35	5.1	46-004-d	
(207.)	S-36	5.1	46-004-e	
(208.)	S-37	5.1	46-004-e	
(209.)	S-38	5.3	46-010-d	
(210.)	S-39	5.3	46-010-d	
(211.)	S-40	5.3	46-008-a	
(212.)	S-41	5.3	46-008-a	
(213.)	S-42	5.4	not needed replace by SS-15 and SS-17	
(214.)	S-43	5.4	not needed replace by SS-16	
(215.)	S-44	5.2	46-005	
(216.)	S-45	5.2	46-005	
(217.)	S-46	5.2	46-005	
(218.)	S-47	5.2	46-005	
(219.)	S-48	5.2	46-005	
(220.)	S-49	5.2	46-005	
(221.)	S-50	5.2	46-005	
(222.)	S-51	5.2	46-005	
(223.)	S-52	5.6	Agg 5.6	

Table E-2
OU 1140 Sample Locations

	Sample Location	Section	Overlapping PRSs	Outfall
(224.)	S-53	5.2	46-002	
(225.)	S-54	5.2	46-002	
(226.)	S-55	5.2	46-002	
(227.)	S-56	5.2	46-002	
(228.)	S-57	5.2	46-002	
(229.)	S-58	5.2	46-002	
(230.)	S-59	5.2	not needed not needed around siphon box	
(231.)	S-60	5.2	46-002	
(232.)	S-61	5.2	not needed not needed around siphon box	
(233.)	S-62	5.2	not needed not needed around siphon box	
(234.)	S-63	5.2	not needed not needed around siphon box	
(235.)	S-64	5.2	46-002	
(236.)	S-65	5.2	46-002	
(237.)	S-66	5.2	46-002	
(238.)	S-67	5.3	46-006-c	
(239.)	S-68	5.3	46-006-c	
(240.)	S-69	5.3	46-008-d	
(241.)	S-70	5.3	46-008-d	
(242.)	S-71	5.3	46-003-f	
(243.)	S-72	5.3	46-003-f	
(244.)	S-73	5.3	46-003-f	
(245.)	S-74	5.3	46-003-h	GG
(246.)	S-75	5.1	46-004-c	
(247.)	S-76	5.1	46-004-c	
(248.)	S-77	5.2	46-002	
(249.)	S-78	5.2	46-002	
(250.)	S-79	5.2	46-002	
(251.)	S-80	5.1	46-003-d	
(252.)	S-81	5.2	46-003-d	
(253.)	SAB-1	5.2	46-002	
(254.)	SAB-1a	5.2	SAB-1 downhole end	
(255.)	SAB-2	5.2	46-005	
(256.)	SAB-2a	5.2	SAB-2 downhole end	
(257.)	SS-1	5.6	Agg 5.6	
(258.)	SS-2	5.6	Agg 5.6	
(259.)	SS-3	5.1	46-003-a	
(260.)	SS-4	5.2	46-005	
(261.)	SS-5	5.2	46-005	
(262.)	SS-6	5.2	46-005	
(263.)	SS-7	5.2	46-005	
(264.)	SS-8	5.2	46-002	
(265.)	SS-9	5.2	46-002	
(266.)	SS-10	5.2	not needed new type replace w S-77 for sand filter	
(267.)	SS-11	5.2	46-002	
(268.)	SS-12	5.2	not needed new type replace w S-78 for sand filter	
(269.)	SS-13	5.2	not needed new type replace w S-79 for sand filter	
(270.)	SS-14	5.1	46-003-a	
(271.)	SS-15	5.4	46-004-f	Y
(272.)	SS-16	5.4	46-004-r 46-004-w 46-aoc-01	Z AA
(273.)	SS-17	5.1	46-003-c 46-004-f	 Y
(274.)	SS-18	5.1	46-004-c	
(275.)	SS-19	5.1	46-004-c	
(276.)	SS-20	5.1	46-004-d	
(277.)	SS-21	5.1	46-004-d	
(278.)	SS-22	5.1	46-004-e	
(279.)	SS-23	5.1	46-004-e	
(280.)	SS-24	5.1	46-004-p	

Table E-2
OU 1140 Sample Locations

	Sample Location	Section	Overlapping PRSs	Outfall
(281.)	SS-25	5.1	46-004-p	
(282.)	V-1	5.1	not needed VCA replace by S-75	
(283.)	V-2	5.1	not needed VCA replace by S-76	
(284.)	V-3	5.1	46-003-e	
(285.)	V-4	5.1	not needed new DQOs	
(286.)	V-5	5.1	46-003-e	
(287.)	V-6	5.1	46-003-e	
(288.)	V-7	5.1	46-003-e	
(289.)	V-8	5.1	46-003-e	
(290.)	V-9	5.1	46-003-e	
(291.)	V-10	5.1	46-003-e	
(292.)	V-11	5.1	not needed new DQOs	
(293.)	V-12	5.1	46-003-e	
(294.)	V-13	5.1	46-003-e	
(295.)	V-14	5.1	not needed new DQOs	
(296.)	V-15	5.5	46-009-a 46-003-a	
(297.)	V-16	5.5	46-009-a	
(298.)	V-17	5.5	not needed overlap w V-31	
(299.)	V-18	5.5	46-009-a	
(300.)	V-19	5.5	46-009-a	
(301.)	V-20	5.5	46-009-a	
(302.)	V-21	5.3	46-003-f	
(303.)	V-22	5.3	46-003-f	
(304.)	V-23	5.3	not needed new DQOs	
(305.)	V-24	5.3	46-003-f	
(306.)	V-25	5.3	not needed new DQOs	
(307.)	V-26	5.1	46-003-a	
(308.)	V-27	5.1	not needed new DQOs	
(309.)	V-28	5.1	46-003-a 46-009-a	
(310.)	V-29	5.1	46-003-a 46-009-a	
(311.)	V-30	5.1	46-003-a 46-009-a	
(312.)	V-31	5.1	46-003-a 46-009-a	
(313.)	V-32	5.1	46-003-a 46-009-a	
(314.)	V-33	5.1	46-003-a 46-009-a	
(315.)	V-34	5.1	not needed new DQOs	
(316.)	V-35	5.1	not needed new DQOs	
(317.)	V-36	5.1	not needed new DQOs	
(318.)	V-37	5.1	not needed new DQOs	
(319.)	V-38	5.1	46-003-c	
(320.)	V-39	5.1	not needed new DQOs	
(321.)	V-40	5.1	not needed new DQOs	
(322.)	V-41	5.1	46-003-c	
(323.)	V-42	5.1	not needed new DQOs	
(324.)	V-43	5.1	46-003-c	
(325.)	V-44	5.1	46-003-c	
(326.)	V-45	5.1	46-003-f	
(327.)	V-46	5.1	not needed new DQOs	
(328.)	V-47	5.1	not needed new DQOs	
(329.)	V-48	5.1	46-003-c	
(330.)	V-49	5.1	not needed new DQOs	
(331.)	V-50	5.1	46-003-f	
(332.)	V-51	5.1	not needed new DQOs	
(333.)	V-52	5.1	46-003-f	
(334.)	V-53	5.1	not needed new DQOs	

Table E-2
OU 1140 Sample Locations

	Sample Location	Section	Overlapping PRSs	Outfall	Sample Location	Section	Overlapping PRSs	Outfall
(335.)	V-54	5.5	46-009-b					
(336.)	V-55	5.5	46-009-b					
(337.)	V-56	5.5	46-009-b					
(338.)	V-57	5.1	46-003-b					
(339.)	V-58	5.1	not needed new DQOs					
(340.)	V-59	5.1	46-003-b					
(341.)	V-60	5.1	46-003-b					
(342.)	V-61	5.1	46-003-b					
(343.)	V-62	5.1	not needed new DQOs					
(344.)	V-63	5.1	46-003-b					
(345.)	V-64	5.1	not needed new DQOs					
(346.)	V-65	5.1	not needed new DQOs					
(347.)	V-66	5.1	46-003-g					
(348.)	V-67	5.1	46-003-g					
(349.)	V-68	5.1	not needed new DQOs					
(350.)	V-69	5.1	46-003-g					
(351.)	V-70	5.1	not needed new DQOs					
(352.)	V-71	5.1	not needed new DQOs					

Table E-3
OU 1140 PRS Sample Locations Summary

	PRS ID
	46-002
	Sample Locations
1	H-133
2	H-134
3	H-135
4	H-136
5	H-137
6	H-138
7	H-139
8	H-140
9	H-141
10	H-142
11	S-53
12	S-54
13	S-55
14	S-56
15	S-57
16	S-58
17	S-60
18	S-64
19	S-65
20	S-66
21	S-77
22	S-78
23	S-79
24	SAB-1
25	SS-8
26	SS-9
27	SS-11

Table E-3
OU 1140 PRS Sample Locations Summary

PRS ID
46-003-a

	Sample Locations
1	H-103
2	H-104
3	H-105
4	H-106
5	H-107
6	H-108
7	H-109
8	SS-3
9	SS-14
10	V-26
11	V-28
12	V-29
13	V-30
14	V-31
15	V-32
16	V-33

Table E-3
OU 1140 PRS Sample Locations Summary

PRS ID
46-003-f

Sample Locations

1	H-117
2	H-118
3	H-119
4	H-120
5	H-121
6	H-122
7	H-165
8	H-166
9	S-71
10	S-72
11	S-73
12	V-21
13	V-22
14	V-24
15	V-45
16	V-50
17	V-52

Table E-3
OU 1140 PRS Sample Locations Summary

	PRS ID
	46-007
	Sample Locations
1	H-4
2	H-5
3	H-6
4	H-7
5	H-8
6	H-9
7	H-10
8	H-11
9	H-14
10	H-15
11	H-16
12	H-17
13	H-18
14	H-19
15	H-20
16	H-21
17	H-22
18	H-23
19	H-54
20	H-60
21	H-61
22	H-62
23	S-7
24	S-14
25	S-15

Table E-3
OU 1140 PRS Sample Locations Summary

	PRS ID
	46-009-a

	Sample Locations
1	H-95
2	H-103
3	H-104
4	H-105
5	H-106
6	H-107
7	H-108
8	H-109
9	H-125
10	H-165
11	H-166
12	H-168
13	V-15
14	V-16
15	V-18
16	V-19
17	V-20
18	V-28
19	V-29
20	V-30
21	V-31
22	V-32
23	V-33

Table E-3
OU 1140 PRS Sample Locations Summary

	PRS ID Agg. 5.6 Sample Locations
1	H-4
2	H-5
3	H-6
4	H-7
5	H-8
6	H-9
7	H-10
8	H-11
9	H-12
10	H-13
11	H-14
12	H-15
13	H-16
14	H-17
15	H-18
16	H-19
17	H-20
18	H-21
19	H-22
20	H-23
21	H-32
22	H-33
23	H-34
24	H-35
25	H-36
26	H-37
27	H-72
28	H-73
29	H-74
30	H-75
31	H-76
32	H-77
33	H-78
34	H-79
35	H-80
36	H-81
37	H-85
38	H-86
39	H-87
40	H-88
41	H-89
42	H-90
43	H-91
44	H-92
45	H-93
46	H-94
47	H-99
48	H-100
49	H-101
50	H-102
51	H-111
52	H-112
53	H-113
54	H-131
55	H-132
56	H-146
57	H-147
58	H-148
59	H-149
60	H-150
61	H-151
62	H-152
63	H-153
64	H-154
65	H-155
66	H-156
67	H-157
68	H-158
69	H-159
70	H-160
71	H-161
72	H-162
73	H-163
74	S-16
75	S-17
76	S-32
77	S-33
78	S-52
79	SS-1
80	SS-2

Table E-4

OU-1140 Sample Locations, Surveys, and Analyses

Sample Location	PRS	Field Surveys			Field Screening							Field Lab.					
		1	1	1	1	1	1			1	1	1			1	1	1
		Land Survey	Geophysics	Radiation	Gross Alpha	Gross Gamma/Beta	Organic Vapor		Explosives	X-Ray Florescence	Lithologic Logging	Gross Alpha	Tritium	Soil Moisture	Gamma Spectroscopy	PCB	VOA
H-11	46-004-m	1		1	1	1	1			1	1	1			1		1
	46-004-s	1		1	1	1	1			1	1	1			1	1	1
	46-004-b2	1		1	1	1	1			1	1	1			1		1
	46-006-l	1		1	1	1	1			1		1				1	1
	46-007	1		1	1	1	1			1		1					1
	46-008-b	1		1	1	1	1									1	
	Agg 5.6	1	1	1													

Sample Location	PRS	Laboratory Analyses															
		1			1		1	1	1		1	1	1	1			
		Gamma Spectroscopy	Isotopic Americium	Total Uranium	Isotopic Uranium	Isotopic Plutonium	Isotopic Thorium	Isotopic Cesium	VOA (SW8240)	Semivolatiles (SW8270)	TCLP	Metals (SW 6010)	PCB (SW 8080)	Asbestos	Mercury	Herbicides	Pesticides
H-11	46-004-m	1			1				1			1			1		
	46-004-s	1			1				1∞	1		1	1		1		
	46-004-b2	1			1		1		1∞	1		1			1		
	46-006-l	1			1				1	1		1	1	1	1		
	46-007	1			1				1	1		1†			1		
	46-008-b									1			1				
	Agg 5.6	1			1		1										

† - Specifically Beryllium in addition to the full suite of metals.

∞ - VOA only on speicmens from sample sites in upper reaches of drainnage channels only.

Table E-4

OU-1140 Sample Locations, Surveys, and Analyses

Sample Location	PRS	Field Surveys			Field Screening							Field Lab.						Laboratory Analyses															
		1	1	1	1	1	1			1	1	1		1	1	1	1	1		1	1	1	1	1	1		1	1	1	1	1		
		Land Survey	Geophysics	Radiation	Gross Alpha	Gross Gamma/Beta	Organic Vapor		Explosives	X-Ray Florescence	Lithologic Logging	Gross Alpha	Tritium	Soil Moisture	Gamma Spectroscopy	PCB	VOA	Gamma Spectroscopy	Isotopic Americium	Total Uranium	Isotopic Uranium	Isotopic Plutonium	Isotopic Thorium	Isotopic Cesium	VOA (SW8240)	Semivolatiles (SW8270)	TCLP	Metals (SW 6010)	PCB (SW 8080)	Asbestos	Mercury	Herbicides	Pesticides
H-165	46-009-a	1		1	1	1	1			1	1	1		1	1	1	1	1			1	1	1	1	1	1		1	1	1			
	46-003-f	1		1	1	1	1			1	1	1			1	1	1	1			1				1∞	1		1	1		1		
	46-008-a	1		1	1	1	1			1																1		1					
	46-008-g	1		1	1	1	1									1	1								1	1			1				
	46-004-l	1		1	1	1	1				1				1		1	1							1								
	46-010-b																																
	AOC-001																														1		
	46-004-f	1		1	1	1	1			1		1			1	1	1	1			1				1	1		1	1	1	1		
	46-004-r	1		1																													
	46-004-w	1		1	1	1	1			1		1				1	1			1					1	1		1			1		
	46-008-d	1		1	1		1			1		1				1	1	1			1				1	1		1	1				
	46-004-n																																
	46-006-b	1		1	1	1	1			1		1				1		1			1					1		1	1				
	Agg 5.6	1	1	1																	1		1										

† - Specifically Beryllium in addition to the full suite of metals.
∞ - VOA only on speicmens from sample sites in upper reaches of drainnage channels only.

Table E-4

OU-1140 Sample Locations, Surveys, and Analyses

Sample Location	PRS	Field Surveys			Field Screening							Field Lab.						Laboratory Analyses															
		1		1	1	1	1			1	1	1			1	1	1	1			1		1	1	1		1	1		1			
		Land Survey	Geophysics	Radiation	Gross Alpha	Gross Gamma/Beta	Organic Vapor		Explosives	X-Ray Florescence	Lithologic Logging	Gross Alpha	Tritium	Soil Moisture	Gamma Spectroscopy	PCB	VOA	Gamma Spectroscopy	Isotopic Americium	Total Uranium	Isotopic Uranium	Isotopic Plutonium	Isotopic Thorium	Isotopic Cesium	VOA (SW8240)	Semivolatiles (SW8270)	TCLP	Metals (SW 6010)	PCB (SW 8080)	Asbestos	Mercury	Herbicides	Pesticides
S-7	46-008-b	1		1	1	1	1									1										1			1				
	46-007	1		1	1	1	1			1		1					1	1			1				1	1		1†			1		
	46-004-b2	1		1	1	1	1			1	1	1			1		1	1			1		1		1▬	1		1			1		

† - Specifically Beryllium in addition to the full suite of metals.
▬ - VOA only on speicmens from sample sites in upper reaches of drainnage channels only.

Table E-4

OU-1140 Sample Locations, Surveys, and Analyses

Sample Location	PRS	Field Surveys			Field Screening							Field Lab.						Laboratory Analyses																
		1		1	1	1	1			1		1				1	1			1				1	1		1			1			
		Land Survey	Geophysics	Radiation	Gross Alpha	Gross Gamma/Beta	Organic Vapor		Explosives	X-Ray Florescence	Lithologic Logging	Gross Alpha	Tritium	Soil Moisture	Gamma Spectroscopy	PCB	VOA	Gamma Spectroscopy	Isotopic Americium	Total Uranium	Isotopic Uranium	Isotopic Plutonium	Isotopic Thorium	Isotopic Cesium	VOA (SW8240)	Semivolatiles (SW8270)	TCLP	Metals (SW 6010)	PCB (SW 8080)	Asbestos	Mercury	Herbicides	Pesticides
SS-16	46-004-r	1		1																													
	46-004-w	1		1	1	1	1			1		1				1	1			1					1	1		1			1		
	46-aoc-01																														1		

† - Specifically Beryllium in addition to the full suite of metals.

∞ - VOA only on speicmens from sample sites in upper reaches of drainnage channels only.

Table E-4

OU-1140 Sample Locations, Surveys, and Analyses

		Field Surveys			Field Screening							Field Lab.						Laboratory Analyses															
		1		1	1	1	1			1	1	1		1	1	1	1	1			1	1	1	1	1		1	1	1	1	1		
Sample Location	PRS	Land Survey	Geophysics	Radiation	Gross Alpha	Gross Gamma/Beta	Organic Vapor		Explosives	X-Ray Florescence	Lithologic Logging	Gross Alpha	Tritium	Soil Moisture	Gamma Spectroscopy	PCB	VOA	Gamma Spectroscopy	Isotopic Americium	Total Uranium	Isotopic Uranium	Isotopic Plutonium	Isotopic Thorium	Isotopic Cesium	VOA (SW8240)	Semivolatiles (SW8270)	TCLP	Metals (SW 6010)	PCB (SW 8080)	Asbestos	Mercury	Herbicides	Pesticides
V-28	46-003-a	1		1	1	1	1			1	1	1			1	1	1	1			1		1		1∞	1		1	1		1		
	46-009-a	1		1	1	1	1			1	1	1		1	1	1	1	1			1	1	1	1	1	1		1	1	1			

† - Specifically Beryllium in addition to the full suite of metals.

∞ - VOA only on speicmens from sample sites in upper reaches of drainnage channels only.

Appendix F

Ecological Risk Assessment

ECOLOGICAL RISK ASSESSMENT

The RCRA facility investigation (RFI) process requires that a health and environmental assessment be conducted. The Los Alamos Environmental Restoration (ER) Program is approaching human and ecological risks separately because of regulatory deadlines. The sampling and analysis plans presented in the Operable Unit (OU) 1140 RFI work plan are designed to be the first step in assessing the potential for human health risk. The data needs for human-health and ecological risk assessments will overlap, but are not identical. It would be more efficient to coordinate both risk assessments rather than to conduct two independent investigations. To the extent possible this will be attempted at OU 1140.

Since the LANL ER Program ecological-risk position is still under development, there is no clear direction for assessing ecological risk at OU 1140. The 1993 Installation Work Plan (IWP) will include guidance on ecological endpoints, which will define the initial list of ecological potential contaminants of concern (EPCOCs). Based on the 1993 IWP and other ecological-risk guidance, additions will be made to the work plan analyte suite for selected samples in the OU 1140 work plan.

Although official ER Program guidance is not yet available, existing information indicates that alkali metal salts are likely to be an important EPCOC at OU 1140. Alkali metals were disposed of as waste at outfalls and surface release potential release sites (PRSs) at OU 1140. These highly reactive wastes would have readily formed alkali-metal salts under ambient conditions; thus, no unreacted alkali metals are suspected to exist in the environment at OU 1140. Alkali metals are not considered to pose a risk to human health and are therefore not included as analytes in the proposed sampling plans. However, alkali-metal salts could pose an ecological risk; for example, sodium is known to be phytotoxic. Therefore, prior to sampling activities, the analyte lists for samples from areas suspected to be contaminated with these wastes will be revised to include alkali metals. If additional EPCOCs are identified at OU 1140 prior to sampling activities, the analyte lists may be revised accordingly.

Any addition of ecological-risk analytes is not intended to supplant a future ecological-risk investigation. The added analytes will provide ecological-risk information from appropriate sample locations already specified for human-health risk assessment. The cost of adding these analyses will be substantially less than sampling these same locations later solely for the purpose of obtaining ecological-risk data.

Appendix G

Unlocated Outfalls

Executive Summary

Chapter 1
Introduction

Chapter 2
Background Information

Chapter 3
Environmental Setting

Chapter 4
Technical Approach

Chapter 5
Evaluation of PRS
Aggregates

Chapter 6
PRSs Recommended for
No Further Action or
Deferred Action

Annexes

Appendixes

UNLOCATED OUTFALLS

In the investigation of outfalls at Technical Area (TA) 46, outfalls of several drain lines indicated on engineering maps could not be located in the field. These outfalls may be buried; connected to French drains, to dry wells, or to lines leading to identified outfalls; or, may not exist.

As part of a Laboratory-wide waste-water-stream-characterization program, all drains at the Laboratory are being documented. At TA-46 the study is scheduled for spring of 1993. As each drain system is described, unlocated outfalls will be found and recorded. During the course of fieldwork for the Operable Unit (OU) 1140 RCRA Facility Investigation (RFI), unlocated outfalls will be investigated at the same time and with the same rigor as potential release sites (PRSs) described in Subsection 5.4, applying the same data quality objectives (DQOs) and sampling plan rationales. Where necessary, geophysical methods will be used to locate drain lines leading to unlocated outfalls. Table G-1 lists drain lines addressed in this appendix.

TABLE G-1

DRAIN LINES WITH UNLOCATED OUTFALLS

BUILDING	AREA OF BUILDING	DESCRIPTION
TA-46-25	All	Industrial waste line
TA-46-31	Room 151a	2 floor drains
TA-46-42	All	Industrial waste line

TA-46-25, called the component test facility, was built in 1957 to house submarine batteries as a power supply for the Rover Program. Engineering drawing ENG-C 2039 shows an industrial waste line extending north of the building to the rim of Cañada del Buey. This line served all sink, floor, and roof drains in TA-46-25. Engineering drawing ENG-C 32300 shows the pipe rerouted to the pump house (TA-46-87) when TA-46-87 was built in 1966. The section of the industrial waste line leading past TA-46-87 to the canyon was truncated and the outfall abandoned at that time. Engineering drawing ENG-C 32309 shows roof drains disconnected from the system. The original outfall has not been located. It is not known if the abandoned section of line lies buried or was excavated (McCulla 1992, 11-203).

TA-46-25 is an 18 x 110 ft one-room building with 20 x 110 ft shed-like overhangs on each side. The batteries, stored under the overhangs, were removed in 1973. The interior of the building contained electrical equipment associated with the battery system. TA-46-25 was later remodeled into laboratories. No uranium was handled in TA-46-25. Potential contaminants of concern (PCOCs) may include metals, semivolatile organic compounds (SVOCs), and volatile organic compounds (VOCs).

TA-46-31, called the test building, is a large laboratory building where various types of experiments have been conducted since its construction in 1958. In 1970 a lithium arc-jet test addition was built adjacent to Room 151. Lithium solution was piped to the room from an outside lithium tank. Engineering drawing ENG-C 38765 shows two separate 2-in.-cast iron pipes leading from floor drains in Room 151a. Outfalls from these lines have not been located. The facility had a vacuum chamber; mercury from vacuum pumps may be a PCOC.

TA-46-42 was built in 1960 as an equipment check-out building. Engineering drawing ENG-C 29129 shows that all floor and roof drains and several sink drains tie into the industrial drain system. The drain exits the east wall of the building as a 6 in. pipe of unknown composition leading north of the building (McCulla 1992, 11-203). The outfall has not been found; it may lead to the ditch in solid waste management unit (SWMU) 46-006(a), described in Subsection 5.3.1.1.

Neither the CEARP Report (DOE 1987, 0264) or the SWMU Report (LANL 1990, 0145) mentions hazardous waste associated with TA-46-42. However, the building housed electronics labs in which solvents, such as trichloroethylene, were used. When found, the outfall will be sampled in conjunction with SWMU 46-006(a).

REFERENCES

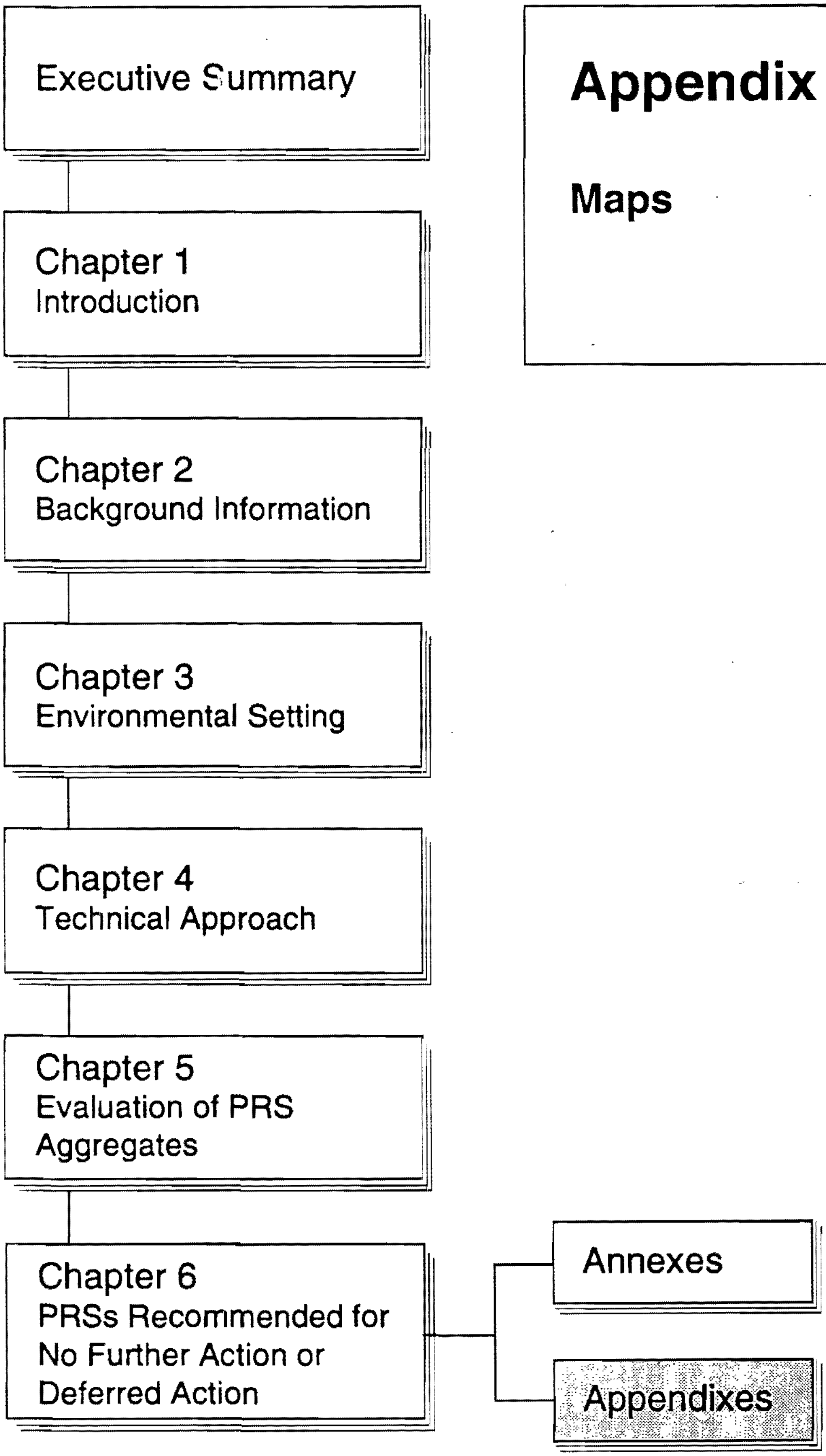
DOE (US Department of Energy), October 1987. "Phase I: Installation Assessment, Los Alamos National Laboratory," Volumes 1 and 2, (draft), Comprehensive Environmental Assessment and Response Program, Albuquerque Operations Office, Albuquerque, New Mexico. **(DOE 1987, 0264)**

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)**

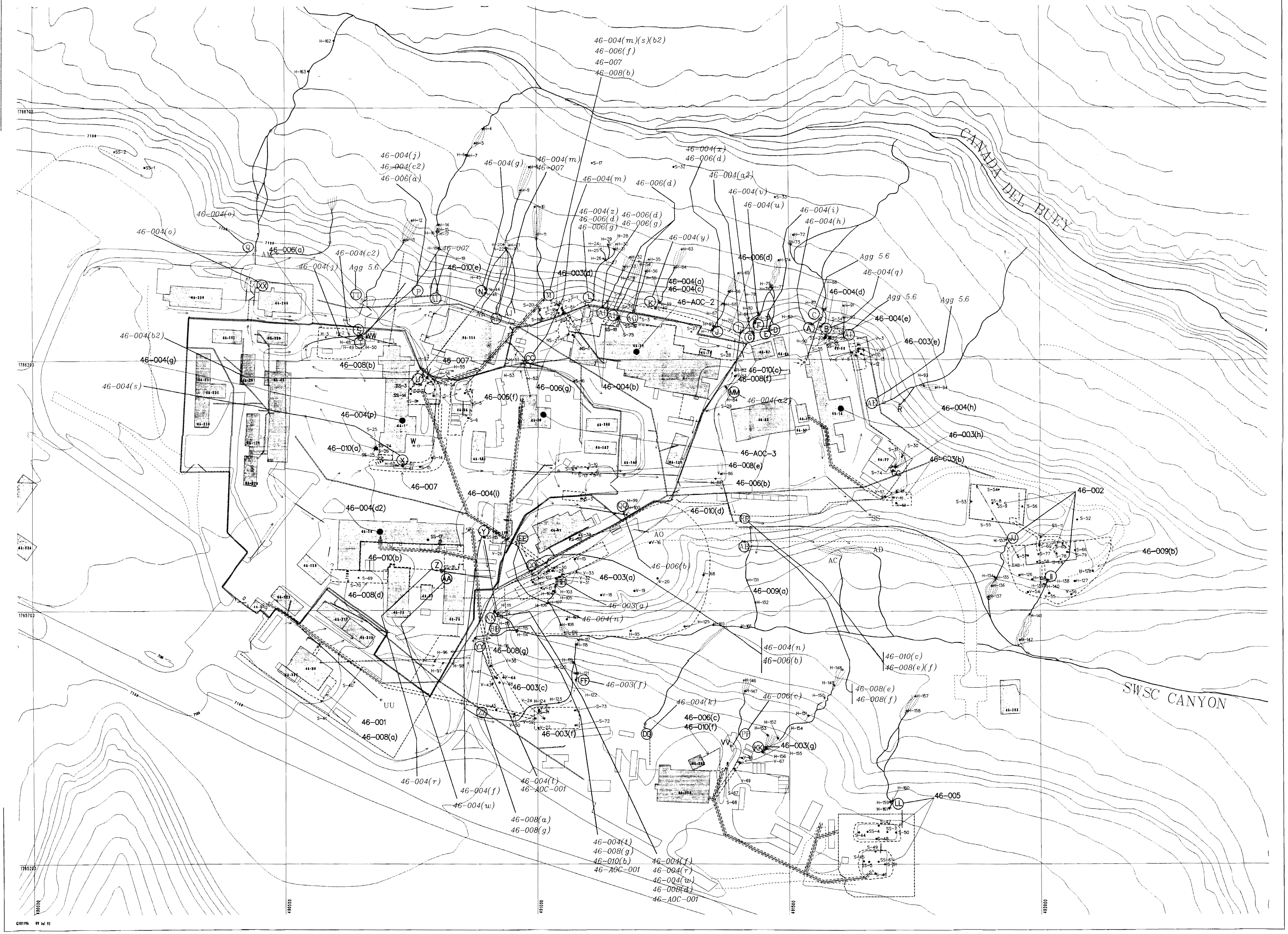
McCulla, A., September 3, 1992. "Summary of Summer Work," Los Alamos National Laboratory Memorandum CLS-ER-RM:92-028 to R. Michelotti (CLS-6) from Allen McCulla (UGS), Los Alamos National Laboratory, Los Alamos, New Mexico. **(McCulla 1992, 11-203)**

Appendix H

Maps



OU 1140 - Sample Locations



LEGEND

- ▨ Contours, 10 foot
- ▨ Contours, 100 foot
- ▨ Fence, Industrial
- ▨ Fence, Security
- ▨ Gate
- ▨ Industrial Waste Line
- ▨ Open Channel Flow
- ▨ Roads, Dirt
- ▨ Roads, Paved
- ▨ Road/Trail
- ▨ Sewer Line
- ▨ Storm Drain
- ▨ PRS, Probable
- ▨ Diffuse Outfall Drainage
- ▨ Incised Drainage Channel
- ○ Sediment Catchment
- ⊞ Storm Grate
- * Outfall
- ● Stack Emission PRS (Agg. 5.6)
- ▨ Permanent Structure
- ☐ Temporary Structure

Sample Points

- ● Agg. 5.1 Septic Systems
- ● Agg. 5.2 Lagoons
- ● Agg. 5.3 Surface Release
- ● Agg. 5.4 Outfalls
- ● Agg. 5.5 Landfill
- ● Agg. 5.6 Stack Emission
- ▨ Shallow Angle Borehole

H - Hand Auger Location
NS - Near Surface Samples
SS - Sediment Sample
SAB - Shallow Angle Borehole
S - Surface Soil Samples
V - Vertical Bore Hole

OUTFALL LEGEND

AE: Surface Run-Off

R: Industrial Drains
(point sources)

Agg 5.6: PRS Contributors to Outfall

NOTES:

Blue arrows indicate direction of water flow. '?' indicates flow of water is unknown at that location.

All sewer lines not otherwise assigned are part of SWMU 46-002.

Prevailing wind direction is from the South and Southwest.

Outfall PRS boundaries are not shown on this map.

All outfall samples will be analyzed for aggregate 5.6 PCOCs.

OU 1140 - Sample Locations

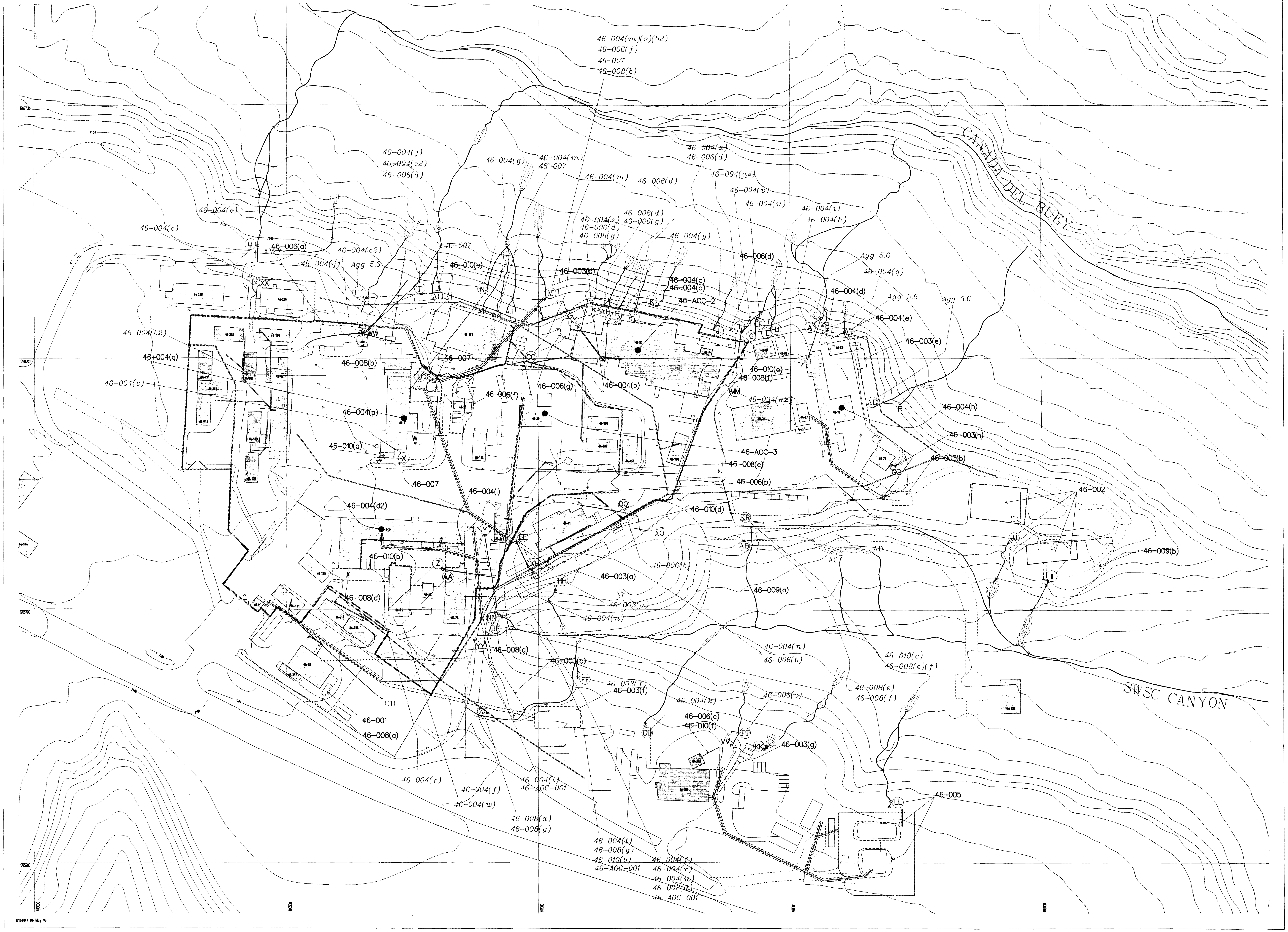
NORTH, NM State Plane
Grid provides NMSP coordinates, in feet
Grid interval, in feet: 500

0 60 120 180 ft

NOTICE: Information on this map is provisional and has not been checked for accuracy

University of California
Los Alamos National Laboratory
Earth & Environmental Sciences Division
FIMAD Facility for Information Management, Analysis and Display
Produced by: Doug Walther
Date: 93-07-09

OU 1140 - PRSs



LEGEND

- Contours, 10 foot
- Contours, 100 foot
- Fence, Industrial
- Fence, Security
- Gate
- Industrial Waste Line
- Open Channel Flow
- Roads, Dirt
- Roads, Paved
- Road/Trail
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OUTFALL LEGEND

AE: Surface Run-Off

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(point sources)

Agg 5.6: PRS Contributors to Outfall

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OU 1140 - PRSs

NORTH, NM State Plane

Grid provides NMSP coordinates, in feet

Grid interval, in feet: 500

0 60 120 180 ft

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