RFI Work Plan for Operable Unit 1122

Environmental Restoration Program

May 1992

A Department of Energy Environmental Cleanup Program

Los Alamos
NATIONAL LABORATORY

LA-UR-92-925

EXECUTIVE SUMMARY

In March 1987, the Department of Energy (DOE) established an Environmental Restoration (ER) Program to address environmental cleanup requirements at all of its facilities nationwide. Los Alamos National Laboratory (LANL or the Laboratory) is operated for the DOE by the University of California (UC) and is participating in the DOE's ER Program.

The Laboratory's Resource Conservation and Recovery Act (RCRA) operating permit sets forth requirements that are implemented by the Laboratory's Environmental Restoration (ER) Program. In particular, the Hazardous and Solid Waste Act Amendments (HSWA) Module and schedules of the permit issued by the Environmental Protection Agency (EPA), give specific requirements affecting the conduct of the ER Program. In addition to RCRA requirements, the Laboratory's ER program also is consistent with the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).

The HSWA Module, which became effective May 23, 1990, requires the Laboratory to prepare an installation-wide work plan to contain the programmatic elements of a RCRA Facility Investigation (RFI)/corrective measures study (CMS). This requirement was satisfied by a Laboratory-wide Installation Work Plan (IWP) submitted to the EPA November 19, 1990 (LANL 1990, 0144). The IWP is updated yearly. The IWP serves as the plan by which DOE/UC will conduct the ER Program at the Laboratory. The IWP describes the ER Program and its history at the Laboratory, provides installation-wide descriptions of current conditions, identifies solid waste management units (SWMUs) and their aggregation into twenty-three ER Program management units called Operable Units (OUs), and presents the Laboratory's overall management and technical approach for meeting the requirements of the HSWA Module. The Operable Unit 1122 work plan, as with all OU work plans, is tiered to the IWP. Relevant information in the IWP is incorporated into the OU 1122 plan by reference.

The purpose of this document is to provide a work plan for conducting the first stage of a Resource, Conservation, and Recovery Act (RCRA) corrective action plan for OU 1122 which consists of Technical Areas (TAs) TA-33 and TA-70. The objectives of this first stage, called a RCRA Facility Investigation (RFI), are to evaluate the nature and extent of release of hazardous waste and hazardous constituents and to gather necessary data to support the next two phases. These next two stages are concerned with evaluation and development of corrective measures and corrective measures implementation.

This RFI work plan addresses activities planned to characterize and evaluate the environmental setting and hazardous materials releases at TA-33 and TA-70 at Los Alamos National Laboratory. All SWMUs listed in Table A and Table B of the HSWA Permit that are identified as located at TA-33 are addressed in this work plan. This contributes to meeting cumulative totals of addressing 35% of Table A SWMUs and 55% of Table B SWMUs required by the HSWA module.

Operable Unit 1122 consists of TA-33 and TA-70 and all SWMUs and areas of concern (AOCs) associated with these two technical areas. Operable Unit 1122 is located in Los Alamos County in north-central New Mexico (Fig. 1). TA-33, also known as Hot Point (HP) Site, and TA-70 are located at the southeast boundary of

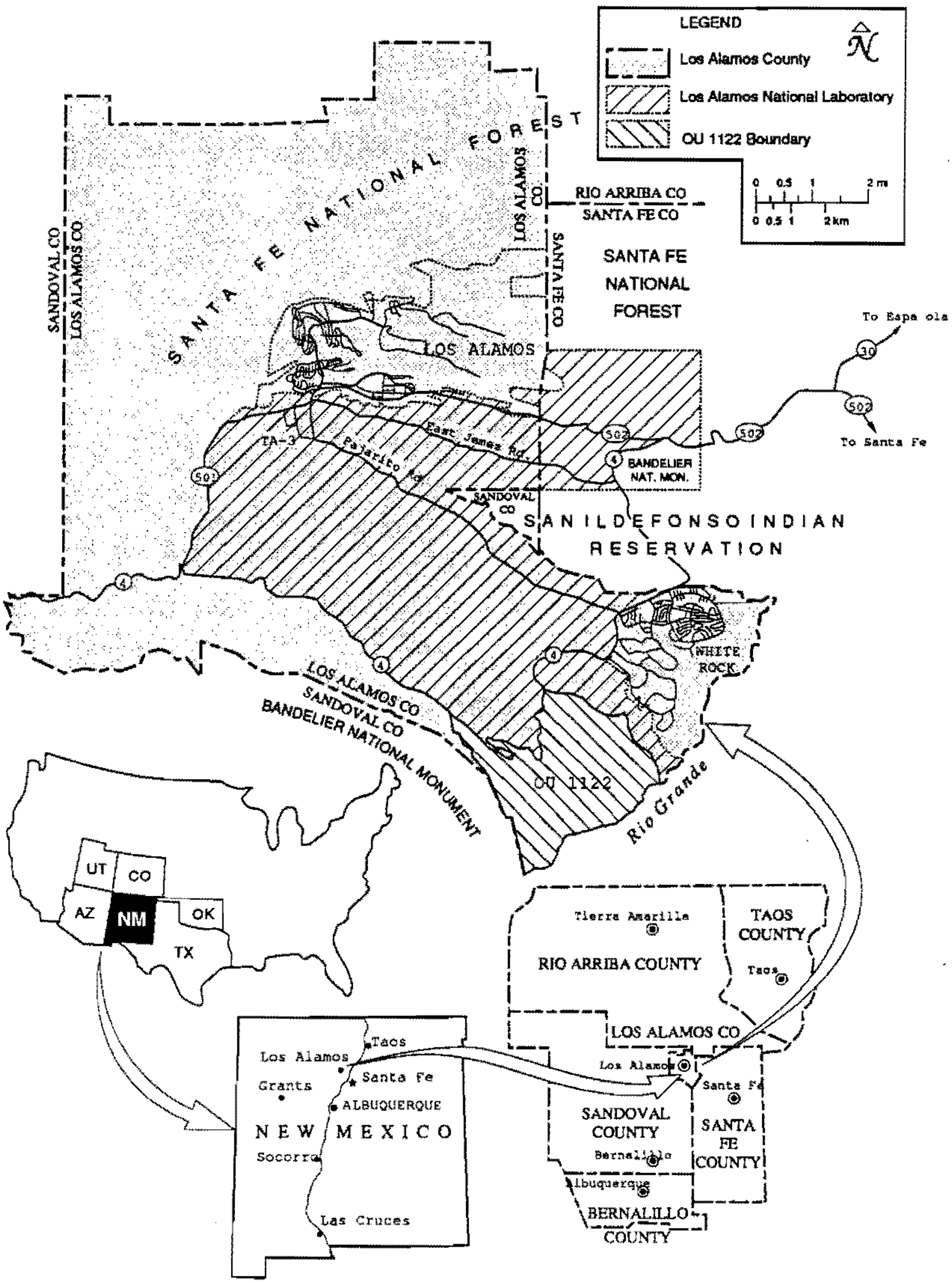

Fig. 1. Location map of Los Alamos National Laboratory.

the Los Alamos National Laboratory (Fig. 2).

TA-33 was created in 1947 as a test site for weapons experiments using conventional high explosives, uranium, beryllium, and polonium radiation sources. The tests were conducted primarily to verify designs of nuclear weapons' components called initiators. The experiments were performed in underground chambers, on surface firing pads, and at firing sites equipped with large guns that fired projectiles into catcher berms. These activities ceased in 1972. A high-pressure tritium facility was operated at the area from 1955 until late 1990. Current activities are centered primarily at Main Site located near the entrance gate, with laboratory groups occupying portions of the office buildings. Other small buildings and surface areas are also used. The National Radio Astronomy Observatory Very Long Baseline Array radiotelescope antenna was sited at TA-33 in 1985 and is still operational.

TA-70 was established in 1989 when the Laboratory redefined the technical area boundaries. TA-70 was formerly part of TA-0, a collection of Laboratory properties not used for Laboratory programs. This site is designated as a buffer zone of the Laboratory and has not been used for any Laboratory operations. Laboratory buffer zones are used to protect, separate, or secure areas based on programmatic needs. These safety buffer zones serve to separate high explosives research and development and testing areas from surrounding non-explosives programmatic activities and the general public. No SWMUs have been identified at TA-70.

The SWMUs in Operable Unit 1122 fall into three general categories as follows:

- surface contamination areas where contaminants were released at or to the land surface, such as fallout from a firing site or stack release fallout, surface spills, and surface solid waste disposal areas;
- surface and near-surface liquid releases, such as discharges from septic systems and industrial drainage systems; and
- subsurface contamination areas, such as material disposal areas (MDAs) and landfills where solid wastes were placed or buried as a result of either programmatic experiments or disposal of waste from experiments.

Primary contaminants at TA-33 consist of uranium, beryllium, high explosives residues, and tritium. Other minor contaminants associated with former Laboratory operations include: plutonium, cadmium, silver, lead, mercury, and solvents. Under current land use patterns in the vicinity of TA-33, no pathways or receptors provide an imminent threat and are not a concern.

This work plan was developed using the observational approach and phased investigations as described in the IWP. The approach also incorporates use of Subpart S action levels as criteria for identifying further phased sampling and determining the need for a corrective measures study (EPA 1990, 0432). This work plan includes surface and subsurface investigations which will provide general environmental characteristics, contaminant identification, levels of contaminant, and the nature and extent of contaminant migration. Investigation groups include the following:

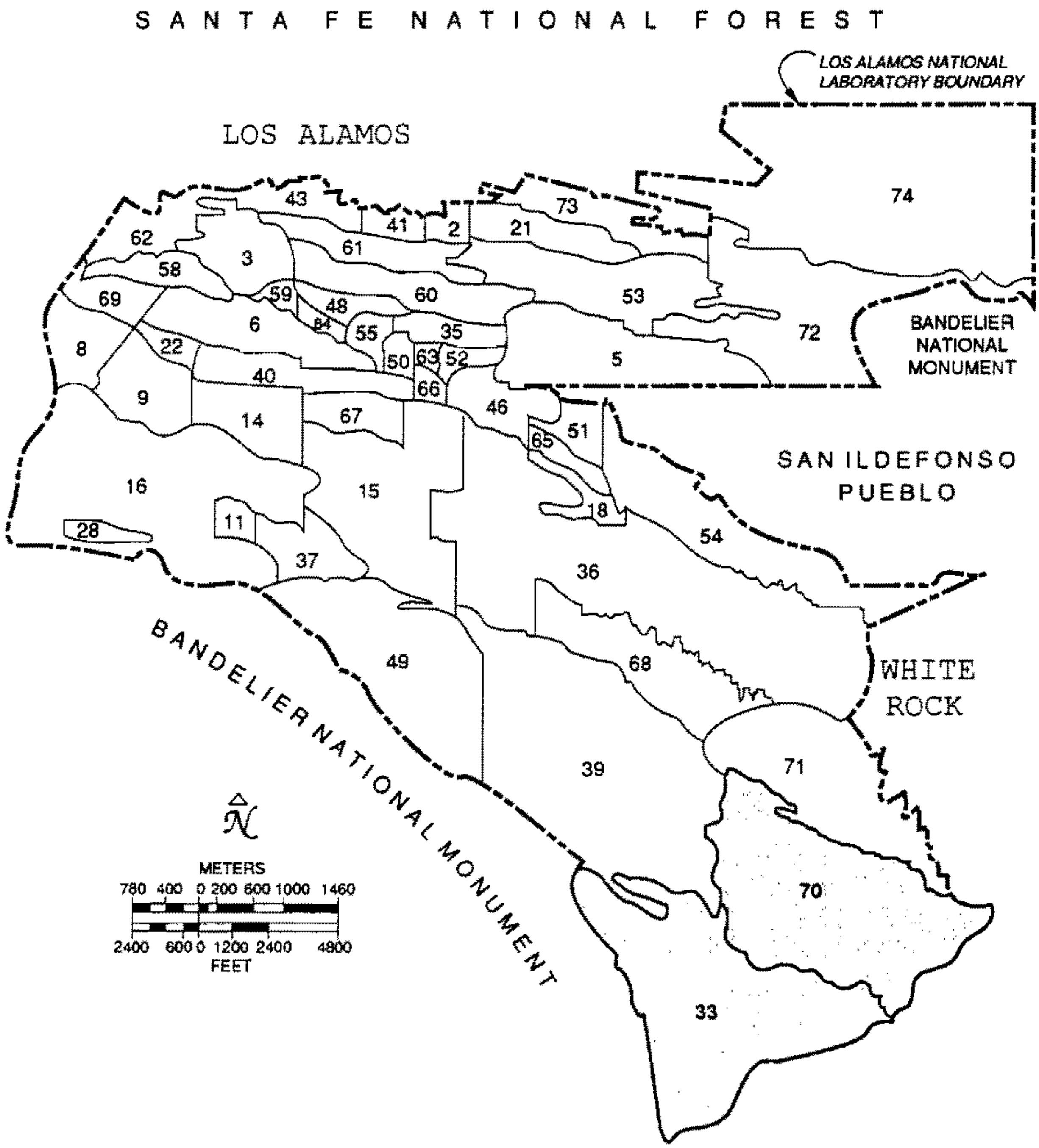

Fig. 2. Technical Area 33 and Technical Area 70 in relation to other sites at Los Alamos National Laboratory.

- Mesa top characterization
- Surface units
- Outfalls and septic systems
- Material disposal areas (MDAs)
- Subsurface units
- Areas of concern (AOCs)
- Units proposed for no further action

Radiological contamination is a general characteristic of TA-33 and a focus of SWMU-specific investigation. For most SWMUs, the release of any hazardous constituents would have been associated with the release of radioactive materials. Field instrument surveys and field screening of samples can be used to identify gross contamination and to serve as Analytical Level I/II data. Field laboratory analyses can be used to provide rapid Analytical Level II data to help guide field operations and to support field decisions. An analytical laboratory will be used to provide Analytical Level III/IV data. A full suite of analytes for analytical laboratory analysis typically includes:

- gamma spectrometry
- tritium
- total uranium
- isotopic plutonium
- volatile organic compounds
- semivolatile organic compounds
- the RCRA-regulated metals

Milestones covering characterization and corrective measures work are presented in Fig. 3. A summary of the estimated schedule and costs covering characterization and corrective measures work is presented in Table 1. These schedules and costs will be updated through DOE change control procedures as appropriate with revisions submitted to the EPA for approval. More detailed schedule and cost information is included in Annex I.

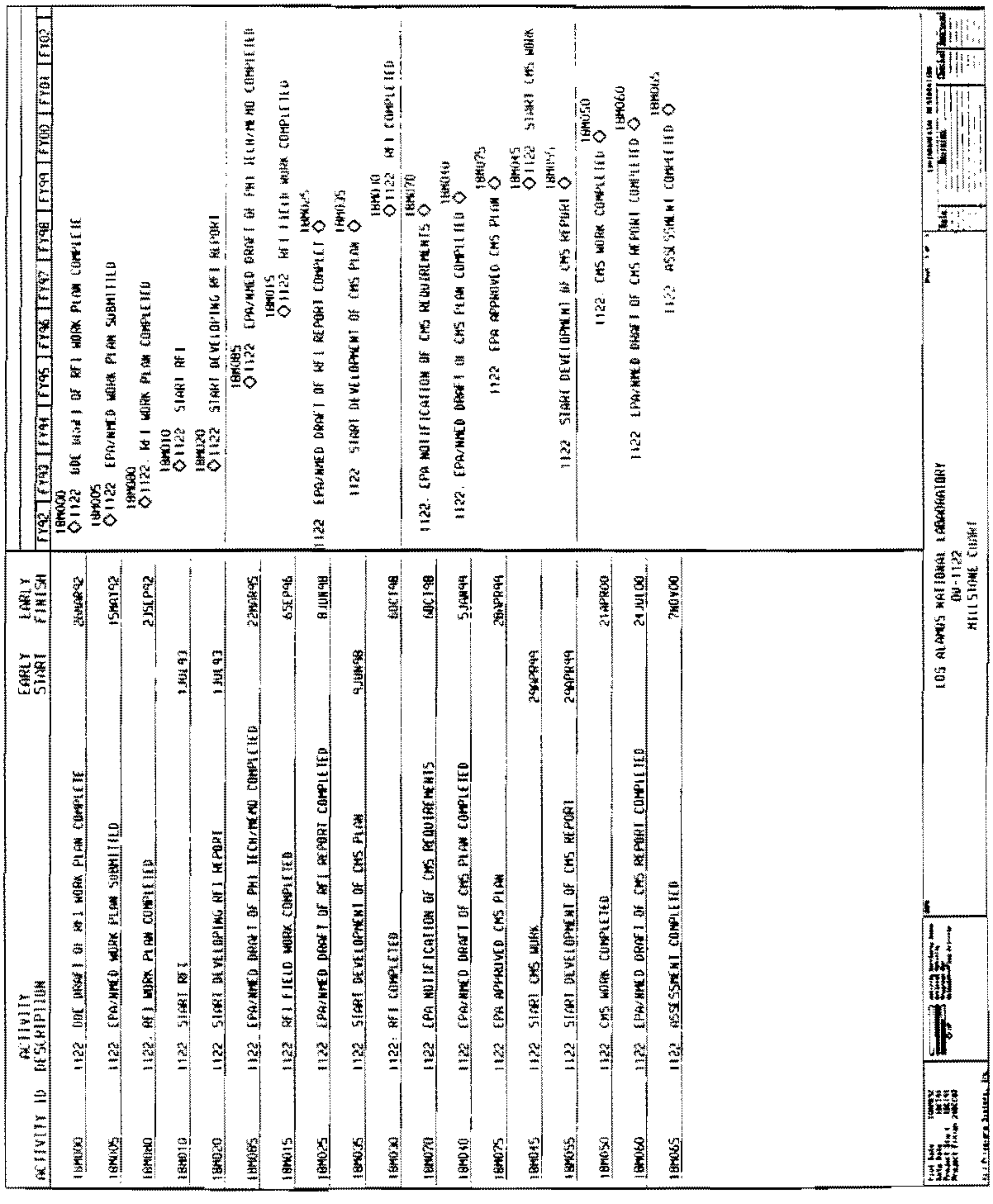

Fig. 3. Milestones for characterization and corrective measures work.

TABLE-1
ESTIMATED SCHEDULE AND COSTS COVERING CHARACTERIZATION AND CORRECTIVE MEASURES

LANL - KEITH DOWLER | FINEST HOUR | ADS 1122: TA-33, 70 ASSESSMENT

REPORT DATE 18FEB92 RUN NO. 76 16:15 | ENVIRONMENTAL RESTORATION | START DATE 1OCT91 FIN DATE 7N

SUMMARY BY WBS LEVEL 4 - DELIVERABLE LEVEL | | DATA DATE 1OCT91 PAGE NO.

	DUR	%	SUMMARY DESCRIPTION	BUDGET	EARNED	SCHEDULED START	SCHEDULED FINISH
1	408	0	ASSESSMENT - RFI WORK PLAN	611985.00	.00	1OCT91	21MAY93
2	814	0	ASSESSMENT - RFI	23648606.99	.00	1JUL93	4OCT96
3	1312	0	ASSESSMENT - RFI REPORT	2047288.24	.00	1JUL93	6OCT98
4	245	0	ASSESSMENT - CMS PLAN	67236.57	.00	9JUN98	2JUN99
5	245	0	ASSESSMENT - CMS	1339099.00	.00	29APR99	21APR00
6	520	0	ASSESSMENT - CMS REPORT	344725.59	.00	7OCT98	7NOV00
7	1992	0	ASSESSMENT - ADS MANAGEMENT	1417192.86	.00	1OCT91	30SEP99
8	2267	0	ASSESSMENT - VCA	227497.00	.00	1OCT91	7NOV00
REPORT TOTAL				29703431.25	.00		

$ X 1000	
EST TO COMPLETION	$29,704
ESCALATION	$406
PRIOR YEARS	$1,334
TOTAL AT COMPLETION	$31,444

REFERENCES

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, Vol. 55 Federal Register, pp. 30798-30884. **(EPA 1990, 0432)**

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

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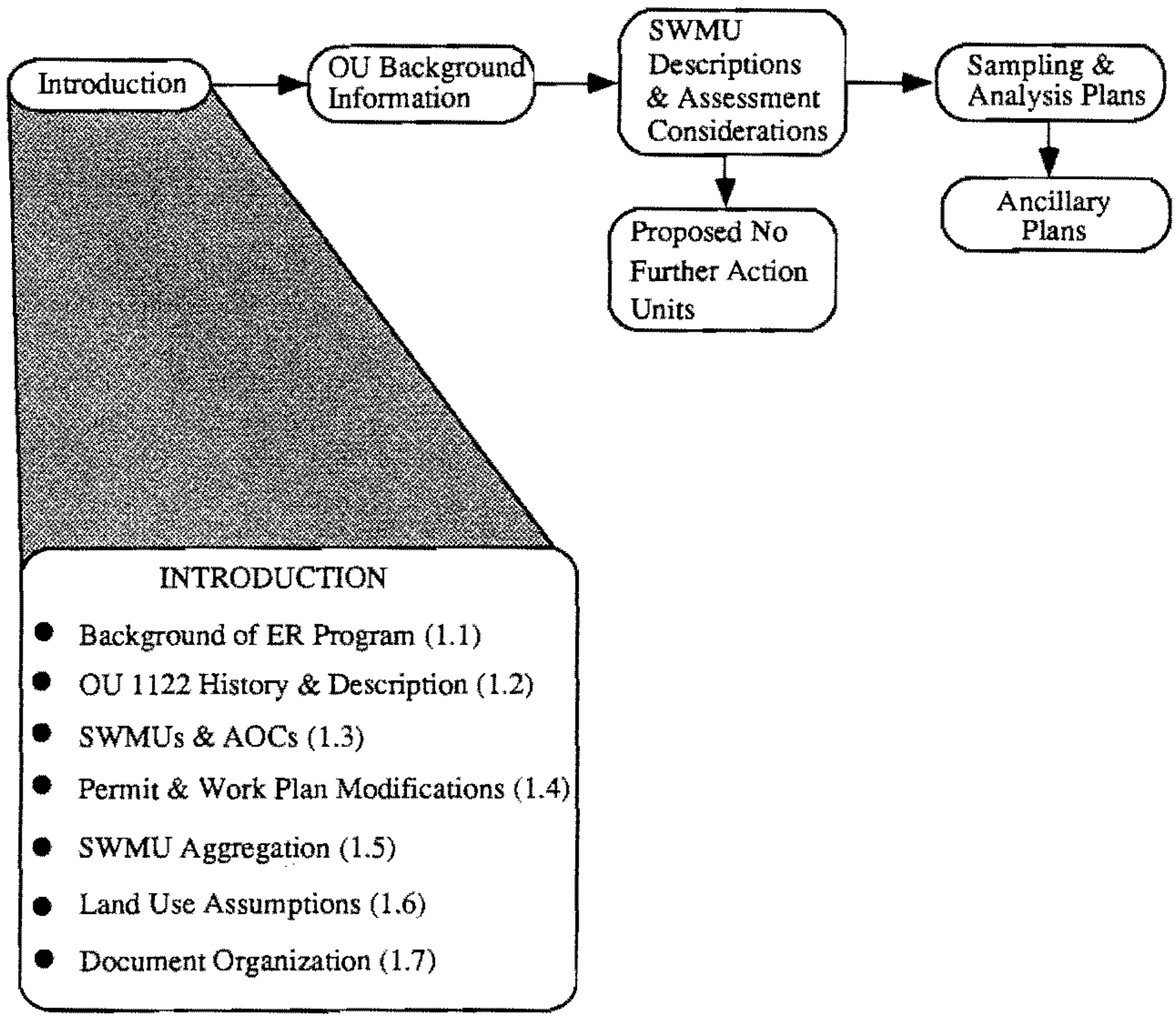
LIST OF ACRONYMS AND ABBREVIATIONS

ADM	Action description memorandum
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
ASME	American Society of Mechanical Engineers
CAR	Corrective action requirement
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
CY	Calendar year
D&D	Decontamination and decommissioning
DoD	US Department of Defense
DOE	US Department of Energy
DOE/AL	US Department of Energy /Albuquerque Operations Office
DOE/HQ	US Department of Energy /Headquarters
DOE/LAAO	US Department of Energy /Los Alamos Area Office
DQO	Data quality objective
EIS	Environmental impact statement
EM	Environmental Management (Division)
EPA	US Environmental Protection Agency
ER	Environmental restoration
ERDA	US Energy Research and Development Administration
ES&H	Environment, safety, and health
FIMAD	Facility for Information Management, Analysis, and Display
FY	Fiscal year
GC/MS	Gas chromatograph/mass spectrometer
HP	Hot Point
H&S	Health and Safety (Division)
HSWA	Hazardous and Solid Waste Amendments
IDLH	Immediately dangerous to life and health
IWP	Installation Work Plan
LANL	Los Alamos National Laboratory
LASL	Los Alamos Scientific Laboratory (LANL before 1979)
LEL	Lower exposure limit
MDA	Material disposal area
MSHA	Mine Safety and Health Administration
Myr	Million year
NEPA	National Environmental Policy Act
NFA	No further action
NIOSH	National Institute of Occupational Safety and Health
NMED	New Mexico Environment Department (formerly the Environmental Improvement Division, NMEID)
NPDES	National pollutant discharge elimination system
NRAO	National Radio Astronomy Observatory

NRC	US Nuclear Regulatory Commission
OEL	Occupational exposure limit
OSHA	Occupational Safety and Health Administration
OU	Operable unit
OUPL	Operable unit project leader
PCB	Polychlorinated biphenyl
PEL	Permissible exposure limit
PL	Project leader
PM	Program manager (ER)
PPM	Parts per million
QA	Quality assurance
QAPjP	Quality assurance project plan
QC	Quality control
QP	Quality procedure
QPP	Quality program plan
QPPL	Quality program project leader
RAM	Real-time aerosol monitor
RCRA	Resource Conservation and Recovery Act
RFA	RCRA facility assessment
RFI	RCRA facility investigation
RFP	Request for proposal
RMP	Records management plan
RPF	Records-Processing Facility
SOP	Standard operating procedure
SWMU	Solid waste management unit
SPPL	Senior programmatic project leader
TA	Technical area
TLD	Thermoluminescent dosimeter
TLV	Threshold limit value
TRU	Transuranic (waste)
TTL	Technical team leader
UC	University of California
USGS	US Geological Survey
VCA	Voluntary corrective action

CHAPTER 1



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1.0 INTRODUCTION

The purpose of this document is to provide a work plan for conducting the first stage of a Resource, Conservation, and Recovery Act (RCRA) corrective action plan for Operable Unit (OU) 1122, which consists of Technical Area (TA) 33 and TA-70. The objectives of this first stage, called a RCRA Facility Investigation (RFI), are to evaluate the nature and extent of the release of hazardous waste and hazardous constituents and to gather necessary data to support the next two stages. These next two stages are concerned with evaluation and development of corrective measures and corrective measures implementation.

This RFI work plan addresses activities planned to characterize and evaluate the environmental setting and hazardous materials releases at TA-33 and TA-70 at Los Alamos National Laboratory (LANL or the Laboratory).

This work plan also addresses radioactive and other hazardous substances not regulated by RCRA but defined in the Comprehensive Environmental Response and Liability Act (CERCLA), as well as other environmental laws. The goal of the Environmental Restoration Program at the Laboratory is to comply with RCRA, CERCLA, the Atomic Energy Act (AEA), the National Environmental Policy Act (NEPA), and other applicable regulations.

The Laboratory ER Program is a RCRA/CERCLA-integrated program. Areas of concern (AOCs) and materials that do not meet the RCRA definitions of hazardous wastes (e.g., some radioactive wastes) defined in CERCLA will be addressed as appropriate.

Cultural and biological resource surveys have been started. Summary reports of the survey work are included in Appendix A and Appendix B. Complete reports with maps will be available before field work begins. Biological resources, as well as sensitive areas, will be identified in these reports and maps.

1.1 *Background of the Environmental Restoration Program*

In March 1987, the Department of Energy (DOE) established an Environmental Restoration Program to address environmental cleanup requirements at all of its facilities nationwide. Los Alamos National Laboratory is operated for the DOE by the University of California (UC) and is participating in the DOE's ER Program.

The Laboratory's RCRA operating permit sets forth requirements that are implemented by the Laboratory's ER Program (EPA 1990, 0306). In particular, the Hazardous and Solid Waste Act Amendments (HSWA) Module and schedules of the permit issued by the Environmental Protection Agency (EPA), give specific requirements affecting the conduct of the ER Program. The HSWA Module became effective May 23, 1990 (EPA 1990, 0432).

The HSWA Module requires the Laboratory to prepare an installation-wide work plan to contain the programmatic elements of a RFI work plan. This requirement was satisfied by a Laboratory-wide Installation Work Plan (IWP) submitted to the EPA November 19, 1990 (LANL 1990, 0144) and updated annually (LANL 1991, 0553). The IWP serves as the plan by which DOE/UC will conduct the ER Program at the Laboratory. The IWP describes the ER Program and its history at the Laboratory, provides installation-wide descriptions of current conditions, identifies solid waste management units (SWMUs) and their aggregation into a number of ER Program management units called Operable Units, and presents the Laboratory's overall management and technical approach for meeting the requirements of the HSWA Module. The IWP serves as an umbrella document that will be referenced in this and subsequent work plans.

Module VIII of the HSWA Permit establishes corrective action requirements (CARs). Task IV, Investigative Analysis, specifies that the permittee must identify all relevant and applicable standards for the protection of human health and the environment. Task VI, Identification and Development of the Corrective Action Alternative or Alternatives, further specifies that based on the results of the RFI, the permittee must identify, screen, and develop the alternatives for removal, containment, treatment, and/or remediation of contamination based on objectives established for corrective action. Cleanup requirements can be divided into three categories: (1) contaminant-specific requirements which address specific contaminants, (2) location-specific requirements which are based on a specific site setting, and (3) action-specific requirements associated with specific response actions. In the absence of more information about type and concentration of contaminants at the SWMUs being investigated, the identification of potential CARs at this time would be premature. The full tabulation of potential location-specific, contaminant-specific, and action-specific requirements will be provided in future technical reports as adequate SWMU information is obtained through the RFI process.

The environmental restoration work at the Laboratory is performed in compliance with a RCRA Part B operating permit. However, this work is also performed in accord with applicable sections of CERCLA, as required by DOE Order 5400.4. CERCLA Section 120 extends natural resource damage liability to federal facilities, which include LANL. The first part of the natural resource damage assessment is a pre-assessment screen that is governed by regulations in 43 CFR 11. The pre-assessment screen will be used to determine whether a full natural resource damage assessment is appropriate. The pre-assessment screen will be integrated with the CERCLA ecological assessment process for this operable unit. A general description of the pre-assessment screen and the ecological assessment will be written for inclusion in the IWP. Any modifications of the general procedure that might be necessary for this operable unit will be described in future reports of progress pertaining to this operable unit facility investigation. This is consistent with "Guidance for Natural Resource Trusteeship and Ecological Evaluation for Environmental Restoration at DOE Facilities" (DOE 1991, 0560).

During the development of the ER Program within the Laboratory and the DOE, work plan tasks have been identified differently for the purposes of long-range planning, accounting, and work breakdown structure. The RFI work associated with TA-33 and TA-70 has been identified as Activity Data Sheet (ADS) 1122 and Operable Unit (OU) 1122. For the remainder of this document, all discussion associated with this RFI will be identified as Operable Unit 1122.

All SWMUs listed in Table A and Table B of the HSWA Permit that are identified as located at TA-33 are addressed in this work plan. This contributes to meeting cumulative totals of addressing 35% of Table A SWMUs and 55% of Table B SWMUs, required by the HSWA module.

1.2 Operable Unit 1122 History and Description

Operable Unit 1122 consists of TA-33 and TA-70 and all SWMUs and AOCs associated with these two technical areas. Operable Unit 1122 is located in Los Alamos County in north-central New Mexico (Fig. 1-1). TA-33, also known as Hot Point (HP) Site, and TA-70 are located at the southeast boundary of the Los Alamos National Laboratory (Fig. 1-1). Contour maps of Operable Unit 1122 aggregated sites showing structures, SWMUs, and boundaries are included in Appendix D.

The 1991 IWP includes maps of the topography, wetlands, and drainage patterns of Los Alamos County (Appendix C); a 100-year floodplain map for Los Alamos National Laboratory (Appendix D); and a map of well locations in Los Alamos County and adjacent locales (Appendix E) (LANL 1991, 0553). These IWP maps include Operable Unit 1122.

TA-33 was created in 1947 as a test site for weapons experiments using conventional high explosives, uranium, and beryllium. Polonium was used as a radiation source. The tests were conducted primarily to verify designs of nuclear weapons components called initiators. The experiments were performed in underground chambers, on surface firing pads, and at firing sites equipped with large guns that fired projectiles into catcher berms. These activities ceased in 1972. A high-pressure tritium facility was operated at the area from 1955 until late 1990. Current activities are centered primarily at Main Site, located near the entrance gate, with Laboratory groups occupying portions of the office buildings. Other small buildings and surface areas are also used. An antenna of the National Radio Astronomy Observatory Very Long Baseline Array radiotelescope was sited at TA-33 in 1985 and is still operational.

TA-70 was established in 1989 when the Laboratory redefined the technical area boundaries. TA-70 was formerly part of TA-0, a collection of Laboratory properties not used for Laboratory programs. This site is designated as a buffer zone and has not been used for any Laboratory operations. Laboratory buffer zones are used to protect, separate, or secure areas based on programmatic needs.

Laboratory activity and SWMU identification was verified during a tour by the OU 1122 project team in June 1991. For the remainder of this document, discussion will center on TA-33.

1.3 Solid Waste Management Units (SWMUs) and Areas of Concern (AOCs)

Waste units that are similar in physical characteristics, use or waste type, are described in the SWMU Report as sub-SWMUs within a larger SWMU description. Sub-SWMUs were grouped to eliminate repetition of information. Each sub-SWMU is considered as a SWMU for the purposes of corrective actions (LANL 1990, 0145) and this work plan.

The 1990 SWMU Report (LANL 1990, 0145) identifies 52 SWMUs within TA-33. Table 1-1 provides a SWMU cross-reference of HSWA Module tables and LANL SWMU reports.

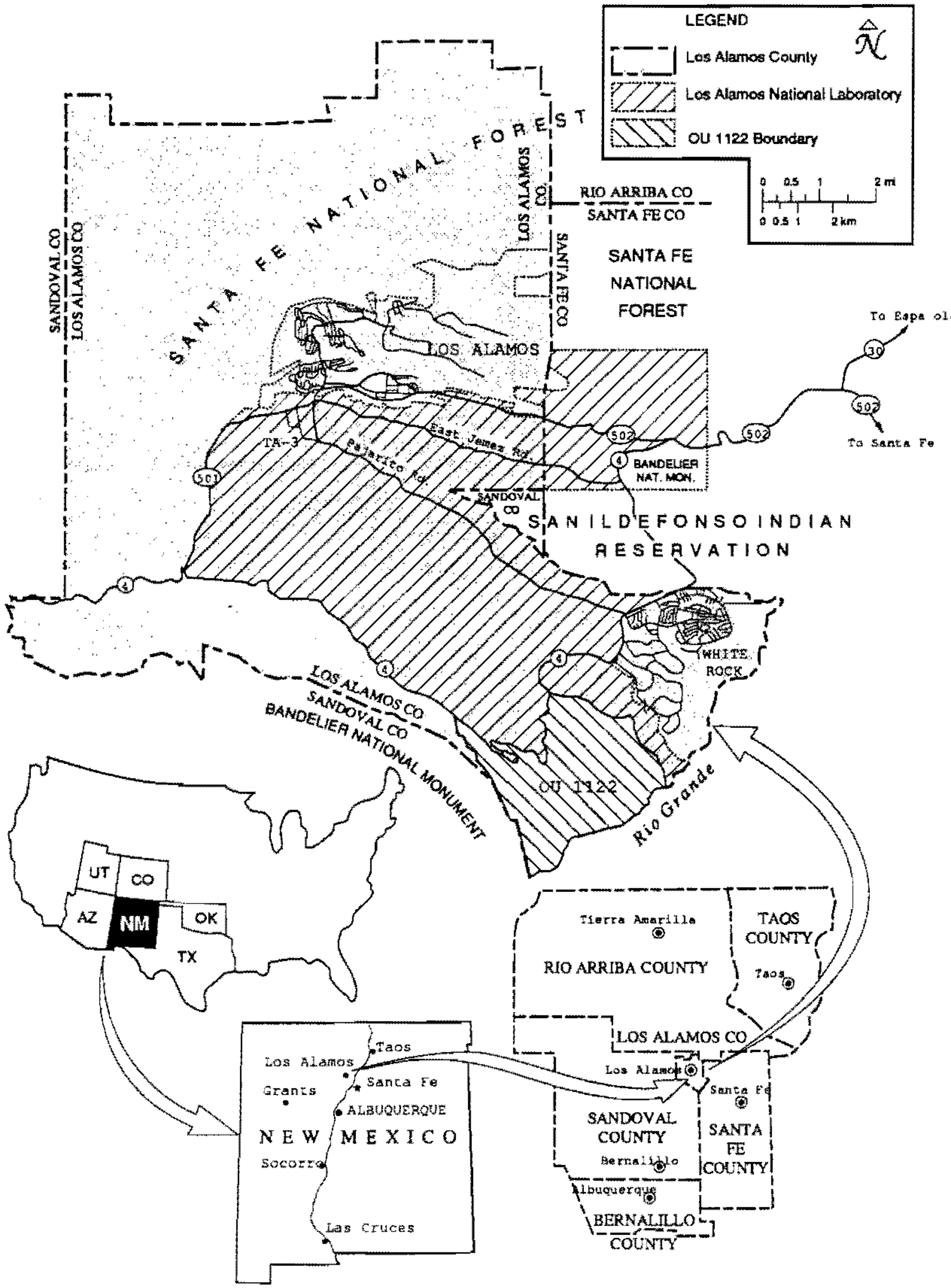

Fig. 1-1. Location of Operable Unit 1122.

TABLE 1-1

TA-33 SWMU CROSS-REFERENCE LIST

HSWA Permit Table A and B	Renumbered SWMUs Old No.	Renumbered SWMUs New No.	New SWMUs	Current SWMUs
33-001(a-e)				33-001(a-e)
33-002(a-c)*				33-002(a-c)
			33-002(d-e)	33-002(d-e)
33-003(a-b)				33-003(a-b)
33-004(a-f)				33-004(a-f)
			33-004(g-n)	33-004(g-n)
				33-005(a-c)[1]
				33-006(a-b)[1]
33-007				33-007(a-c)[1]
33-008(a-b)				33-008(a-b)
33-009				33-009
33-010(a-c)				33-010(a-c)
			33-010 (d-h)	33-010(d-h)
33-011	33-011	33-011 (a)		33-011(a)
			33-011 (b-e)	33-011(b-e)
33-012(a)				33-012(a)
				33-012(b-d)[1]
33-013				33-013
33-014				33-014
				33-015[1]
				33-016[1]
33-017*				33-017

* SWMUs listed in Table B of the HSWA Module as priority SWMUs

1 These SWMUs or SWMU subunits were not originally listed in either Table A or B of the HSWA Module, but are now listed in the 1990 SWMU Report (LANL 1990, 0145).

In addition to SWMUs, the 1990 SWMU Report (LANL 1990, 0145) identifies areas of concern. Table 1-2 identifies the two areas of concern within Operable Unit 1122. Areas of concern are sites that do not meet the RCRA definition of solid waste management units such as potential release sites; however, they are areas of environmental concern that can be regulated by other acts or permit programs.

In addition to areas of concern, this work plan will investigate and evaluate materials that also do not meet the RCRA definition of hazardous wastes. Thus, use of RCRA terminology (e.g., SWMU and hazardous waste) in the work plan implies that radioactive and hazardous substances, as defined in CERCLA and elsewhere, will be addressed as appropriate (LANL 1991, 0553).

TABLE 1-2

TA-33 AREAS OF CONCERN

Site No.	Associated Structure	Description
C-33-001	TA-33-124	Transformer pad with stains; no active leak noted during transformer assessment on 9/24/85; PCB ID No. 5031. (LANL Transformer Assessment Sheets)
C-33-002	TA-33-95	Transformer in vault with old stains present; no active leak noted during transformer assessment; PCB ID No. 5606. (LANL Transformer Assessment Sheets)

1.4 Permit and Work Plan Modifications

Section 3.5 of the IWP (LANL 1991, 0553) states that each RFI work plan may propose a HSWA Module Class III permit modification to adjust the SWMUs listed in Table A and Table B of the HSWA Module. Such adjustments may be made to remove SWMUs determined not to need further investigation and to add SWMUs to the current SWMU Report. Listed below are SWMUs that are proposed for deletion from Table A of the HSWA Module based on information obtained during the preparation of this RFI work plan. Chapter 5, Proposed No Further Action Units, discusses the details of these SWMUs.

SWMUs identified for no further action:

- SWMUs 33-012(b-d) - Active waste satellite storage areas
- SWMU 33-004(e) - Septic tank, TA-33-169
- SWMU 33-004(f) /SWMU 33-004(n) - Septic tank, TA-33-23/ septic tank
- SWMU 33-004(l) - TA-33-89 outfall

To update the EPA on the progress of RFI field work, it is proposed to submit RFI phase reports regarding site characterization activities on SWMU aggregates. These reports may also serve to modify work plans and field sampling plans to reflect initial characterization.

Therefore, RFI phase reports are essentially partial RFI Phase I reports and partial RFI Phase II work plans. The schedule for these RFI phase reports/work plan modifications is presented in Annex I, the Project Management Plan.

1.5 SWMU Aggregation

SWMUs have been aggregated into five geographical sites within the operable unit. The five sites and locations where they are addressed in Chapters 3 and 4 of the RFI work plan are tabulated below.

	RFI Location	
Aggregated Site	**Chapter 3, Section**	**Chapter 4, Section**
Main Site	3.2	4.2
Area 6 Site	3.3	4.3
South Site	3.4	4.4
East Site	3.5	4.5
NRAO Site	3.6	4.6

1.6 Land Use Assumptions

In order to establish preliminary remediation goals for OU 1122, present land use must be considered and scenarios for future land use must be defined. Proposed corrective measures and conditional remedies must be compatible with both present and future land use.

1.6.1 Present Land Use

TA-33 is designated as a multiuse experimental science zone (EX-4) by the Los Alamos National Laboratory Site Development Plan (Pava 1990, 0368). Although the site is remote and its use is constrained by limited utility service, "it has proven ideal for experiments not requiring daily oversight, or those requiring isolation or that are sensitive to electromagnetic interference" (Pava 1990, 0368). Current and recent activity at TA-33 has been concentrated in the area near the entrance from State Road 4, where approximately 60 full-time employees occupy the main office buildings. The only other active sites are an antenna that is part of the National Radio Astronomy Observatory's Very Large Array and a number of smaller antennae operated by LANL for atmospheric observations; these are visited periodically by maintenance workers.

No programmatic activities have ever been carried out at TA-70, and none are planned for the near future, although TA-70 is reserved for "future large-scale experimental science" (Pava 1990, 0368). At present, TA-70 serves only as a buffer zone and may be used occasionally by hikers. The areas outside of the mesa tops at both TA-33 and TA-70, which are primarily sloped canyon walls and canyon bottoms, are designated as buffer zones (ER-1) in the Site Development Plan.

1.6.2 Future Land Use

Both technical areas will eventually be released to the control of the adjacent Bandelier National Monument. Recreational use and limited construction will then occur on the site.

1.7 Document Organization

This RFI work plan is organized to correspond to the requirements of the HSWA Module (EPA 1990, 0432) and to the proposed outline included in the IWP (LANL 1991, 0553).

1.7.1 Correspondence with HSWA Permit

The HSWA Module defines five general tasks in the RCRA Facility Investigation process. Table 1-3 summarizes the five tasks and lists the ER Program equivalents for each task. The sections of the Operable Unit 1122 RFI work plan that correspond to each of the five tasks is discussed below:

RFI Task I. Description of Current Conditions The task consists of a presentation of facility background information and a discussion of the nature and extent of contamination. The background information on OU 1122 is presented in Chapter 2 and Chapter 3. This information consists of the geographic setting, history of activities, current activities, the environmental setting, and geological features. The nature and extent of contamination is covered in sections discussing individual SWMUs, Chapter 3.

RFI Task II. RFI Work Plan This task requires plans for Quality Assurance, Health and Safety, Records Management, and Community Relations. These plans are presented as Annexes II through V of this work plan.

RFI Task III. Facility Investigation This task requires further characterization of the environmental setting, source, contamination, and potential receptor identification. These requirements are addressed in Chapters 3 and 4 of this work plan.

RFI Task IV. Investigative Analysis This task contains subsets of Data Analysis and Protection Standard. These considerations are addressed in Revision 1 of the IWP.

RFI Task V. Reports This task calls for preliminary, work plan, progress, draft, and final reports. Work plans are provided on an installation-wide basis (the IWP) and for specific ER Program activities. This document is the RFI work plan for Operable Unit 1122. It contains the Phase I Field Sampling Plans, Project Management Plan, Quality Assurance Project Plan, Records Management Plan, Health and Safety Plan, and Community Relations Plan.

Monthly progress reports for the ER Program will be submitted as described in the IWP, as will draft and final RFI Reports.

TABLE 1-3

RFI GUIDANCE FROM THE LABORATORY'S RCRA PART B PERMIT

Scope of the RFI	ER Program Equivalent	
The RCRA Facility Investigation consists of five tasks:	LANL Installation RI/FS Work Plan	LANL Task/Site RI/FS
Task I: Description of current conditions A. Facility Background B. Nature and Extent of Contamination	I. LANL Installation RI/FS Work Plan A. Installation RI/FS Work Plan 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 Program	II. LANL Task/Site RI/FS Documents A. Quality Assurance Project Plan and Field Sampling Plan B. Technical Data Management Plan C. Health and Safety Plan D. Community Relations 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	V. Reports A. LANL Installation RI/FS Work Plan	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. Progress	B. Annual Update of LANL Installation RI/FS Work Plan	B. LANL Task/Site RI/FS Documents and LANL Monthly Management Status Report
C. Draft and Final	C. Draft and Final	C. Draft and Final

1.7.2 Correspondence with RFI Outline Proposed in the Installation Work Plan

A proposed outline for RFI work plans is presented in the IWP (LANL 1991, 0553). The correspondence between the proposed outline and the OU 1122 work plan is shown in Table 1-4. The IWP allowed for modification of work plans as necessary for individual activities. This work plan exercises that option.

TABLE 1-4

CORRESPONDENCE OF OU 1122 WORK PLAN WITH TABLE 3.2 OUTLINE PROPOSED IN THE 1991 INSTALLATION WORK PLAN

IWP PROPOSED OUTLINE	OU 1122 WORK PLAN
EXECUTIVE SUMMARY	EXECUTIVE SUMMARY
1.0 INTRODUCTION	1.0 INTRODUCTION
2.0 TASK (OR AREA) OF INVESTIGATION DESCRIPTION AND IDENTIFICATION OF DATA NEEDS	2.0 BACKGROUND INFORMATION FOR OPERABLE UNIT 1122
2.1 Background	2.1 Geographic Setting
2.1.1 History of Task (or Area) Activities	2.2 History of Activities at Operable Unit 1122
2.1.2 Past Waste Management Practices	2.3 Past Waste Management Practices
2.2 Current Description	2.4 Current Activities at TA-33
2.3 Existing Information	2.5 Geology
2.3.1 Environmental Setting	2.6 Hydrology
	2.7 Soils
	2.8 Surface Features of Operable Unit 1122
	2.9 Environmental Setting
2.3.2 Potential Pathways for Contaminant Migration	3.2.3, 3.3.3, 3.4.3, 3.5.3, and 3.6.3, Conceptual Exposure Model
2.3.3 Cumulative Public Health and Environmental Impacts	3.2.3, 3.3.3, 3.4.3, 3.5.3, and 3.6.3, Conceptual Exposure Model
2.4 Task (or Area) Data Needs	3.2.5, 3.3.5, 3.4.5, 3.5.5, and 3.6.5, Decisions and Investigation Objectives
3.0 SWMU DESCRIPTION AND IDENTIFICATION OF DATA NEEDS	3.0 SOLID WASTE MANAGEMENT UNIT (SWMU) DESCRIPTIONS
3.1 Title of First SWMU	3.2 Title of First SWMU Aggregate
3.1.1 Existing Information	3.2.1 SWMU Aggregate Descriptions
3.1.2 Data Needs	3.3.1 Decisions and Investigation Objectives
3.1.3 Data Quality Objectives	3.2.6 Phase I Data Quality Objectives
4.0 FIELD SAMPLING PLAN	4.0 OU 1122 SAMPLING PLAN
4.1 Task (or Area) Sampling Plan	4.1 SWMU Aggregate Sampling Plans
5.0 IMPLEMENTATION OF FIELD SAMPLING PLAN	ANNEX I PROJECT MANAGEMENT PLAN
6.0 QUALITY PROGRAM PLAN	ANNEX II QUALITY ASSURANCE PROJECT PLAN
7.0 HEALTH AND SAFETY PROGRAM PLAN	ANNEX III HEALTH AND SAFETY PROJECT PLAN
8.0 RECORDS MANAGEMENT PLAN	ANNEX IV RECORDS MANAGEMENT PROJECT PLAN
9.0 COMMUNITY RELATIONS PLAN	ANNEX V COMMUNITY RELATIONS PROJECT PLAN

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EPA (US Environmental Protection Agency), April 10, 1990. Module VIII of RCRA Permit No. NM0890010515, EPA Region VI, issued to Los Alamos National Laboratory, Los Alamos, New Mexico, effective May 23, 1990. **(EPA 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, Vol. 55 Federal Register, pp. 30798-30884. **(EPA 1990, 0432)**

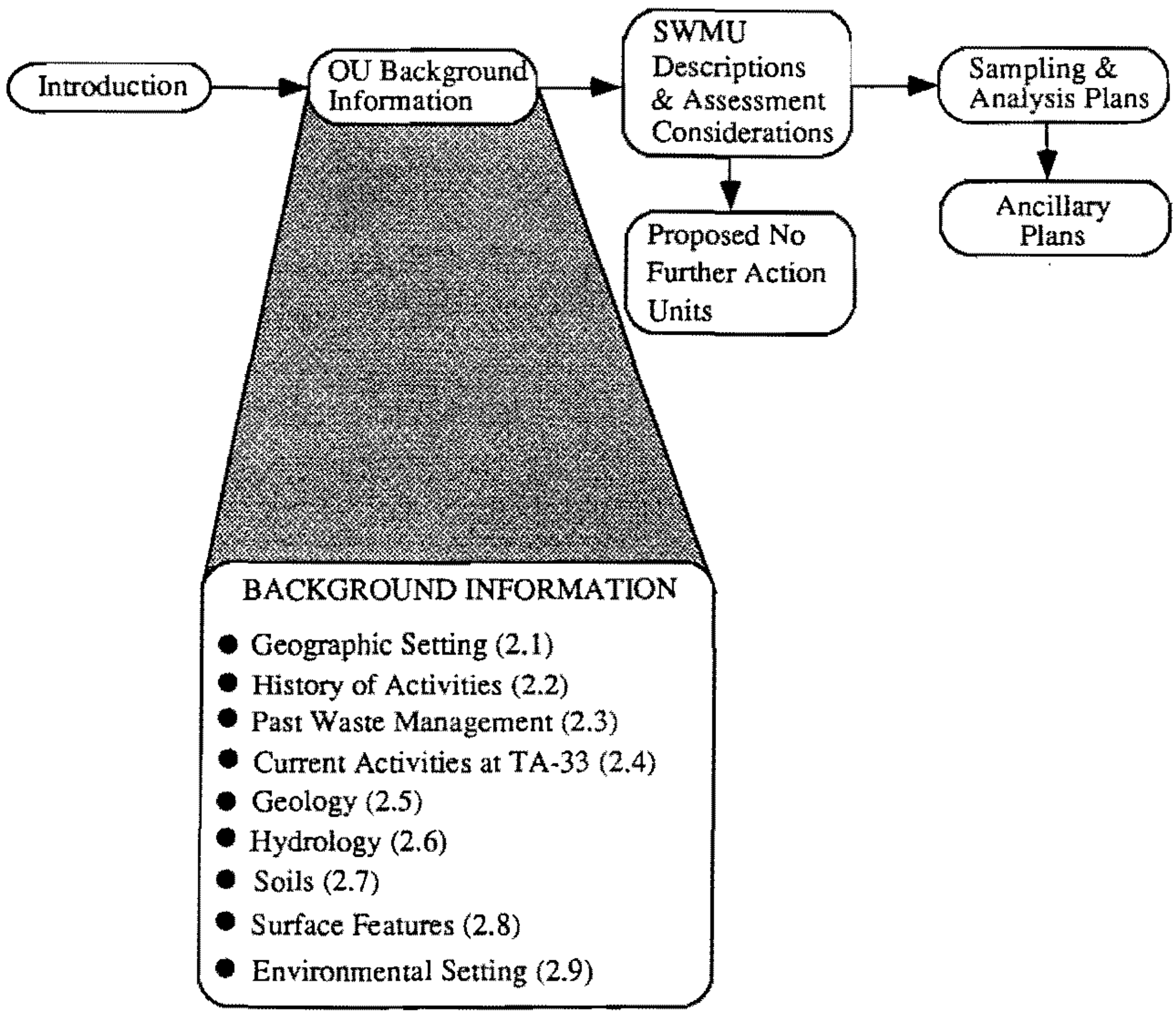
LANL (Los Alamos National Laboratory), November 1990. "Installation Work Plan for Environmental Restoration," Los Alamos National Laboratory Report LA-UR-90-3825, Los Alamos, New Mexico. **(LANL 1990, 0144)**

LANL (Los Alamos National Laboratory), November 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 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)**

Pava, D. S., September 1990. "Los Alamos National Laboratory Site Development Plan 1990," Los Alamos National Laboratory Report LA-CP-90-0405, Los Alamos, New Mexico. **(Pava 1990, 0368)**

CHAPTER 2



Introduction
OU Background Information
SWMU Descriptions & Assessment Considerations
Sampling & Analysis Plans
Proposed No Further Action Units
Ancillary Plans
BACKGROUND INFORMATION
Geographic Setting (2.1)
History of Activities (2.2)
Past Waste Management (2.3)
Current Activities at TA-33 (2.4)
Geology (2.5)
Hydrology (2.6)
Soils (2.7)
Surface Features (2.8)
Environmental Setting (2.9)

2.0 BACKGROUND INFORMATION FOR OPERABLE UNIT 1122

This chapter of the RCRA Facility Investigation (RFI) Work Plan provides background information on Operable Unit 1122, which consists of Technical Area 33 (TA-33) and TA-70. Programmatic activities are described from the earliest-known Laboratory activity to the present. Although no activity took place at TA-70, it is included in Operable Unit 1122 and serves as a buffer zone. TA-70 will be mentioned only if there is information relevant to a topic. Descriptions of activities provide the basis, not only for evaluation of present conditions and environmental impacts, but also for proposed characterization study plans.

This work plan addresses all Solid Waste Management Units (SWMUs) and areas of concern (AOCs) at TA-33 identified in "Solid Waste Units Management Report," (LANL 1990, 0145). No SWMUs have been identified at TA-70. During the course of the site characterization, new SWMUs may be identified that will be addressed as they are identified. SWMUs aggregated into units that have chemical similarities and geographical proximity are addressed as one unit in this RFI work plan.

2.1 Geographic Setting

Operable Unit 1122 is bounded by Water Canyon on the north, State Road 4 on the northwest, and White Rock Canyon of the Rio Grande to the southeast. On the southwest it is bounded by a fence on a ridge northeast of Frijoles Canyon. Ancho Canyon separates TA-33 and TA-70 (Fig. 2-1). A large drainage, Chaquehui Canyon, cuts the lower southern third of TA-33 toward the southeast. All Laboratory sites are north of this canyon. Facilities are located on level mesa tops. Three tributary drainages of Chaquehui Canyon drain the area.

2.2 History of Activities at Operable Unit 1122

TA-33 was established in 1947 as a substitute test site for weapons components experiments then being conducted at Trinity Site in southern New Mexico. The facility was built for a weapons testing group, W-3. The land was previously owned by the US Forest Service.

TA-33 comprises five sites (Fig. 2-2): a laboratory and office complex near the entrance at State Road 4 (Main Site), a western firing site (Area 6), a southern firing site (South Site), an eastern firing site (East Site), and the current site of the National Radio Astronomy Observatory (NRAO) antenna, formerly a storage area and disposal site. Three material disposal areas are located at TA-33: MDA-D at East Site, MDA-E at South Site, and MDA-K at Main Site. In addition, several storage bunkers are located at TA-33.

Experiments conducted at TA-33 involved testing of beryllium-containing initiators. Many experiments used uranium components. Polonium-210 was used as the radioactive source. Initiator testing had ended at TA-33 by 1972. With a half-life of 138 days, all polonium-210 has since decayed to undetectable levels. Polonium-210 was prepared offsite.

Electronics trailers serving remote-sensing towers for atmospheric studies are parked at former firing sites. Office buildings and laboratories are in use at Main Site. A high-pressure tritium facility was operational at Main Site until late 1990.

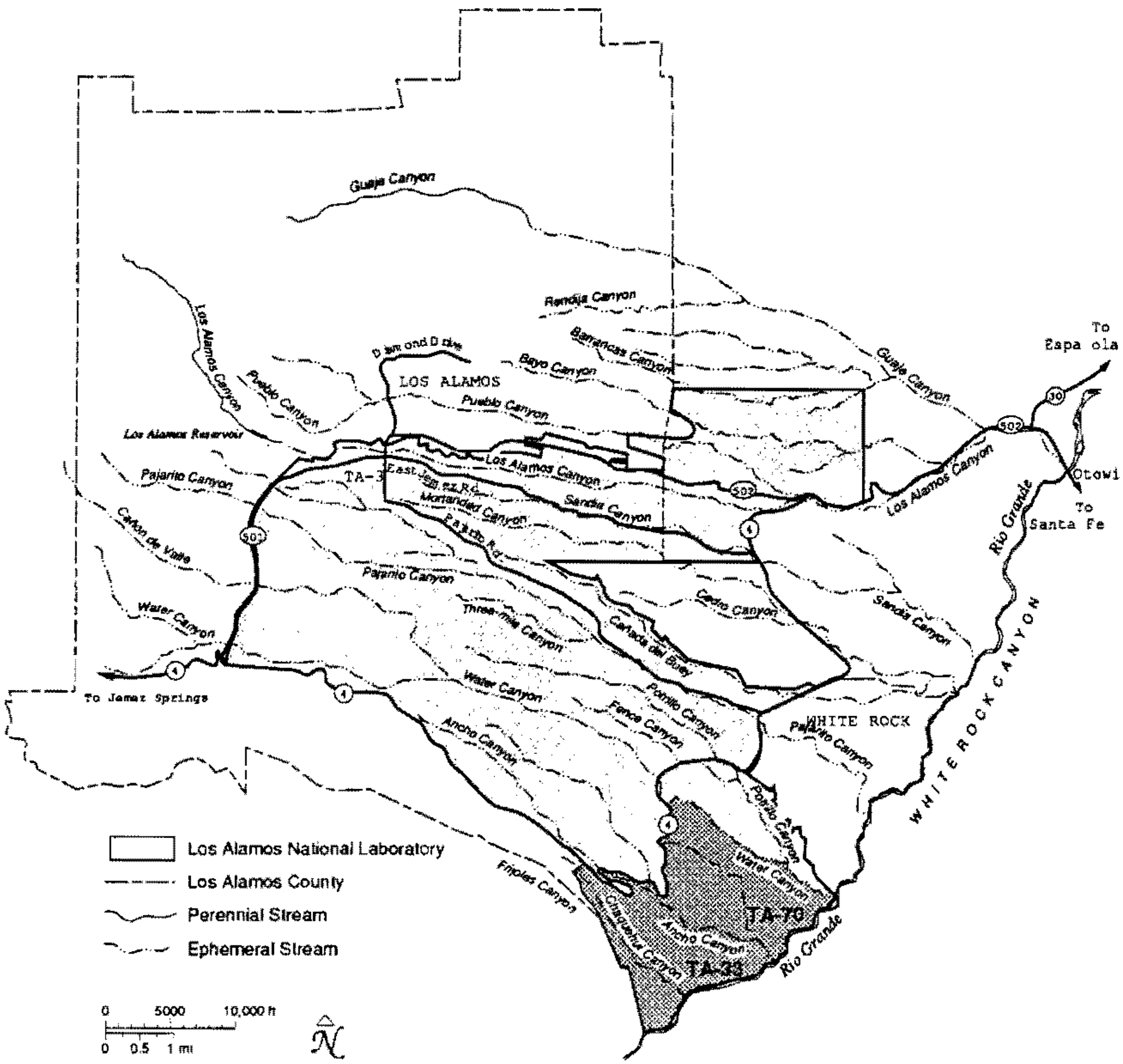


Fig. 2-1. Operable Unit 1122, TA-33 and TA-70.

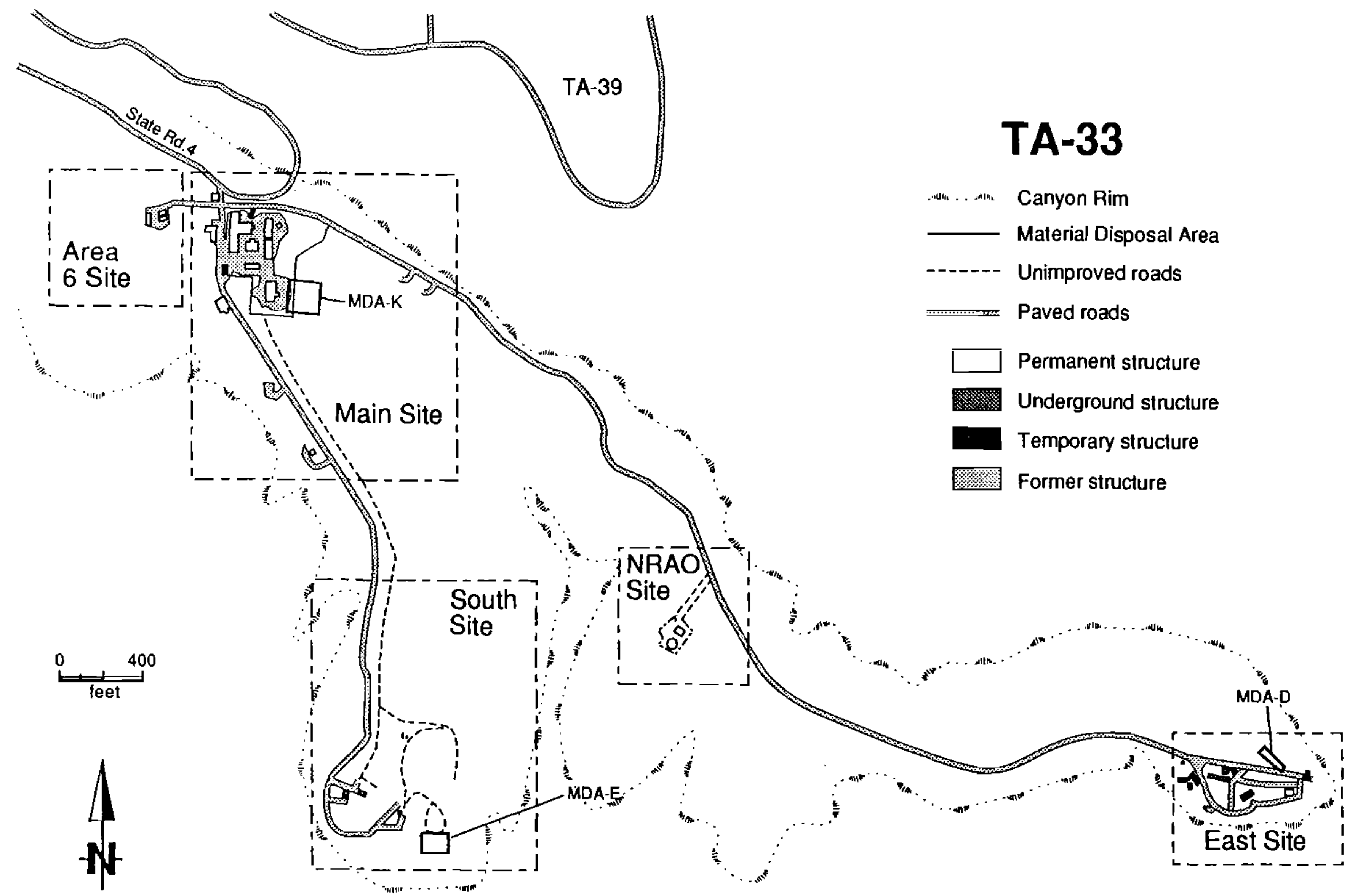


Fig. 2-2. The five sites at TA-33.

Detailed histories of each site are included in Chapter 3.

2.3 Past Waste Management Practices

Waste management practices at the firing sites conformed to the standard procedures of the day. Often firing debris was bulldozed into an adjacent canyon after a shot to prepare the pad for the next shot.

Septic systems, constructed in all four areas to serve both laboratory and sanitary drains, were used for disposal of liquid wastes. Some laboratory drains may have received radioactive or chemical-contaminated waste. These septic tanks were often tied to outfalls, discharging into canyons either directly or through drain fields.

Past waste management practices in the Main Area shops and labs focused on safety and minimizing hazards to personnel. Fans installed at machine stations vented hazardous fumes away from the work area. These fumes included uranium, cadmium, lead, and possibly mercury fumes. Fumes were vented to the atmosphere from shops' stacks (Jordan 1954, 02-001).

The fume hood and floor area in TA-33-16 at Area 6 were vented with stacks and blowers, releasing toxic materials to the atmosphere. These materials included lead, barium, and epoxy solvents (Milford 1956, 02-002).

2.4 Current Activities at TA-33

Current activities at TA-33 are centered primarily at Main Site. International Technology Group (IT-6) occupies laboratories and offices. Other small buildings are used for storage by groups from the Earth and Environmental Sciences (EES) Division. These buildings and outside areas are used primarily for storage of rock core samples that have been taken in support of the Hot Dry Rock projects at Fenton Hill.

The National Radio Astronomy Observatory (NRAO) Site consists of an 82 ft diameter radiotelescope antenna and a support building.

The Atmospheric Sciences Group (SST-7) operates three instrument tower assemblies and associated electronics trailers for atmospheric studies at the former firing sites. These operations do not pose any environmental risks.

Facilities at Area 6, South, and East Sites are inactive. The tritium facility ceased operations in 1990 and is being prepared for decommissioning and decontamination. Building drains and outfalls have been identified. Active septic systems are now licensed with the State of New Mexico Environment Department (NMED). There are two National Pollution Discharge Elimination System (NPDES) permitted outfalls at Main Site. Details of current activities are discussed in Chapter 3.

Waste-generating operations at TA-33 conform to Laboratory waste management policies as described in Administrative Requirements AR-1 through AR-6 of the Laboratory Environment, Safety, and Health Manual. (LANL 1990, 0335) These requirements provide for the minimization, segregation, and disposal of mixed waste, low-level radioactive waste, chemical waste, hazardous waste, sanitary landfill waste, and TRU waste. These Laboratory waste policies are derived from and meet the requirements of appropriate DOE orders, RCRA, Code of Federal Regulations, State of New Mexico Hazardous Waste regulations, and Laboratory practices.

2.5 Geology

A general summary of the geology of Los Alamos National Laboratory is given in Section 2.6 of the Installation Work Plan (LANL 1991, 0553).

2.5.1 Stratigraphy

Because there are no deep drill holes within Operable Unit 1122, the stratigraphy must be inferred from surface and canyon-wall exposures and from drilling results from well EGH-LA-1 on Sigma Mesa (Potzich 1978, 02-003) and wells DT-5A, DT-9, and DT-10 at TA-49 (Fig. 2-3). The stratigraphy in these wells is shown in Fig. 2-4. Well EGH-LA-1 was spudded in the Tshirege Member of the Bandelier Tuff and bottomed in the Tschicoma Formation at a depth of 2 292 ft after passing through the Otowi Member of the Bandelier Tuff, the Guaje Pumice Bed, and interbedded Tschicoma, Puye, and Chamita Formations. The Puye Formation also contains interbedded Cerros del Rio basalt flows. Wells DT-5A, DT-9, and DT-10 were also spudded in the Tshirege Member and bottomed in the Santa Fe Group. The static water level was measured in wells DT-5A, DT-9, and DT-10. These depths are shown in Fig. 2-4.

All of the formations encountered in EGH-LA-1 exhibit considerable lateral and vertical variation, making it difficult to extrapolate thicknesses to Operable Unit 1122. Stratigraphic relationships are particularly hard to predict within the lowermost three formations, the Tschicoma, Puye, and Chamita, because of the lateral variations and complex intertonguing.

The mineralogy of the 1.13 million year old (Myr) Tshirege Member of the Bandelier Tuff, which caps the mesa on which TA-33 is situated, was described by Smith and Bailey (1966, 0377). Significant variations in phenocryst abundances occur throughout this member with total phenocrysts increasing from about 5% in the basal air-fall pumice to about 35% two-thirds of the way up the member. From that point, total phenocrysts decrease to about 20% at the top of the member. The phenocrysts are quartz and sanidine (potassium feldspar). Hawley (1978, 02-004) reported the presence of indurated (hardened) zeolitized paleogroundwater tables at the base of the Tshirege Member and x-ray diffraction data for this interval obtained at Los Alamos indicate the presence of clinoptilolite (a zeolite mineral). These zones are well exposed along State Road 4 at the bottom of Ancho Canyon.

Limited chemical data are available for the Tshirege Member. Smith and Bailey (1966, 0377) reported that silicon dioxide decreases upward in the member from about 77% near the base to about 72% near the top. Total alkalies decrease slightly from bottom to top and iron oxide decreases relative to magnesium oxide. Uranium, thorium, and niobium show a 3 to 4-fold decrease from the base of the member to the top. Gardner et al. (1986, 0310) reported a uranium content of 12 ppm for the Tshirege Member.

The thickness of the 1.5 Myr Otowi Member of the Bandelier Tuff is highly variable because it filled preexisting topography developed on the older units. The contact between the Otowi Member and overlying Tshirege Member is marked by a partial

Location of Wells EGH-LA-1 (TA-60) and DT-5A, DT-9, and DT-10 (TA-49)

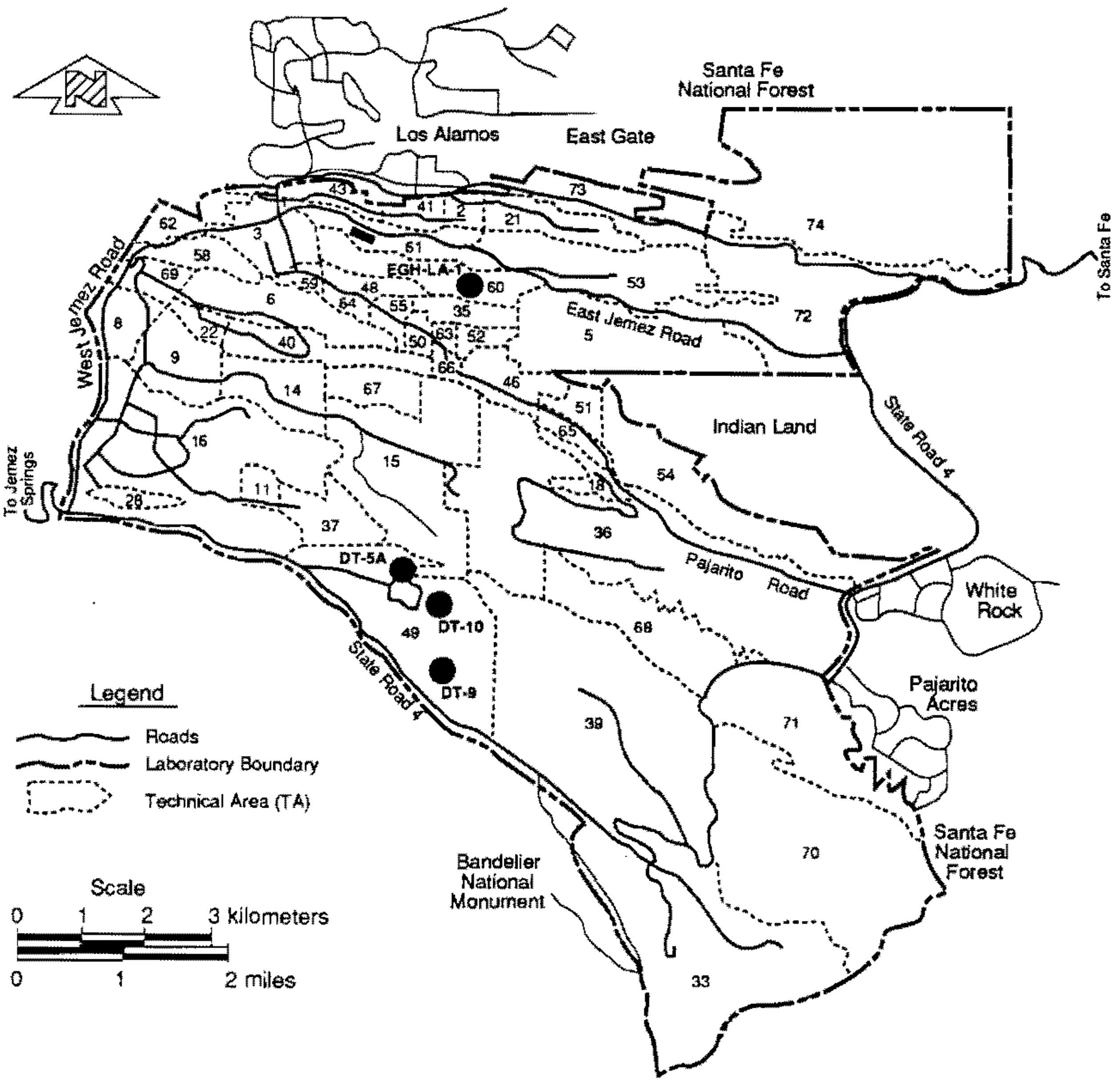


Fig. 2-3. Location of wells EGH-LA-1 (TA-60) and DT-5A, DT-9, and DT-10 (TA-49).

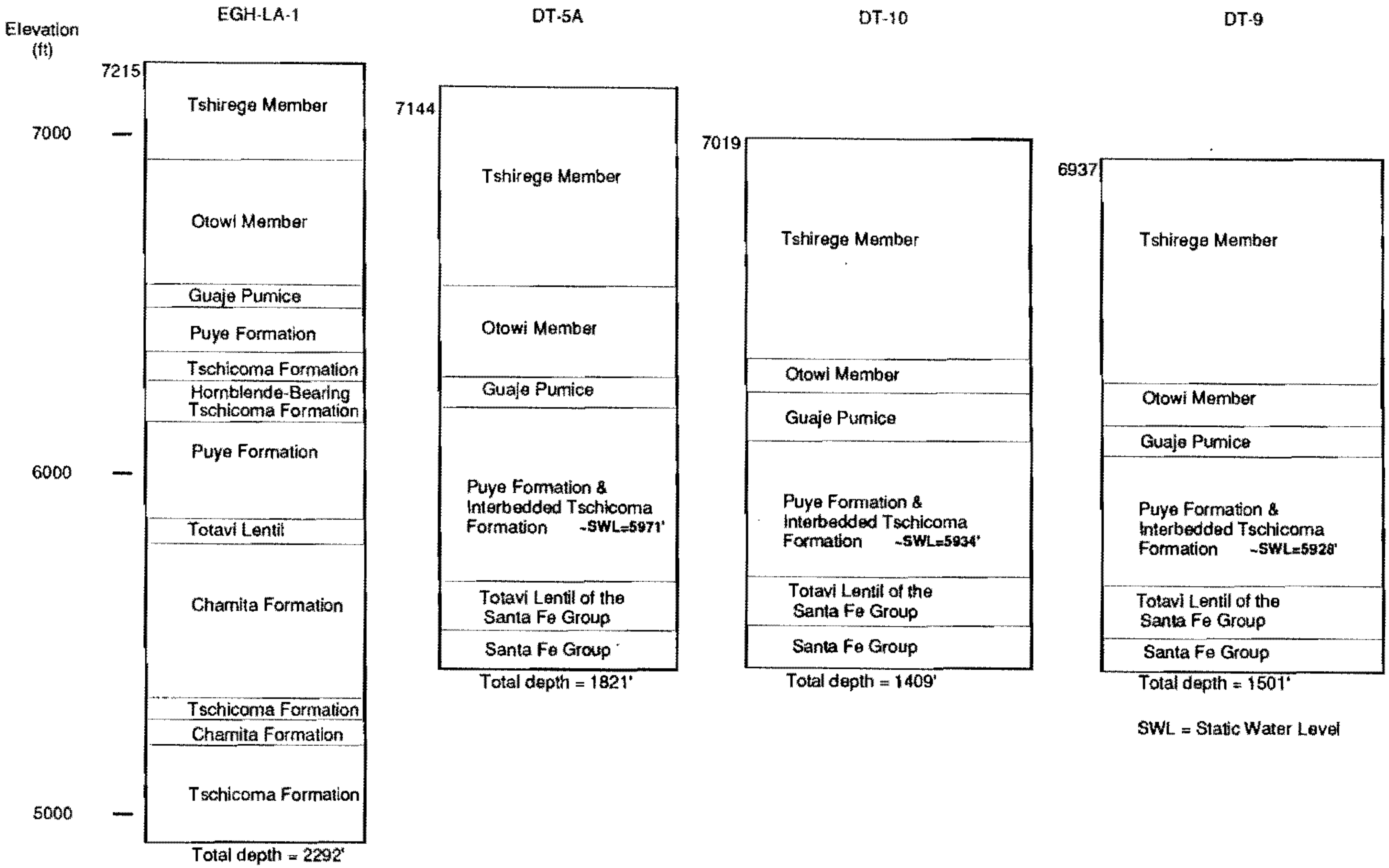


Fig. 2-4. Lithologic logs of deep wells near Operable Unit 1122.

soil zone of oxidation and clay development crosscut by irregular fractures filled with secondary alteration minerals, such as clays and zeolites. Crowe et al. (1978, 0041) and Kuentz (1986, 0602) examined the petrography of the Otowi Member and found that quartz and sanidine make up 95% of the modal phenocryst mineralogy with smaller amounts of orthopyroxene, clinopyroxene, magnetite and other iron-titanium oxides, allanite, and zircon. Although the major modal components of the tuff would not interact with most contaminants, the trace iron-titanium oxides may be important in retarding movement of some radionuclides.

The Guaje Pumice Bed, which lies beneath the Otowi Member, consists of five ash fall units of rhyolitic composition. Because this unit is not indurated, it can be expected to be permeable.

The Puye Formation underlies the Guaje Pumice Bed. It is a fanglomerate containing cobbles of dacite to andesite in a volcanic sand matrix and is interbedded with at least 25 ash beds of dacitic to rhyolitic composition, Tschicoma Formation, and Cerros del Rio basalts. Those ash beds are probably permeable. The fanglomerates exhibit considerable lateral variation and are complex intertonguing mixtures of stream flow, sheet flow, debris flow, block and pumice fall, and ignimbrite deposits.

The Tschicoma Formation is interbedded with the Puye and Chamita Formations. The Tschicoma Formation is predominantly coarsely porphyritic dacites, rhyodacites, and quartz latites with phenocrysts of pyroxene, hornblende, biotite, plagioclase, and occasional quartz (Smith et al. 1970, 02-005).

The Chamita Formation, the upper formation in the Santa Fe Group, thickens toward the west side of the Española Basin and overlies and interfingers with the Tesuque and Tschicoma Formations. Potzich (1978, 02-003) identified 125 ft of Chamita Formation in the Sigma Mesa well.

A cinder cone of the Cerros del Rio basalts occurs within Operable Unit 1122 and basalt flows of this unit are exposed in the cliff faces and in the bottom of Ancho Canyon. The cinder cone is dissected by a small canyon that drains into Chaquehui Canyon. Both basalts and basaltic andesites are present in this unit. The basalts may inhibit downward movement of water beneath TA-33 producing a perched water table.

2.5.2 Structure

Operable Unit 1122 lies east of the main trace of the Pajarito fault zone and the geology of the operable unit has not been affected by this major fault. Dransfield and Gardner (1985, 0082) mapped an inferred northeast-striking fault slightly west of the radiotelescope antenna at TA-33. There are no SWMUs near this fault. The geologic map of Smith et al. (1970, 02-005) shows a northwest-striking inferred fault in Frijoles Canyon south of this operable unit. No other faults have been mapped within this operable unit.

A large landslide is present within TA-70. No other landslide of this size occurs within or adjacent to Laboratory property. If landslides of this magnitude occurred in the future at either East or South Sites, buried materials or waste that may contain hazardous or radioactive contaminants could be exposed.

2.6 Hydrology

The general hydrology of Los Alamos National Laboratory has been described in the Installation Work Plan (LANL 1991, 0553). Only data unique to Operable Unit 1122 will be presented here. Topography of the operable unit is shown on the pocket topographic maps in Appendix D.

Groundwater may occur in three modes within Operable Unit 1122: 1) water in shallow alluvium along canyon bottoms, 2) perched water (a groundwater body above an impermeable layer that is separated from an underlying main body of groundwater by an unsaturated zone) and, 3) the main aquifer of the Los Alamos area.

Alluvium deposited by ephemeral streams is present within all the canyons enclosed by Operable Unit 1122. The alluvium is quite permeable in contrast to the underlying tuff and basalts. Ephemeral run-off in canyons infiltrates the alluvium until its downward movement is slowed by the less permeable tuff and basalts. This results in a shallow alluvial groundwater body that moves downgradient in the alluvium. As water moves downgradient in the alluvium, it is depleted by evapotranspiration and infiltration into the underlying volcanic rocks. Infiltration of water into the Bandelier Tuff is shown by one drill hole at MDA-K where high tritium concentrations are observed at depths of 100 ft and 170 ft.

Perched water may occur above impermeable rocks. It is not known if the Cerros del Rio basalts, which are present below the Bandelier Tuff, are fractured. If the basalts are not fractured, they may preclude downward movement of the water along fractures to the main aquifer. Although the existence of perched water at Operable Unit 1122 has not been demonstrated, the presence of the basalts below the Bandelier Tuff suggests that this is a possible mode of occurrence.

The surface of the main aquifer at Los Alamos rises westward from the Rio Grande within rocks of the Santa Fe Group into the Puye Formation. No drill holes or wells have penetrated the main aquifer beneath Operable Unit 1122 but, by analogy with other parts of the Laboratory (particularly TA-49), the aquifer probably lies at a depth of about 900 ft.

Springs in and near Chaquehui Canyon (Springs 8A, 9, 9A, and Doe) are located 130-200 ft above the river (see Fig. 2-5). They provide water for large areas of vegetation.

2.7 Soils

Within Operable Unit 1122, soils are generally thin except in the area between the roads to the south and east points. In this area, winds have removed the soil except where it is held in place by tree roots. This results in the trees apparently standing on soil pedestals 3-6 ft high. At TA-33 thicker soils have developed or have been retained by vegetation within MDA-K, the only place where large amounts of process water have been discharged.

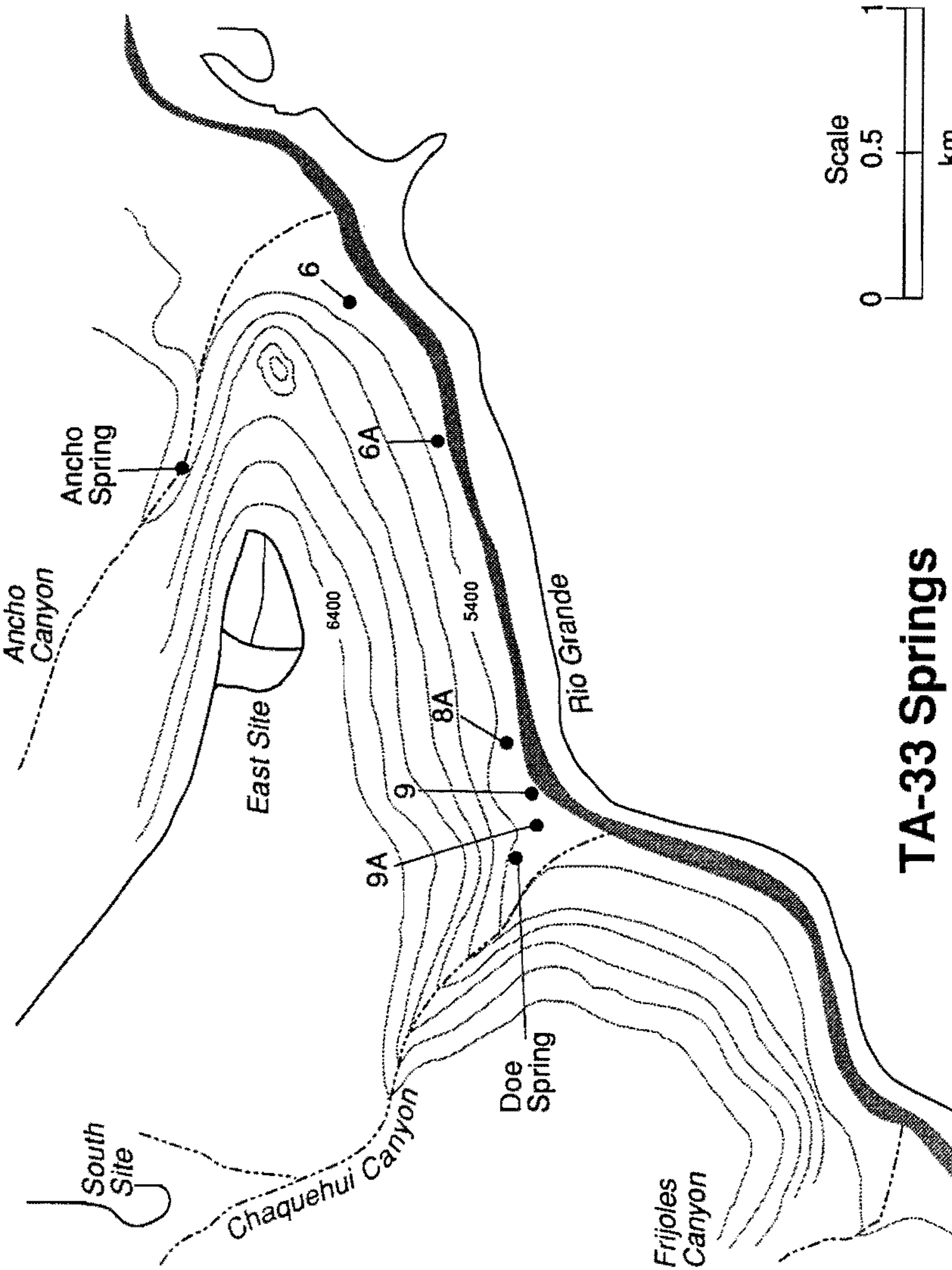


Fig. 2-5. TA-33 springs.

2.8 Surface Features of Operable Unit 1122

Surface deposits on the mesa top include locally derived soils and, in places, a thin cover of fine-grained eolian sediments. Coarse-grained colluvium lies on the steep hillsides and along the bases of the cliffs. Deposits within the canyons include the colluvium along the cliff bases and alluvial sediments deposited by intermittent streams along the axes of the canyons. Alluvial fans may be present where small canyons discharge into the larger drainage systems. Alluvium within the canyons thickens eastward as the canyons widen in their downstream reaches.

Much of the eastern part of TA-70 is covered by landslide deposits composed of the Tshirege Member of Bandelier Tuff.

2.9 Environmental Setting

An overview of the environmental setting is described in the Installation Work Plan, Volume I, Chapter 2, Section 2.5 (LANL 1991, 0553).

2.9.1 Climate

The climate of Los Alamos National Laboratory and Los Alamos County is described in the Installation Work Plan, Section 2.5.3 (LANL 1991, 0553). No unique conditions exist within Operable Unit 1122.

2.9.2 Ecology

A summary report of the biological survey is included in Appendix B.

2.9.2.1 Flora

Of the land cleared for the operational sites, much of the unpaved area is overgrown with invasive shrubs. Most common of these is chamisa which grows in dense thickets varying from 2-7 ft. in height. A few specimens of mountain mahogany, four-wing saltbush, Apache plume, and wavyleaf oak are also found. Some disturbed areas have only a thin soil layer. The dominant shrub on these sites is snakeweed with some stands of false tarragon. The invasive grass, hidden dropseed, grows on portions of these poorer areas.

2.9.2.2 Fauna

Animals common to the lower piñon-juniper woodland inhabit TA-33. These are described in the Installation Work Plan, Section 2.5.2.2 (LANL 1991, 0553). The lower Pajarito Plateau, including TA-33 and TA-70, is part of the seasonal range of mule deer and elk. Mountain lion tracks have been observed. Site workers have reported trespass cattle and there have been many reports of rattlesnakes at TA-33.

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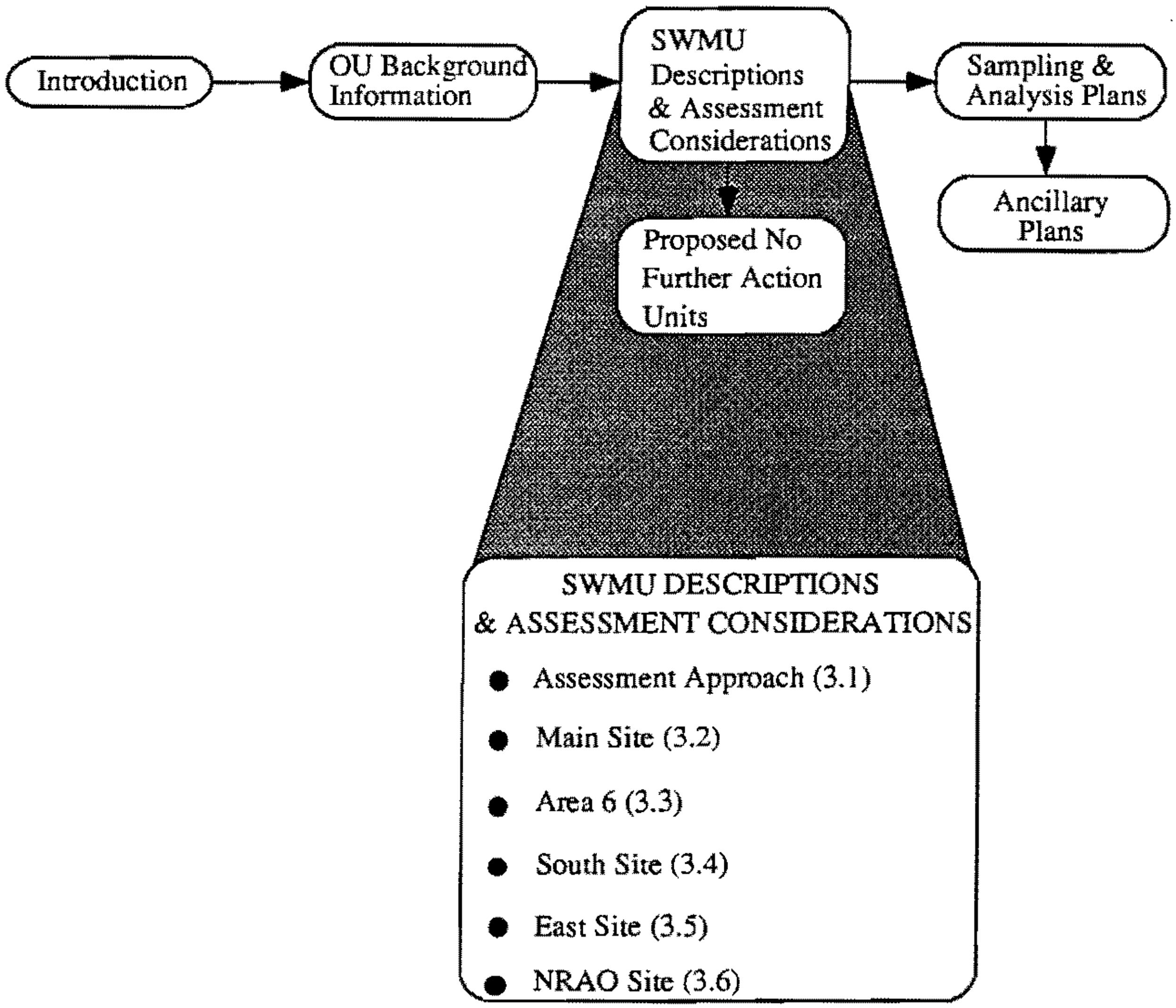
CHAPTER 3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SWMU Descriptions & Assessment Considerations
Sampling & Analysis Plans
Ancillary Plans
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3.0 SOLID WASTE MANAGEMENT UNIT (SWMU) DESCRIPTIONS AND ASSESSMENT CONSIDERATIONS

This chapter of the RCRA Facility Investigation (RFI) work plan provides detailed descriptions of each Solid Waste Management Unit (SWMU) located at Technical Area 33 (TA-33). The descriptions cover all known information about activities, source terms, and present conditions associated with each SWMU.

This chapter also summarizes existing information about the source terms, the significant migration pathways, and the potential public health and environmental impacts of the 59 SWMUs included in Operable Unit 1122. Potential response actions, data needs, and data quality objectives are described for all SWMUs.

The "Solid Waste Management Units Report" (LANL 1990, 0145) identified 59 SWMUs at TA-33, listed in Table 3-1. These SWMUs are aggregated into five major locations, Fig. 3-1:

1. Main Site - a laboratory and office complex near the entrance to TA-33

2. Area 6 - the western firing site adjacent to Main Site

3. South Site - the southern firing site

4. East Site - the eastern firing site

5. National Radio Astronomy Observatory (NRAO) - The NRAO antenna and related sites

This chapter also addresses two areas of concern. Areas of concern are "sites that do not fall under the definition of solid waste management units; however, they are areas of environmental concern" and will be addressed in operable unit RFI plans (LANL 1990, 0145).

The areas of concern, listed in Table 3-1, are associated with polychlorinated biphenyl (PCB) oil-containing power transformers.

3.1 Assessment Approach

This section reviews some of the methods used in the OU 1122 RFI work plan. Only environmental data needs are discussed here in any detail. Some of the evaluation criteria developed for making remedial decisions about these sites (cf. Appendix I, Decision Analysis, of the Installation Work Plan, [IWP]) may require nonenvironmental data, such as information about socioeconomic impacts, but these data will be developed programmatically (LANL 1991, 0553). Environmental data are generally required to evaluate criteria based on human health and safety impacts and ecological risk.

Tools for managing uncertainty during the RFI are discussed in Appendix H, Design of Statistical Sampling Plans, in the IWP (LANL 1991, 0553). These include:

a) the observational approach, which in the RFI phase, provides

TABLE 3-1

SUSPECTED CHEMICAL AND RADIOLOGICAL CONTAMINANTS AT OPERABLE UNIT 1122 (TA-33)

Location	SWMU or AOC Number	Description	Potential Chemical Contaminants	Potential Radiological Contaminants
South Site MDA-E	33-001(a)	Disposal Pit #1	Beryllium	Uranium
South Site MDA-E	33-001(b)	Disposal Pit #2	Beryllium	Uranium
South Site MDA-E	33-001(c)	Disposal Pit #3	Beryllium and kerosene	Uranium
South Site MDA-E	33-001(d)	Disposal Pit #4	Beryllium	Uranium
South Site	33-001(e)	Chamber, TA-33-29	Beryllium and explosives residues	None known
Main Site MDA-K	33-002(a)	Septic Tank, TA-33-93	Solvents	Uranium, plutonium, and tritium
Main Site MDA-K	33-002(b)	Sump, TA-33-134	Ethanol, methanol, trichloroethene, benzene, acetone, beryllium, and mercury	Depleted uranium and tritium
Main Site MDA-K	33-002(c)	Sump, TA-33-133	Trichloroethene, methanol, ethanol, acetone, and propanol	Tritium
Main Site MDA-K	33-002(d)	Cooling water Outfall from TA-33-86	None known	Tritium
Main Site MDA-K	33-002(e)	Roof Drain Outfall from TA-33-86	Semivolatile organic compounds	Tritium
East Site MDA-D	33-003(a)	Chamber, TA-33-4	Beryllium and explosives	None known
East Site MDA-D	33-003(b)	Chamber, TA-33-6	Beryllium and explosives	None known
Main Site	33-004(a)	Septic Tank, TA-33-31	Beryllium, lead, mercury, cadmium, silver, benzene, and trichloroethene	Tritium and depleted uranium

TABLE 3-1. (continued)

SUSPECTED CHEMICAL AND RADIOLOGICAL CONTAMINANTS AT OPERABLE UNIT 1122 (TA-33)

Location	SWMU or AOC Number	Description	Potential Chemical Contaminants	Potential Radiological Contaminants
South Site	33-004(b)	Septic Tank, TA-33-33	Photoprocessing chemicals	None known
East Site	33-004(c)	Septic Tank, TA-33-96	Photoprocessing chemicals and volatile organics	None known
Area 6 Site	33-004(d)	Septic Tank, TA-33-121	Photoprocessing chemicals, beryllium, and volatile organics	Uranium
Main Site	33-004(e)	Septic Seepage Pit, TA-33-169	None known	None known
Main Site	33-004(f)	Septic Tank at TA-33-23	None known	None known
Area 6 Site	33-004(g)	Outfall from TA-33-16	Lead, barium, beryllium, zinc, high explosives, and organic compounds	Uranium
Main Site	33-004(h)	Outfall from TA-33-20	Beryllium	Uranium
Main Site	33-004(i)	Outfalls from TA-33-39	Lead, cadmium, beryllium, silver, mercury, and solvents	Uranium
South Site	33-004(j)	Outfall from TA-33-26	Beryllium	Uranium
East Site	33-004(k)	Outfall from TA-33-87	Photoprocessing chemicals	None known
East Site	33-004(l)	Outfall from TA-33-89	None known	None known
NRAO	33-004(m)	NRAO Septic Tank TA-33-179	Solvents	None known
Main Site	33-004(n)	Septic Tank at TA-33-23	None known	None known
Main Site	33-005(a)	Septic System from TA-33-21	None known	None known

TABLE 3-1, (continued)

SUSPECTED CHEMICAL AND RADIOLOGICAL CONTAMINANTS AT OPERABLE UNIT 1122 (TA-33)

Location	SWMU or AOC Number	Description	Potential Chemical Contaminants	Potential Radiological Contaminants
Main Site	33-005(b)	Drainage System from TA-33-21	None known	None known
Main Site	33-005(c)	Industrial Waste Drainage from TA-33-21	None known	Plutonium
South Site	33-006(a)	Shot Pad	Beryllium, lead, and high explosives residues	Uranium and tritium
East Site	33-006(b)	Gun Firing Area	Beryllium, lead, cadmium, oil, and high explosives residues	Uranium, tritium, and cobalt-60
East Site	33-007(a)	Gun Firing Area	Beryllium, lead, cadmium, oil, other metals, and high explosives residues	Uranium, tritium, and cobalt-60
South Site	33-007(b)	Gun Firing Area	Beryllium, other metals, oil, and high explosives residues	Uranium, tritium, and cobalt-60
Area 6 Site	33-007(c)	Gun Firing Area	Beryllium, oil, other metals, and high explosives residues	Uranium, tritium, and cobalt-60
South Site	33-008(a)	Nonradioactive Landfill	Beryllium, lead, high explosives residues, and unknown chemicals	None known
East Site	33-008(b)	Nonradioactive Landfill	Beryllium, lead, high explosives residues, and unknown chemicals	None known
Area 6 Site	33-009	Surface Disposal	Polychlorinated biphenyls and beryllium	Depleted uranium

TABLE 3-1. (continued)

SUSPECTED CHEMICAL AND RADIOLOGICAL CONTAMINANTS AT OPERABLE UNIT 1122 (TA-33)

Location	SWMU or AOC Number	Description	Potential Chemical Contaminants	Potential Radiological Contaminants
East Site	33-010(a)	Canyon-side Disposal	Beryllium, lead	Uranium
East Site	33-010(b)	Canyon-side Disposal	Beryllium, lead	Uranium
South Site	33-010(c)	Surface Disposal	Beryllium, lead, and high explosives residues	Uranium
East Site	33-010(d)	Surface Disposal	Beryllium, lead	Uranium
Area 6 Site	33-010(e)	Canyon-side Disposal	None known	None known
Main Site	33-010(f)	Surface Disposal	None known	None known
South Site	33-010(g)	Canyon-side Disposal	Beryllium, metals, and high explosives residues	Uranium
South Site	33-010(h)	Surface Disposal	Beryllium, metals, and high explosives residues	Uranium
Main Site	33-011(a)	Drum Storage, TA-33-21	Polychlorinated biphenyls and oils	None known
NRAO	33-011(b)	General Storage Area at NRAO	Beryllium and other metals	Uranium
South Site	33-011(c)	Blivit Storage Area	None known	Tritium
Main Site	33-011(d)	General Storage Area, TA-33-20	Beryllium	Uranium
Main Site	33-011(e)	General Storage Area, TA-33-22	None known	Uranium
Main Site	33-012(a)	Active Satellite Storage Area, TA-33-39	Solvents, oils, metals, and polychlorinated biphenyls	None known
Main Site	33-012(b)	Active Satellite Storage Area, TA-33-114	Photoprocessing chemicals	None known

TABLE 3-1. (concluded)

SUSPECTED CHEMICAL AND RADIOLOGICAL CONTAMINANTS AT OPERABLE UNIT 1122 (TA-33)

Location	SWMU or AOC Number	Description	Potential Chemical Contaminants	Potential Radiological Contaminants
Main Site	33-012(c)	Active Satellite Storage Area, TA-33-114	Waste organics	None known
Main Site	33-012(d)	Active Satellite Storage Area, TA-33-19	Solvents, particularly freon	None known
Main Site	33-013	Drum Storage Area, TA-33-86	Oil, metals, and solvents	Tritium
South Site	33-014	Burn Site	High explosives, propellant powders, black powder, and beryllium	Uranium
Main Site	33-015	Incinerator	None known	None known
Main Site	33-016	Sump, TA-33-23	High explosives, propellants, and oil	None known
Main Site	33-017	Operational Releases	Beryllium, lead, cadmium, mercury, silver	Tritium, deuterium, uranium, and plutonium
Main Site	C-33-001	Area of Concern TA-33-124	Polychlorinated biphenyls	None known
East Site	C-33-002	Area of Concern TA-33-95	Polychlorinated biphenyls	None known

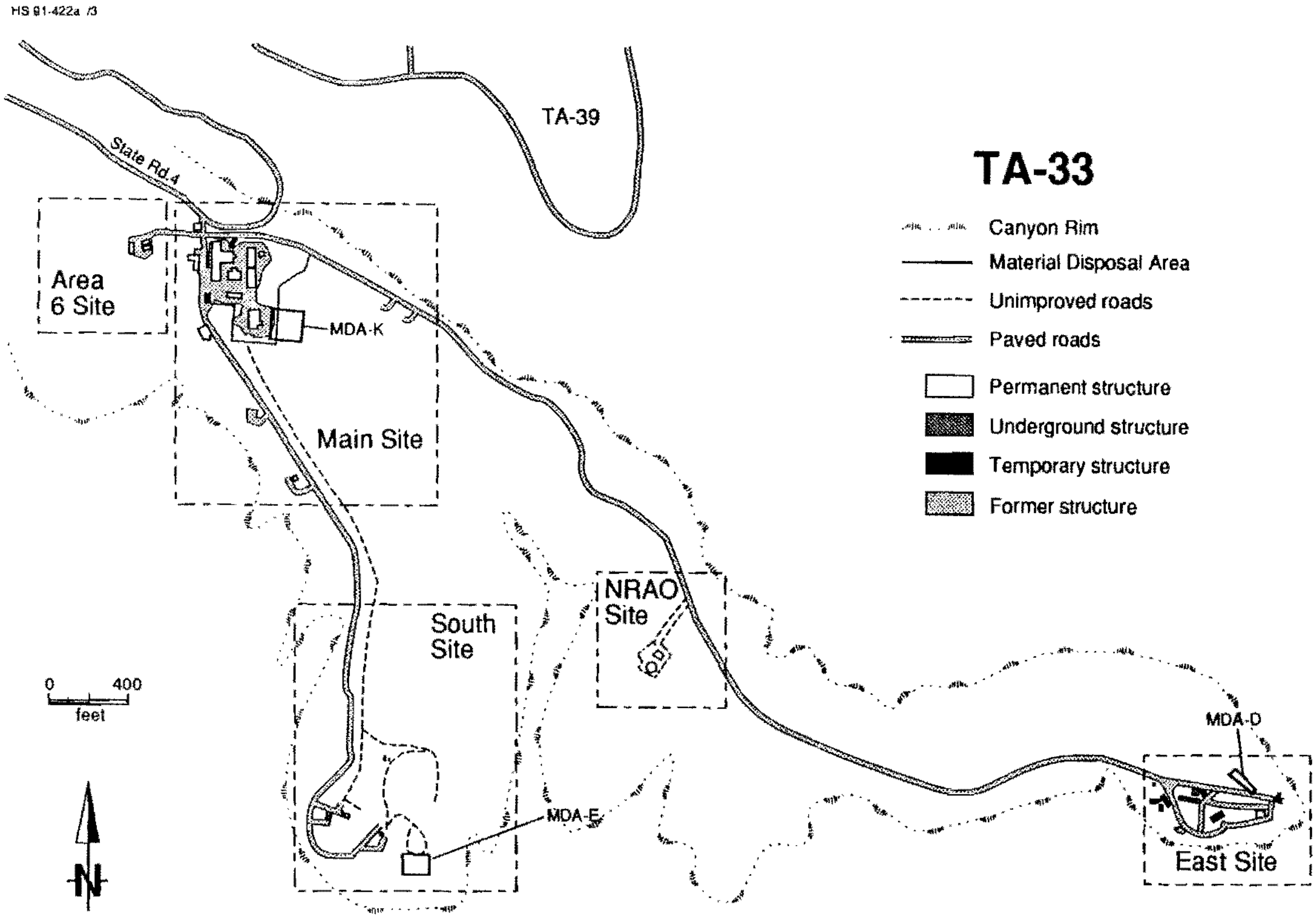

Fig. 3-1. The five major locations at TA-33.

guidelines for determining the level of detail appropriate for site characterization prior to engineering a corrective measure;

b) phasing within the RCRA facility investigation, so that data needs can be reevaluated during site characterization, as required to develop the site conceptual model sufficiently for baseline risk assessment and corrective measures studies (CMS); and

c) the data quality objectives (DQO) process, a formal procedure for ensuring that proposed data collection activities are developed from and tied back to appropriate decision criteria.

Specific applications in the OU 1122 work plan are outlined in Sections 3.1.1.1 through 3.1.1.3. Tables 3-3, 3-4, 3-5, 3-9, and 3-10 list the OU 1122 SWMUs with the type of investigation proposed for RFI Phase 1 and the sections where data quality objectives for each SWMU are developed.

Conceptual exposure models appropriate for assessing the potential health and environmental impacts of the SWMUs within OU 1122 are outlined in Section 3.1.2. These are included because they suggest the most important exposure pathways requiring investigation during the RFI. A more detailed approach to risk analysis is being developed programmatically and will be included in the 1992 update of the IWP.

3.1.1.1 The Observational Approach

The observational approach has implications for all phases (RFI, CMS, and Corrective Measures Implementation [CMI]) of the RCRA process, as discussed in Appendix J of the IWP and by Brown et al. (1990, 0503). For the RFI phase, the goal is to determine the most probable site conditions with sufficient precision so that the remaining uncertainties can be handled by contingency plans in the remedial design and implementation phases. That is, site characterization beyond a certain level of detail is more efficiently continued in parallel with corrective measures implementation, provided that appropriate observational programs are incorporated into those later phases of the RCRA corrective action process.

In the OU 1122 work plan, the observational approach is explicitly included for those septic systems and sumps which are, or soon will be, designated as inactive. Minimal sampling is planned for these systems during the RFI phase because their removal as a voluntary corrective action (VCA) is foreseen in the near future, and small releases (if any) of hazardous materials from their subsurface components can be detected much more reliably during excavation. In Tables 3-3, 3-4, 3-5, and 3-9, the RFI Phase I for SWMUs being addressed in this way is designated by "VCA." (The outfalls of septic systems, including drain fields and seepage pits, will also be subject to "reconnaissance" investigations, see below.)

3.1.1.2 Phasing within the RCRA Facility Investigation

It is not possible to identify all of the data needed to complete a facility investigation at the outset of the RCRA corrective action process. This is recognized in the proposed RCRA Subpart S, which recommends that investigations be "conducted in a step-wise fashion, with early screens to determine whether further investigation is necessary" (EPA 1990, 0432). In this work plan, a step-wise or "phased" approach to the RFI phase of the RCRA corrective action process is planned.

The initial (RFI Phase 1) investigation of each site, for which detailed sampling plans are provided in the OU 1122 work plan, is intended to address the most obvious gaps in the existing information about that site. In particular, there are few or no existing data for many of the OU 1122 SWMUs, and no evidence to suggest that releases have occurred at these sites. Intensive investigation of these SWMUs is not warranted until the existence of a release has been established. RFI Phase 1 investigation of these sites consists of reconnaissance sampling of the areas most likely to be contaminated if a release has occurred, such as environmental media in the immediate vicinity of existing or former structures, storage areas or disposal areas, and along channels below outfalls. (Phase 1 for these SWMUs is designated "reconn" in Tables 3-3, 3-4, 3-5, 3-9, and 3-10.) The selection of sampling locations may be biased, where appropriate, by field indications such as staining or high field screening results.

Where reconnaissance investigations show that contaminants are present above action levels, additional RFI Phase 2 investigations may be proposed to obtain data to complete a baseline risk assessment or to form the basis for the CMS. Subpart S action levels will be used where available. For other contaminants, including radionuclides, action levels corresponding to risks on the order of 10^{-4} to 10^{-6} under conservative exposure scenarios will be computed using Subpart S methods.

For a few SWMUs in OU 1122, those for which a source of contamination is known or likely to be present, the RFI Phase 1 investigations are designed to define the extent of contamination in environmental media near the source. (Phase 1 for these SWMUs is designated "extent" in Tables 3-3, 3-4, 3-5, 3-9, and 3-10.) The details of these investigations vary, depending on the nature of the site, but all are focused on the questions that must be answered in order to develop the conceptual exposure model to the point where it can be used to complete a baseline risk assessment and design of remedial action.

SWMU 33-001, a material disposal area (MDA) near the edge of the mesa top at South Site, is a singular case. Here the most significant unanswered environmental question concerns the long-term stability of this site and the appropriateness of a conditional remedy that would leave it in place. The RFI Phase 1 includes a study of a landslide in TA-70 as well as a comparison of the geological characteristics of South Site and the TA-70 site. (Phase 1 for these SWMUs is designated "environ" in Table 3-5.) The ultimate remedial decision for this MDA may depend critically on the answers to nonenvironmental questions which are not addressed by the OU 1122 work plan.

3.1.1.3 Data Quality Objectives

The DQO process provides a structured procedure for designing efficient sampling plans (EPA 1987, 0086). It begins by reviewing the current state of knowledge about the site. In the OU 1122 work plan this is done in Sections 3.#.1 (SWMU descriptions), 3.#.2 (SWMU histories), 3.#.3 (conceptual models), and 3.#.4 (existing data). The next step is to formulate the question (or "decision", in the terminology of Neptune et al.) to be investigated (Neptune et al. 1990, 0511). In this work plan, specific questions are posed in Section 3.#.5, which begins by outlining conceptual remedial alternatives, followed by specific questions for RFI Phase 1 and potential questions for RFI Phase 2.

Subsequent steps of the process describe data needed to answer each RFI Phase 1 question: the types of measurements to be made (decision inputs), the areas and media on which they are to be made (decision domain), and the statistics to be computed (decision logic). These steps of the DQO process are presented in Sections 3.#.6 of the OU 1122 work plan.

For statistical decision making, the quantity of data required should be determined by the tolerance for making an incorrect decision. However, the development of "discomfort curves" (Step 6 of the DQO process as outlined by Neptune, et al.) to quantify this tolerance is too formal a procedure for Phase 1 (Neptune et al. 1990, 0511). Moreover, information on site and sampling variability that would be needed to use quantified constraints on uncertainty in optimizing sampling plans is generally unavailable. One of the goals of the RFI Phase 1 investigations will be to obtain this information for optimizing RFI Phase 2 sampling designs, where these are implemented.

The principal goal of "VCA" and "reconnaissance" investigations is to detect contamination if present over a substantial portion of a small site. Proposed sample sizes depend on initial estimates of the probability that the site is contaminated above action levels, and decisions are based on the maximum observation obtained at that site. A single observation above action levels may trigger additional, RFI Phase 2 investigation. Table 3-2 shows sample size N required to detect, with probability of at least P, that at least a fraction f of the site is contaminated above a prespecified action level, calculated using:

$$P = 1 - (1-f)^N \qquad 3.1$$

<u>TABLE 3-2</u>

MINIMUM NUMBER OF INDEPENDENT OBSERVATIONS TO EXCEED POPULATION QUANTILE Q WITH PRESPECIFIED PROBABILITY P

	q =	0.50	0.55	0.60	0.65	0.70	0.75	0.80	0.85	0.90	0.95
P =	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

(Field duplicates should not be counted in applying equation 3.1, which assumes N independent observations.) Thus, 2 to 4 observations provide 75-90% confidence that we will be able to detect contamination that affects at least half of the site, but low probability of observing smaller amounts of contamination, e.g., less than 30%. RFI Phase 1 "reconnaissance" sampling with fewer than 5 observations are proposed at some SWMUs for which the historical data strongly suggest that no release has occurred. Other "reconnaissance" sampling plans will provide 5 to 20 observations.

Larger sample sizes are provided only for Phase 1 "extent" characterization. For sites in this category, the goal of the Phase 1 investigation may be to estimate the spatial extent of contamination, as in areas that may have received widespread operational releases, or to provide sufficient information to complete a baseline risk assessment.

The classification of individual SWMUs into these categories is discussed in Sections 3.#.6.

Sampling and analysis plans, the final step of the DQO process, are presented in Chapter 4. In general, the sampling plans for each part of the site consist of an integrated surface sampling plan, which includes both SWMU-specific surface sampling and sampling of drainage sediments, plus separate subsurface, SWMU-specific sampling plans for those SWMUs with potential subsurface contamination.

3.1.2 Conceptual Exposure Models for Risk Assessment

Three different exposure scenarios can provide a basis for baseline risk assessment in OU 1122:

a) Current use scenario: Human receptors at TA-33 include approximately 60 full-time Laboratory employees housed in the Main Site office complex and the workers who visit the outlying sites periodically to maintain the NRAO facility and the smaller antennae. In addition, small wetlands that undoubtedly attract a number of animals have been created below some of the Main Site outfalls. Dermal contact, inhalation, and voluntary or involuntary ingestion of surface contamination are possible under this scenario.

   Section 2.5 of the IWP describes the population distribution within a 50-mile radius of the Laboratory. The IWP presents a table documenting population density at 9 distance intervals for 16 compass directions, based on 1989 projections from 1980 census data. New data from the 1990 census gives the total number of residents within the 50-mile radius of the Laboratory as 213 000. (LANL 1991, 0553)

   The closest residents to TA-33 are about 1 mile to the southwest in Bandelier National Monument (BNM). About 60 people normally reside at BNM. Most of the people at Bandelier are visitors who spend a few hours at the monument. Visitation to BNM in 1990 was about 350 000 people. The next closest residents are located about 3 miles to the north in the residential area of White Rock, which includes the developments of Pajarito Acres and La Senda. The town of Los Alamos lies approximately 7 miles to the north. The 1990 census gives the population of White Rock as 6,800 and of Los Alamos as 11,400.

State Road 4 is a lightly used, publicly accessible road at the northwest corner of TA-33. Yearly average traffic on this road in the vicinity of TA-33 is about 700 vehicles per day.

b) Recreational scenarios: TA-70 and the canyons carrying runoff from TA-33 (lower Ancho and Chaquehui Canyons) may be used by hikers. Eventually both TA-70 and TA-33 may be released for limited public use under the control of Bandelier National Monument. Human receptors under these scenarios would include park employees and members of the public. While dermal contact, inhalation, and ingestion of surface contamination are all possible under this scenario, human exposure would occur over much shorter periods than under the current use scenario.

c) Construction scenarios: Subsurface contamination must be exposed at the surface or migrate downward through the vadose zone before a complete exposure pathway can exist. Except for highly soluble or vapor phase contaminants, vadose zone migration is much less likely than exposure by wind or water erosion or by construction. Future excavation, either by the Laboratory or after the Laboratory relinquishes institutional control, thus provides a worst-case scenario for exposure to subsurface contamination, where again dermal contact, inhalation, and ingestion of contamination by workers, during a relatively brief period of time, are all possible.

Conceptual exposure models for these three major scenarios are illustrated by Figs. 3-2, 3-3, and 3-4. These models were used in the development of the sampling plan. While the three scenarios described above all involve direct exposure, additional pathways for contamination through the environment leading to offsite exposure are possible, as shown. However, these pathways are expected to be less important than those affecting onsite receptors.

The primary and secondary sources are identical in Figs. 3-2, 3-3, and 3-4, but the significant release mechanisms, migration pathways and exposure routes vary depending on the scenario as well as on the type of SWMU. Thus, exposure of contaminants by human intrusion is unlikely under routine current use, but significant in construction scenarios. Collection of items by the public, such as depleted uranium projectiles, becomes more likely after loss of institutional control, when the area would be open to the public. Low-level surface contamination, a category that includes the majority of the TA-33 SWMUs, is potentially significant under both current and future recreational use scenarios.

Under the current and recreational use scenarios, it is expected that mean contaminant levels over fairly large areas are the most relevant measures of contaminant level for risk, because users of the site do not spend much time in a small area or grow

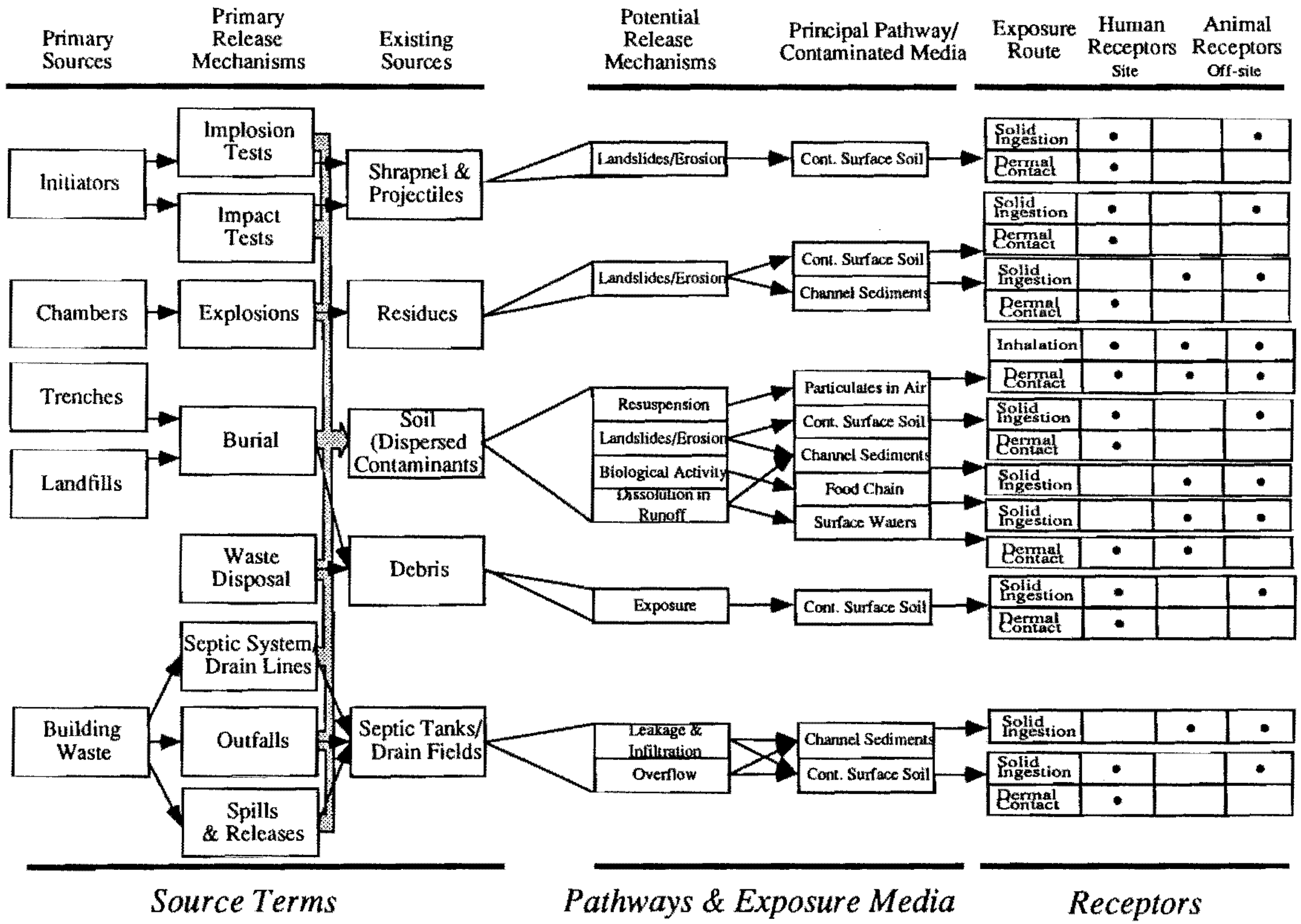

Fig. 3-2. Conceptual exposure model for a current use scenario.

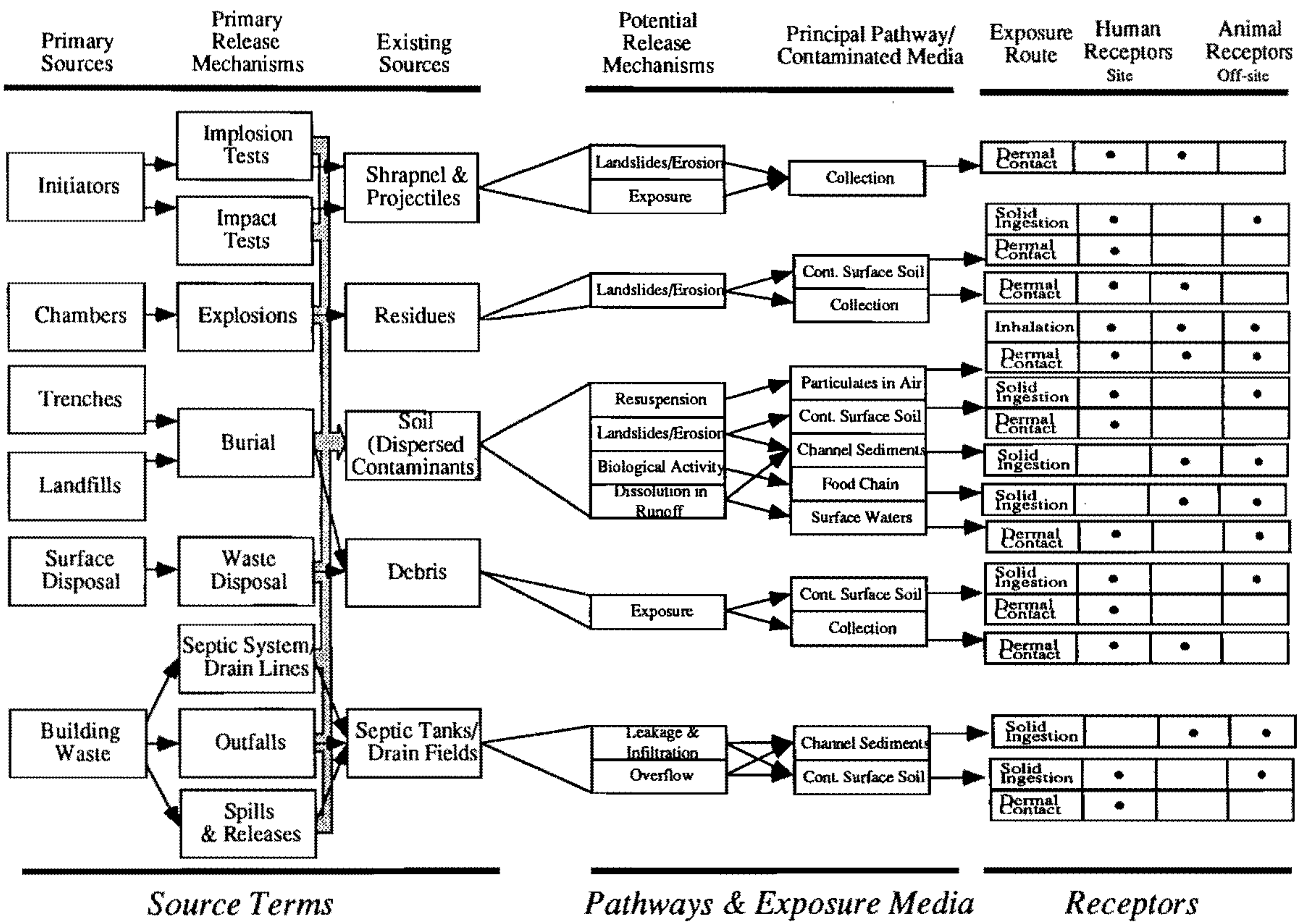

Fig. 3-3. Conceptual exposure model for a recreational use scenario.

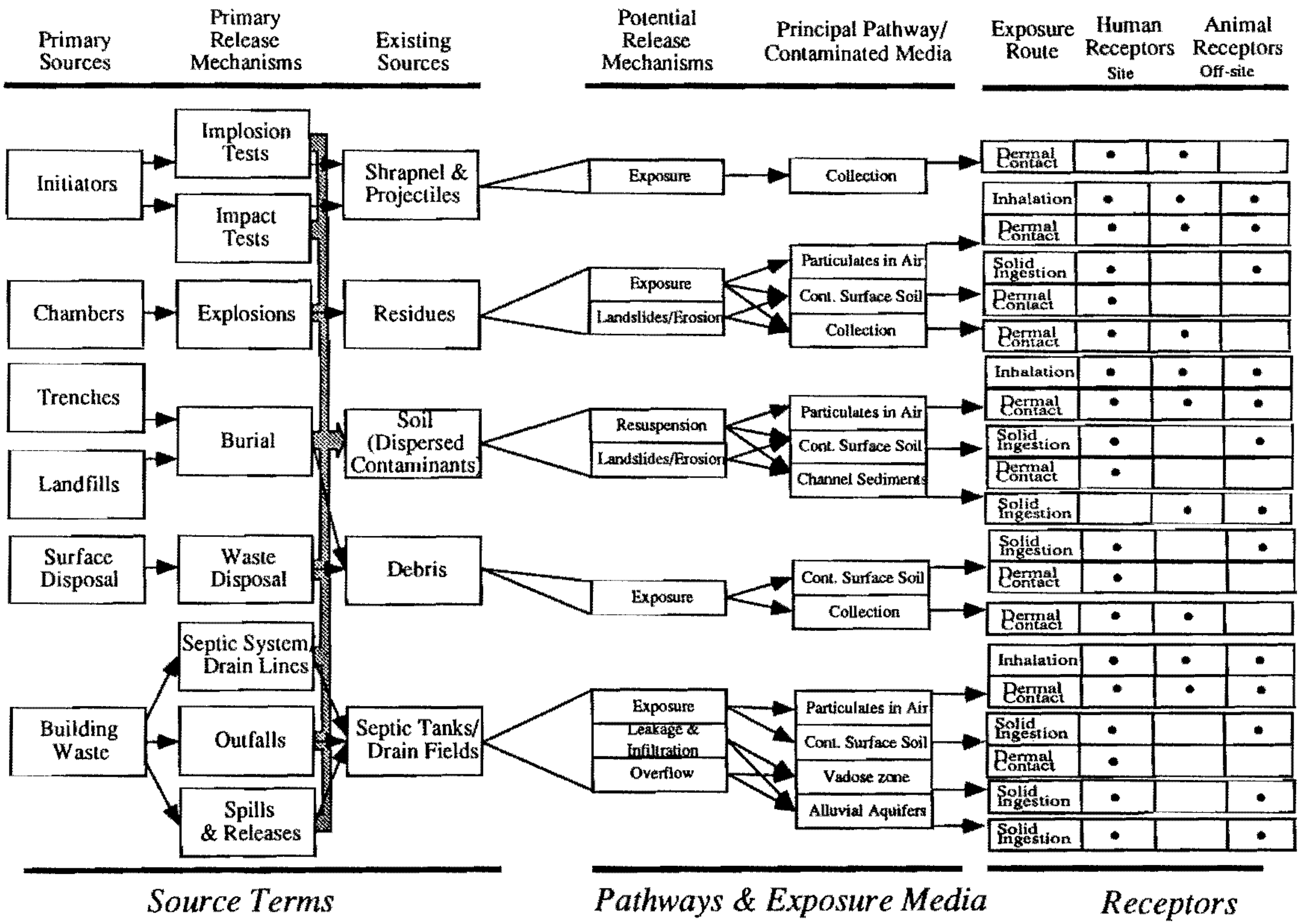

Fig. 3-4. Conceptual exposure model for a construction scenario.

their food there. Grid sampling (or spatially stratified sampling) combined with limited SWMU-specific sampling of well-localized areas will provide data to bound these averages. For future construction scenarios, the mean level of contamination within a volume the size of a basement are relevant. Subsurface SWMUs at TA-33 are fairly small and well-located, so that extensive sampling is not required to bound these mean contamination levels.

Risk assessment methodology and preliminary remediation goals based on these or other scenarios will be developed in the 1992 update of the IWP.

3.2 MAIN SITE

All SWMUs located at Main Site are listed in Table 3-3. The location of each SWMU at Main Site is shown in Fig. 3-5.

3.2.1 Site Description

Main Site is located just inside the entrance gate of TA-33 from State Road 4. The area surrounding the buildings is paved with asphalt. The buildings within the fence house offices, laboratories, and shops. Several trailers are parked in the area. The eastern section, about one-third of the fenced area, slopes steeply to a shallow drainage which drains southeast into Chaquehui Canyon. This eastern section is undeveloped and is covered with shrubs and trees. The northern quarter of the fenced area is undeveloped, with bare soil and a few low shrubs.

The tritium facility (TA-33-86) is located at the southern end of Main Site. The area is level and separately fenced. Most of the area is paved with asphalt. Material Disposal Area K (MDA-K) lies east of the tritium facility's fence. The area is unpaved and retains the natural contour of the land, sloping to the shallow drainage on the north.

From the entrance gate the west road continues south past Main Site. Three small sites lie along the west side of this road. The first is the former site of the cut-off building (TA-33-21), now removed; it lies off the southwestern corner of Main Site. The area has been leveled and is used as a storage yard for drilling equipment.

Continuing south about 600 ft beyond the former site of TA-33-21 is TA-33-22, a small bunker with an asphalt pad on the south side. TA-33-23 lies another 600 ft further south. It is also a small building with an asphalt pad on the south. This building was designed to handle explosives. Small areas around the bunker and the explosives building have been cleared. The west road sites drain into Chaquehui Canyon to the southwest.

3.2.2 SWMU and Area of Concern Descriptions and Histories

This section discusses the physical description, historical use, present use, and identifies potential contaminants for all SWMUs and an area of concern at Main Site.

TABLE 3-3

SOLID WASTE MANAGEMENT UNITS (SWMUs) LOCATED AT TA-33, MAIN SITE

SWMU or AOC	Associated Type	Structure #	Chapter 3 or 5 Discussion: Description	Data	DQOs	Phase 1 Approach
33-002(a)	septic system	TA-33-93	3.2.2.1	3.2.4	3.2.6.3	VCA
	drain field		3.2.2.1	3.2.4	3.2.6.3	reconn
33-002(b)	sump	TA-33-86	3.2.2.1	3.2.4	3.2.6.3	VCA
33-002(c)	sump	TA-33-86	3.2.2.1	3.2.4	3.2.6.3	VCA
33-002(d)	*outfall*	TA-33-86	3.2.2.1	3.2.4	3.2.6.2	reconn
33-002(e)	outfall	TA-33-86	3.2.2.1	3.2.4	3.2.6.2	reconn
33-002	subsurface	MDA -K		3.2.4	3.2.6.5	extent
33-004(a)	septic system	TA-33-31	3.2.2.3		3.2.6.3	VCA
	drain field		3.2.2.3		3.2.6.3	reconn
	seepage pits		3.2.2.3		3.2.6.3	reconn
33-004(e)	seepage pit	TA-33-169	5.1			NFA
33-004(f)	septic tank	TA-33-206	5.2			NFA
33-004(h)	*outfall*	TA-33-20	3.2.2.4		3.2.6.2	reconn
33-004(i)	2 outfalls	TA-33-39	3.2.2.5		3.2.6.2	reconn
33-004(n)	septic tank	TA-33-206	5.2			NFA
33-005(a)	outfall drain	TA-33-21	3.2.2.10		3.2.6.2	reconn
	excavated septic tank		3.2.2.10	3.2.4	3.2.6.4	extent
33-005(b)	outfall		3.2.2.10		3.2.6.2	reconn
33-005(c)	excavated drain field		3.2.2.10	3.2.4	3.2.6.4	extent
33-010(f)	surface disposal	TA-33-86	3.2.2.6		3.2.6.2	reconn
33-011(a)	*drum storage*	TA-33-21	3.2.2.11		3.2.6.2	reconn
33-011(d)	general storage	TA-33-20	3.2.2.7		3.2.6.2	reconn
33-011(e)	drum storage	TA-33-22	3.2.2.12		3.2.6.2	reconn
33-012(a)	drum storage	TA-33-39	3.2.2.9		3.2.6.2	reconn
33-012(b)	satellite storage	TA-33-114	5.4			NFA
33-012(c)	satellite storage	TA-33-114	5.4			NFA
33-012(d)	satellite storage	TA-33-19	5.4			NFA
33-013	drum storage	TA-33-86	3.2.2.8		3.2.6.2	reconn
33-015	*incinerator*	TA-33-110	3.2.2.13		3.2.6.2	reconn
33-016	sump	TA-33-23	3.2.2.14		3.2.6.3	reconn
	outfall		3.2.2.14		3.2.6.2	reconn
33-017	operational release		3.2.2.2		3.2.6.2	extent
	drainage		3.2.1		3.2.6.2	extent
C-33-001	transformer	TA-33-124	3.2.2.15		3.2.6.2	reconn

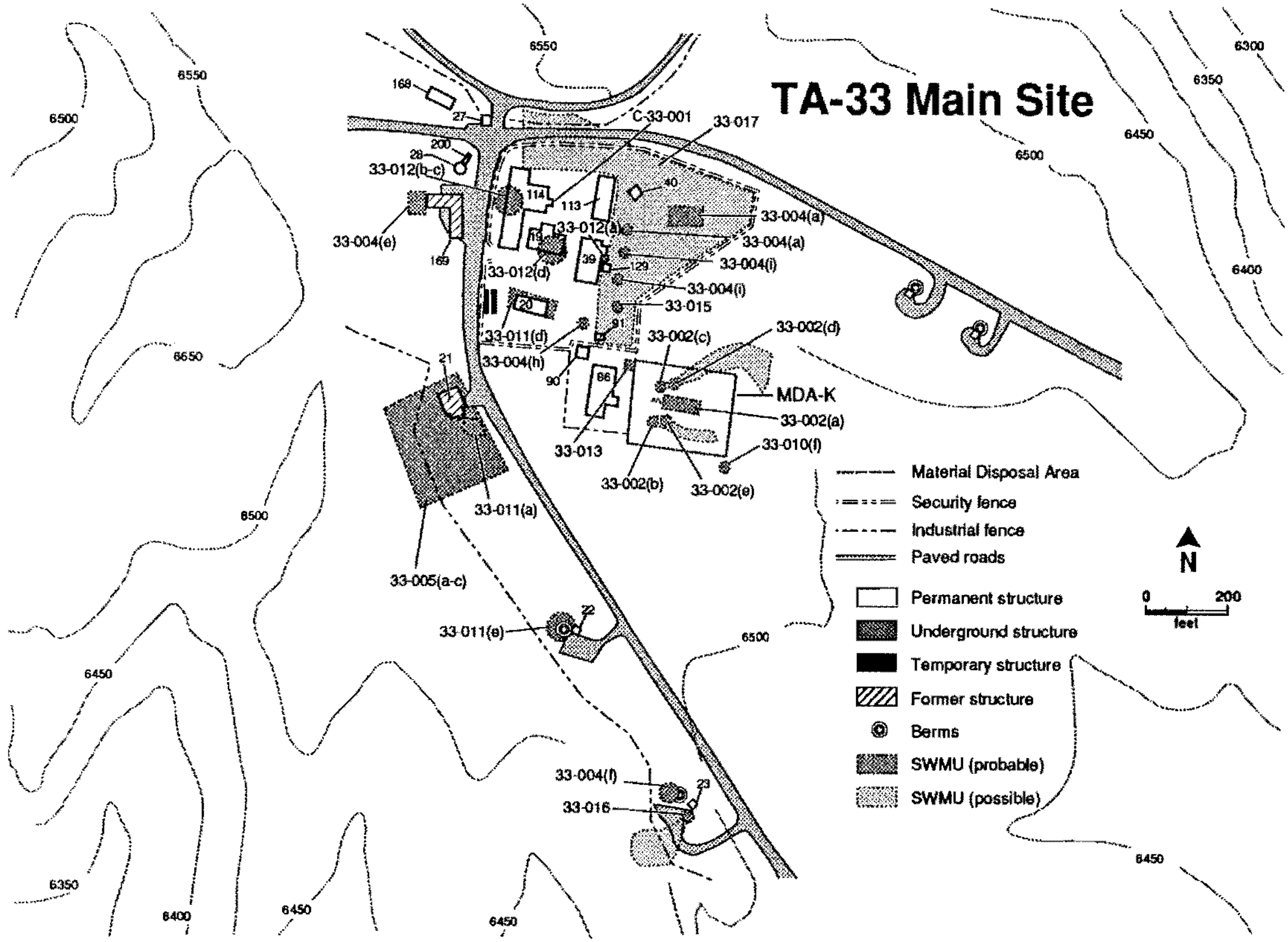

Fig. 3-5. TA-33 Main Site.

3.2.2.1 SWMUs 33-002(a-e) Material Disposal Area K (MDA-K)

3.2.2.1.1 Physical Description

MDA-K (SWMUs 33-002[a through e]) contains a septic system, two sumps, a siphon tank, an associated leach field, a building outfall, and a roof drain that serves TA-33-86. MDA-K covers approximately one acre and is an unfenced area east of TA-33-86. The ground slopes gently to the east. The septic system discharges to adjacent soils by means of a leach field. Sumps TA-33-133 and TA-33-134 also discharged to adjacent soils. A noncontact cooling water drain line discharges to an NPDES-permitted outfall (EPA 04A147). Because of the large amounts of water discharged, vegetation is heavy within the MDA; even cattails grow on the site.

The septic system, which serves TA-33-86 and a guard station, TA-33-90, includes a drain line, a septic tank, a siphon tank, and a leach field. This system has New Mexico Environment Department (NMED) Permit Number LA-35. The septic tank, TA-33-93 (SWMU 33-002[a]), was installed in 1954.

The two sumps, sump TA-33-134 (SWMU 33-002[b]) and TA-33-133 (SWMU-33-002[c]), are unlined seepage pits 6 ft in diameter and 8 ft deep, each with a 3-in. concrete cover overlain by 1 in. of soil. Sump TA-33-133 is located north of sump TA-33-134. Both sumps were originally connected to sinks and floor drains in TA-33-86.

Sump TA-33-133, now inactive, has been disconnected and the drain line from the building extended approximately 90 ft past the sump to create the noncontact cooling water outfall, SWMU 33-002(d).

A roof drain (SWMU 33-002[e]), serving TA-33-86, discharges to an outfall east of the building. This 2-in. drain line is approximately 90 ft long.

3.2.2.1.2 Historical Use and Potential Contaminants

The tritium facility, TA-33-86, began operation in June 1955. For a short time, the building also housed a uranium fluidized-bed reaction vessel (Ahlquist 1983, 02-006).

The tritium facility experienced accidental releases of tritium over the years. Its septic system (TA-33-93), sumps, leach field, and cooling water outflow are contaminated with tritium. In addition, solvents were used to clean contaminated parts. These waste streams are collectively known as MDA-K.

The septic system was used primarily for sanitary wastes but also received tritium and possible uranium-contaminated liquids. In 1961, it received two emergency releases of plutonium-contaminated liquid.

Sump TA-33-134 received organic contaminants such as ethanol and methanol (<5 gal./yr), trichloroethene, and benzene and acetone contaminated with tritium (about 5 gal./yr). The sump may also have received beryllium, mercury, and depleted uranium. Sump TA-33-133 received tritium and small quantities of solvents such as trichloroethene, methanol, ethanol, acetone, and propanol. Both sumps have been inactive since 1959 (LANL 1990, 0145).

The noncontact cooling water contains tritium but no other contaminants are expected to be present. The roof drain of TA-33-86 is expected to contain tritium that has been released from the stacks.

3.2.2.1.3 Present Use and Potential Contaminants

The septic system (SWMU 33-002[a]), the noncontact cooling water (SWMU 33-002[d]), and the roof drain (SWMU 33-002[e]) are all active and still serve the high-pressure tritium facility in TA-33-86. The tritium facility ceased normal operations in December 1990. Tritium is presently being removed from equipment in preparation for decontamination and decommissioning (D&D) of the facility (Harris 1992, 02-007). Small tritium releases can be expected during the tritium removal and the D&D activities. The two sumps (SWMUs 33-002[b] and 33-002[c]) are inactive.

3.2.2.1.4 Potential Contaminant Summary

Materials likely to be present in MDA-K include tritium, uranium, and plutonium; tritium-contaminated liquids; organic contaminants such as trichlorethene, benzene, and acetone contaminated with tritium; beryllium; mercury; methanol; propanol; and sanitary wastes.

3.2.2.2 SWMU 33-017 Main Operations

3.2.2.2.1 Physical Description

SWMU 33-017 lies at the northern and eastern edge of Main Site (Fig. 3-5). It is 600 ft long and varies from 100 to 600 ft wide. The site lies at the head of a small drainage, a tributary of Chaquehui Canyon. The SWMU slopes steeply to the east at its southern and central sections; the elevation drop is 30 ft in a 100-ft span at its steepest point. The northern third is nearly level. The entire Main Site complex is fenced and access is controlled. The SWMU is not separately fenced. A small extension of SWMU 33-017 lies north of the fenced area, between the road to East Site and the rim of Ancho Canyon.

Bank cuts of up to 6 ft have been made in the tuff at the western half of the site. The surface of SWMU 33-017 is highly disturbed; much of the site has been bulldozed or gravelled. The surface within SWMU 33-017 is covered by a mixture of tuff debris and soil fill from the site preparation. Bedrock is exposed at the north and south ends and in a drainage wash in the central section. In the northern third of the SWMU, thin layers of sand and soil are deposited over bedrock tuff.

The Main Site office complex is paved with asphalt; SWMU 33-017 receives all runoff from this paving. In addition, the 80 x 90-ft tile field serving septic tank TA-33-31 is included within this SWMU. Outfall EPA 03A038 from TA-33-114 discharges directly to the SWMU. Because of its sheltered nature and the water it receives from these sources, the site is heavily vegetated.

A runoff ditch angles from the southwest corner of the SWMU to the fence line, exiting the SWMU about 50 ft north of the angle in the fence. This ditch carries runoff from the asphalt paving. It also receives runoff from a separate ditch that lines the southern periphery of the complex.

Three separate SWMUs are within SWMU 33-017: septic tank TA-33-33, SWMU 33-004(a); outfalls from TA-33-39, SWMU 33-004(i); and incinerator TA-33-110, SWMU 33-015. The septic tank is active; the outfalls and incinerator are inactive.

3.2.2.2.2 Historical Use and Potential Contaminants

Construction started at Main Site in July 1949 to support Weapons Group (W-3) initiator experiments. Included in the initial construction project were TA-33-19 laboratory and office, TA-33-20 warehouse, and TA-33-31 septic tank. TA-33-20 was a warehouse serving the entire TA-33 facility. TA-33-19 housed an electronics lab in which mercury was used (Jordan 1954, 02-008).

TA-33-40, was completed in March 1951. It housed a 24-in. saw with self-contained coolant. The building floor drain ran downhill several feet without a sump or holdup: effluents leached into the ground (Barker 1951, 02-009). In TA-33-40 steel and uranium projectiles were sawed open after they were retrieved from the experimental events. Both natural and depleted uranium were used. The projectiles also contained polonium (half-life 138 days) and beryllium. Reports documented uranium fumes emanating from the saw building during operations (Lawrence 1951, 02-010) and a fan was put in the roof. Loss of uranium ranged from 1 to 2 lb per week (Hyatt 1953, 02-011).

TA-33-39, was completed in August 1951. It housed a welding and soldering bench employing cadmium and silver and a lead melting facility (Hyatt 1951, 02-012). Cadmium, stainless steel, and polystyrene plastic were also machined in TA-33-39. All work areas were supplied with hoods exhausting to the atmosphere. Blower fans were installed in the hoods to ensure operator safety (Jordan 1954, 02-008).

The high-pressure tritium facility, TA-33-86, was completed in June 1955. The facility processed tritium gas (half-life 12.3 yr). To protect operating personnel, large airflows were passed over the equipment and were exhausted through an 80-ft stack. This procedure resulted in an annual release of 2 000 to 6 000 Ci. In addition, the facility was the site of several accidental releases. A report estimates that in the 15-yr period between 1955 and 1970, the facility released 60 000 Ci to the atmosphere (Coffin 1971, 02-013). TA-33-86 also housed a tritium decontamination facility that used benzene, acetone, and methanol. The process was handled in a chemical fume hood equipped with an exhaust fan (Schulte 1957, 02-014). In 1960 a uranium fluidized-bed reaction vessel was installed in TA-33-86. The vessel was provided with a discharge stack and fan. It was later shipped to Brookhaven (Ahlquist 1983, 02-006).

TA-33-113 was completed in September 1957. It processed uranium, sometimes contaminated with polonium and tritium. Local exhaust hoods with blowers were installed over the machines (Hyatt 1956, 02-015). In August 1960, 200 g of powdered uranium oxide were spilled in the building (H-Division 1960, 02-016). It was not recorded if uranium was released to the atmosphere. A memo indicated that oralloy (enriched uranium) was also machined in this building (Mitchell 1961, 02-017).

TA-33-114 was completed in September 1960. There is no record of hazardous operations in this building prior to 1972, nor during its occupancy by Hot Dry Rock personnel, though photoprocessing may have occurred.

Group W-3 operations at TA-33 ceased in 1972. The site was obtained for offices, laboratories, and storage facilities for the Hot Dry Rock experiments at Fenton Hill in the Jemez Mountains. A 1987 site visit notes a drum storage site (SWMU 33-012[a]) and a vehicle maintenance area east of TA-33-39 that may have leaked organics to the asphalt paving, which then could reach SWMU 33-017 as runoff (LANL 1990, 0145).

3.2.2.2.3 Present Use and Potential Contaminants

In 1989 International Technologies Group IT-6 acquired the office buildings and labs TA-33-19 and TA-33-114. The group engages in electronics design and fabrication. Machine shops TA-33-39 and TA-33-113 are inactive. Both are controlled under current LANL waste management practices. Other buildings at Main Site, TA-33-40 and TA-33-90, are used for equipment storage or are vacant.

The high-pressure tritium facility ceased normal operations in December 1990. Tritium is presently being removed from equipment in preparation for decontamination and decommissioning of the facility.

3.2.2.2.4 Potential Contaminant Summary

Materials handled in laboratories and shops adjacent to SWMU 33-017 included tritium, deuterium, depleted and enriched uranium, polonium, beryllium, beryllium oxide, mercury, lead, silver, cadmium, and organic solvents.

3.2.2.3 SWMU 33-004(a) Active Septic System, Septic Tank TA-33-31

3.2.2.3.1 Physical Description

SWMU 33-004(a) includes a septic tank TA-33-31, a sampling box, drain lines, two seepage pits, and a disconnected drain field. The septic tank lies 50 ft northeast of TA-33-39 on the steeply sloping bank below the asphalt paving. It has a capacity of 1 360 gallons. The 90 x 80-ft drain field is on the more gently sloping area 200 ft to the northeast. Its 4-in. tiles are spaced about 10 ft apart and run roughly north-south (LANL 1990, 0145). The two seepage pits which are now connected to the drain line, were connected to the drain field. Each has a diameter of 4 ft and a depth of 50 ft, and is filled with gravel around a central vertical pipe.

3.2.2.3.2 Historical Use and Potential Contaminants

Prior to 1951, the septic tank discharged to the drain field through a vitrified-clay pipe. At that time, the septic system received sanitary wastes from TA-33-19, and TA-33-27, while industrial waste from TA-33-19 discharged directly to an outfall through a vitrified-clay pipe 65 ft long with an 8-in. diameter.

The system was redesigned in 1951. The sanitary sewer from TA-33-19 was rerouted through new manholes to the septic tank TA-33-31. The industrial waste line from TA-33-19 was truncated and connected to the new sewer line. A sewer line from the TA-33-39 completed the same year, was also connected to this line, while a floor drain from TA-33-39 was connected directly to the septic tank. Some piping and one manhole were abandoned in place.

Additional connections were made as new buildings were constructed at Main Site: sewer lines from TA-33-113 in 1957, TA-33-114 in 1960, and TA-33-168 in 1974.

Activities in Main Site buildings during this period are described in Section 3.1.2.1.2. Although the waste routed to the system was primarily sanitary sewage, it may have included natural and depleted uranium, cadmium, silver, lead, beryllium, mercury, tritium, and solvents such as trichloroethene and benzene (LANL 1990, 0145).

3.2.2.3.3 Present Use

TA-33-31 septic system receives sanitary and industrial wastes from TA-33-19, TA-33-39, TA-33-113, TA-33-114, and TA-33-168; NMED Permit Number LA-32. Currently-generated waste is collected in satellite storage areas in accordance with Laboratory waste management practices.

3.2.2.4 SWMU 33-004(h) TA-33-20 Outfall

Engineering drawings show that a drain exited TA-33-20 from its southeast corner. The drain is an 8-in. diameter vitrified-clay pipe. SWMU 33-004(h), outfall from this drain is located on the periphery of and drains into SWMU 33-017 (LANL 1990, 0145).

TA-33-20 was completed in June 1950. It was used to store beryllium and uranium (Ahlquist 1983, 02-006).

TA-33-20 has been cleaned and is being used as a laboratory by Group IT-6. The drain is currently inactive but it is not known when the drain line was deactivated. The outfall has not been located.

3.2.2.5 SWMU 33-004(i) TA-33-39 Outfalls

SWMU 33-004(i) is within the boundaries of SWMU 33-017. The two outfalls lie east of TA-33-39 on the steeply sloping bank below the asphalt paving. The area is overgrown with a thicket of chamisa.

TA-33-39 was completed in August 1951. It housed a welding and soldering bench using cadmium and silver, a lead-melting facility, a beryllium-machining room, and a sandblasting compartment. Cadmium, uranium, stainless steel, and polystyrene plastic were also machined in the building.

The machine shop ceased operations in late 1990. Mechanical and Electronics Support Group, MEC-5, is responsible for the equipment that remains in the shop. The drains are currently inactive.

3.2.2.6 SWMU 33-010(f) Surface Disposal

Concrete, old cans, metal pieces, and debris were found near the southeast corner of MDA-K at Main Site during an ER Program reconnaissance in 1987 (LANL 1990, 0145). Nothing is known of the origins of this SWMU.

3.2.2.7 SWMU 33-011(d) Storage Area TA-33-20

SWMU 33-011(d) is a section of the asphalt around TA-33-20. Site workers indicate that uranium and beryllium were stored in and around TA-33-20. In addition, scrap from recovered shots containing uranium, beryllium, and tungsten were stored south of TA-33-20 (Ahlquist 1983, 02-006).

An ER Program Site Reconnaissance in 1987 found no materials remaining in the area (LANL 1990, 0145). OU 1122 team personnel verified that all material has been removed.

3.2.2.8 SWMU 33-013 Drum Storage Behind TA-33-86

Pumps and drums containing oil contaminated with tritium and possibly with metals and solvents were formerly stored on the asphalt inside the northeast corner of the fence around TA-33-86. Stains were noted on the asphalt during the 1987 ER Program Site Reconnaissance.

The storage area was moved to a fenced site at the southeast end of TA-33-86 in the spring of 1989. No additional cleanup of the former site is reported. The site now appears to be a clean asphalt pad (LANL 1990, 0145).

3.2.2.9 SWMUs 33-012(a) Active Satellite Storage Area

SWMU Report states that SWMU 33-012(a) is a satellite storage area for TA-33-39 (LANL 1990, 0145). The storage area is described as consisting of 55-gal. steel drums containing waste oils for recycling. The drums were stored either on pallets or directly on an asphalt pad. The wastes consisted of solvents and solvent-contaminated oil potentially containing PCBs and metals. Multiple oil stains were observed around the unit at TA-33-39.

Currently there are no drums stored around TA-33-39 and no evidence of oil stains on the asphalt pad around the building. The shop is being used as a staging area for the redistribution of machinery to other shops. This operation occasionally creates waste and an inside waste satellite storage area is being operated.

3.2.2.10 SWMUs 33-005(a-c) TA-33-21 Septic System and Drain Lines

3.2.2.10.1 Physical Description

TA-33-21 was located across west road, 325 ft west of Main Site's tritium facility. Three drainage systems received effluent from TA-33-21. The septic system, SWMU 33-005(a), served the restrooms and change room lavatories, urinals, and commodes. The lines discharged to manhole TA-33-74, which drained to septic tank TA-33-32. Overflow from the system surfaced a few feet south of the tank.

A drain line, SWMU 33-005(b), served a sink, floor drain, and safety shower in the counting room. An industrial waste drain, SWMU 33-005(c), served sink, shower, and glovebox drains in the process and hot change rooms. This system discharged to a leach field approximately 50 ft south of the building. The three systems may have discharged to separate outfalls (Cox et al 1975, 02-018). The system has been removed.

3.2.2.10.2 Historical Use and Potential Contaminants

TA-33-21 was completed in June 1950 and contained gloveboxes housing a small slit saw used to section projectiles made of uranium and containing beryllium and polonium. Because TA-33-21 contained gloveboxes, it was also used for other experiments which used plutonium (Hoard 1990, 02-019).

In April 1960, a mixture of plutonium and beryllium powders was accidentally released at TA-33-21, contaminating the entire building. The structure was decontaminated within weeks, but never used again. In 1974 the entire complex, including the building and associated septic system, drains, and leach field, was removed and the area decontaminated. The debris was taken to MDA-G, TA-54. During removal of the industrial waste system, 30 ft of trench was found to be contaminated. All the clay pipe and 8.2 ft^3 of soil were buried at MDA-G. After the decommissioning program was complete, the depression was filled with clean soil and seeded to native grasses. The remaining soil contained <20 pCi/g gross alpha (Cox et al. 1975, 02-018). No analyses were made for nonradioactive hazardous waste.

3.2.2.10.3 Present Use

The site is level. It is used as a storage area for drilling pipe used at the Fenton Hill Hot Dry Rock facility.

3.2.2.11 SWMU 33-011(a) TA-33-21 Drum Storage Area

A unimproved road angles southwest off the west road at the drilling storage area, the former site of TA-33-21. A drum storage area, which covered 0.25 acre, was located in the angle of this road and the paved west road.

Fifty-five-gallon drums containing waste oils were held for recycling. Aerial photographs taken in 1986 and 1987 show the drums. Soil analyses showed 1 to 2 ppm PCBs (LANL 1990, 0145). The drums and soil have been removed.

3.2.2.12 SWMU 33-011(e) TA-33-22 Storage Area

The drum storage area was located just northwest of TA-33-22. The types of material in the drums are unknown. The drums have been removed and the area cleared. Soil samples showed uranium and gamma emitters above background (LANL 1990, 0145).

3.2.2.13 SWMU 33-015 Incinerator TA-33-110

This incinerator, TA-33-110, lies within SWMU 33-017 at Main Site. It is located near the southeast corner of that SWMU, due east of TA-33-20, on a hillside sloping down into a side wash of Chaquehui Canyon. The incinerator is about 3 ft square and 6 ft high.

The incinerator was used from 1955; it is not known when use was discontinued. Personnel working at the site state that the incinerator was used only for uncontaminated office waste (LANL 1990, 0145).

3.2.2.14 SWMU 33-016 TA-33-23 Sump

The sump at TA-33-23 is 3 x 2 x 2 ft deep. It is located outside the building to the left of the door. A drain line leads to an outfall 150 ft south of the building on the slope of a small side canyon of Chaquehui.

TA-33-23 was used by Weapons Group W-3 to prepare propellant charges for gun tests at South Site. It was built in June 1950. Presumably, the sump was constructed at the same time. Explosive work ceased when Group W-3 left TA-33 in 1972. The sump may have contained high explosives and oil.

The building, used for storage of lithologic cores from the Hot Dry Rock Program, is presently managed by EES-1, the Geology/Geochemistry Group. No water is used in the building to activate the sump; however, it can receive rainwater and snowmelt.

3.2.2.15 Area of Concern Number C-33-001

TA-33-124, a power transformer mounted on a concrete pad adjacent to the east wall of TA-33-114, is designated as an area of concern. The concrete pad and transformer are enclosed in a fence with access through a locked gate. The concrete pad is surrounded by a paved parking area between adjacent buildings. The transformer pad exhibits evidence of oil stains. No active leaks were noted during a LANL transformer assessment September 24, 1985. The transformer site was inspected March 19, 1992, and no evidence of active leaks was observed. This transformer is scheduled to be replaced during the summer of 1992. The transformer pad will be sampled and cleaned as required during the replacement operation (Morales 1992, 02-040).

3.2.2.16 Main Site SWMUs Recommended for No Further Action

The following SWMUs are recommended for no further action: 33-004(e), 33-004(f), and 33-012(b-d). These are discussed in Chapter 5.

3.2.3 Conceptual Exposure Model

Most of the activities that were primary sources of contamination for the SWMUs described in the preceding section have ceased. Decontamination of the high-pressure tritium facility may release some additional tritium to MDA-K. However, present waste streams are NPDES-permitted and storage sites are managed under approved procedures.

Some contamination may remain in a number of secondary sources. Residual contamination may exist in both the active and inactive components of the septic systems, in sumps, in material surrounding these structures, and in surface soils and channel sediments. Analyses indicate that tritium is present to a depth of at least 175 ft beneath MDA-K (see Fig. 3-6).

Contaminants could be released from the subsurface structures and material by excavation, by leaking, or by infiltration and leaching. Contaminated surface soil or sediments might be suspended by wind or in surface runoff.

The three major exposure scenarios outlined in Section 3.1.2 are all applicable to Main Site. In particular, about 60 Laboratory employees work in the Main Site office complex, and the areas of ponding and heavy vegetation probably attract animals who might ingest contaminated water and vegetation. Thus, the "current use" scenario is particularly relevant. In addition, a tritium-bearing plume is known to have reached a depth of at least 175 ft below the ponded water associated with one of the outfalls (Section 3.2.4.3). The depth to the main aquifer beneath this site is approximately 900 ft. It is not known whether a perched aquifer is present beneath the site. Several small springs exist within Operable Unit 1122 near the Rio Grande. Discharge is lost to evaporation or infiltration before reaching the river (Purtymun et al. 1980, 0208). The springs are monitored annually for gross alpha, gross beta, and uranium.

The Laboratory currently intends continued institutional control over material disposal areas (MDAs) with eventual transfer of DOE property to another government agency, such as Bandelier National Monument. Recreational use and limited construction might then occur on the site, but residential and agricultural use is not anticipated.

3.2.4 Review of Existing Data

3.2.4.1 Summary

Existing data are primarily related to MDA-K, which was included in a preliminary investigation by Weston (LANL 1989, 02-020). Surface monitoring at MDA-K is performed by the Laboratory's Environmental Surveillance Program. The most recent survey by the Environmental Surveillance Program occurred in 1986 (LANL 1987, 02-021). Surface contamination east of TA-33-86 was examined in field radiation surveys, soil samples, and vegetation samples. Elevated levels of tritium were observed in both soil and vegetation samples.

The surface sampling done by Weston confirmed these results. As some of Weston's sampling locations were north of MDA-K, these data suggest that surface tritium contamination is probably due to airborne emissions rather than the septic system, sumps, and outfalls that comprise MDA-K, and may be extensive throughout Main Site. These MDA-K data are not representative of areas closer to the Main Site shops, but they suggest that contamination from those sources is not widespread.

Weston also took near-surface samples from and near the septic tank and sumps, and from two cored holes. Again, elevated tritium values were found, particularly in the sump TA-33-134 and at the bottom (175 ft) of the drill hole sited next to the cattails below the noncontact cooling water outfall.

The following sections describe the above results in more detail.

Apart from MDA-K, the only quantitative information at Main Site comes from the report on the decommissioning of building TA-33-21 (Cox et al. 1975, 02-018). This report states that "Pu concentrations ranged from 0.01±0.01 to 0.10±0.01 pCi/gm for soil left in place" (Cox et al. 1975, 02-018). A field survey showed less than 20 pCi/gm gross alpha activity throughout the site, as observed with a ZnS alpha counting system.

3.2.4.2 Surface Data

The 1986 LANL survey of MDA-K collected observations at 30 points on a 32.8 x 32.8 ft grid covering MDA-K, plus five additional points in the drainage channel from the roof drain (Fig. 3-7). The point (1,1) on this grid is 54.4 ft north of the southeast corner of the fence around the tritium facility, and the western row of sampling locations lies along this fence. At the time of the survey, there was some radioactive pipe inside the fence next to sample location (1,6).

Field surveys were conducted with RASCAL (for radionuclides emitting higher-energy gamma rays, such as cesium-137) and Phoswich (for radionuclides such as isotopes of uranium, plutonium, and americium, emitting low-energy gamma and x-rays). Some very high observations were obtained at (1,6) despite attempts to shield the instruments from the pipe. Apart from these observations, the RASCAL measurements do not differ significantly from background as measured near the entrance to Bandelier National Monument, approximately one mile to the west. Phoswich observations are about 20% higher than the background measurements on the average.

Soil and vegetation samples were analyzed for tritium and uranium. Tritium in soil moisture is high along the fence (7 200 to 220 000 pCi/ml) and drops off rapidly to the south and east with a slight rise in the channel (Fig. 3-8). All of these observations are above natural background levels (less than 10 pCi/ml). Total uranium measurements are all within background ranges (1 to 6 ppm).

In general, tritium in vegetation roughly correlates with tritium in soil (Fig. 3-9).

A sample taken at SWMU 33-002(e) showed trace levels (<2.5 ppm) of 11 semivolatile organic compounds, none of which is known to have been used at TA-33. This SWMU is the outfall for draining the asphalt roof of TA-33-86.

The 1989 survey by Weston included five composite soil samples (from sampling locations 4 through 8 on Fig. 3-10). Tritium data from composites 4, 5, and 6 (2 400 to 4 600 pCi/ml) suggest an extension to the north (in the direction of the prevailing daytime winds) of the plume seen in the LANL data described above. The composite soil samples were also analyzed for volatiles, semivolatiles, pesticides, PCBs, explosives, and some additional radionuclides. No concentrations above detection limits of any of these contaminants were observed, except for two samples which showed less than 10 ppb of tetrachloroethene and toluene. Total metals analyses indicated the following hazardous metals above detection limits: chromium at less than 6 ppm and lead at less than 10 ppm, except for sample composite 8, which yielded 19 ppm of lead. Barium results ranged from 50 to 135 ppm.

3.2.4.3 Subsurface Data

The 1989 Weston survey also took samples from the two sumps, outfalls, and some additional soil samples from the immediate vicinity of the sumps and septic tank (Fig. 3-10). Sump TA-33-134 (SWMU 33-002[b]) produced an observation of 190 000 pCi/ml of tritium, and several other observations were above 10 000 pCi/ml (see Fig. 3-6). Other contaminants are within background ranges or below detection limits.

Two boreholes were drilled in MDA-K (LANL 1989, 02-020). Electromagnetic (EM) and electrical earth resistivity (EER) data were used to locate the point of resistivity change, near the cattails area, where one of these holes (LAN33-0018) was drilled (Fig. 3-10). Tritium measurements in moisture in the tuff at selected intervals are graphed in Fig. 3-6, and range up to 82 000 pCi/ml at a depth of 99 ft. At the bottom of this hole (175 ft) another peak is observed at 9 100 pCi/ml. Other contaminants are within background ranges or below detection limits.

The second borehole (LAN33-0019) was drilled to 150 ft at the east end of the septic system leach field. No elevated levels of any contaminant were found in this hole.

3.2.5 Decisions and Investigation Objectives

3.2.5.1 Potential Response Actions

Voluntary corrective actions are possible at a number of Main Site SWMUs. Two of the septic systems at Main Site are active but because this site is remote, it will not be integrated into the new Laboratory wastewater treatment system. Current and future use of the system serving the Main Site office complex (SWMU 33 004[a]) will be restricted to sanitary wastes. If the old system, parts of which have been in place for several decades, is contaminated, then the septic tank and system piping can be excavated and replaced. The drain field, which is no longer connected to the system, can be excavated. The seepage pits could be disconnected from the system to reduce infiltration and leaching, or possibly could be excavated altogether.

It is anticipated that the two sumps in MDA-K (SWMUs 33-002[b] and 33-002[c]) contain hazardous organic constituents. Depending on the extent of these contaminants, the sumps and subunits may require removal. The septic system may also need to be removed or replaced. Removal of any of these systems would be coordinated with decontamination and decommissioning (D&D) activities at TA-33-86.

The remainder of MDA-K, consisting of a tritiated soil moisture plume, will utilize stabilization-in place concepts in view of the 12.6 year half-life of tritium.

If the previous cleanup during decommissioning did not remove all contaminants, TA-33-21 will be cleaned to meet risk-based standards. If the sump at TA-33-23 is contaminated with explosives, it and its drain line will be removed, and the soil and tuff in the excavations will be cleaned to risk-based levels.

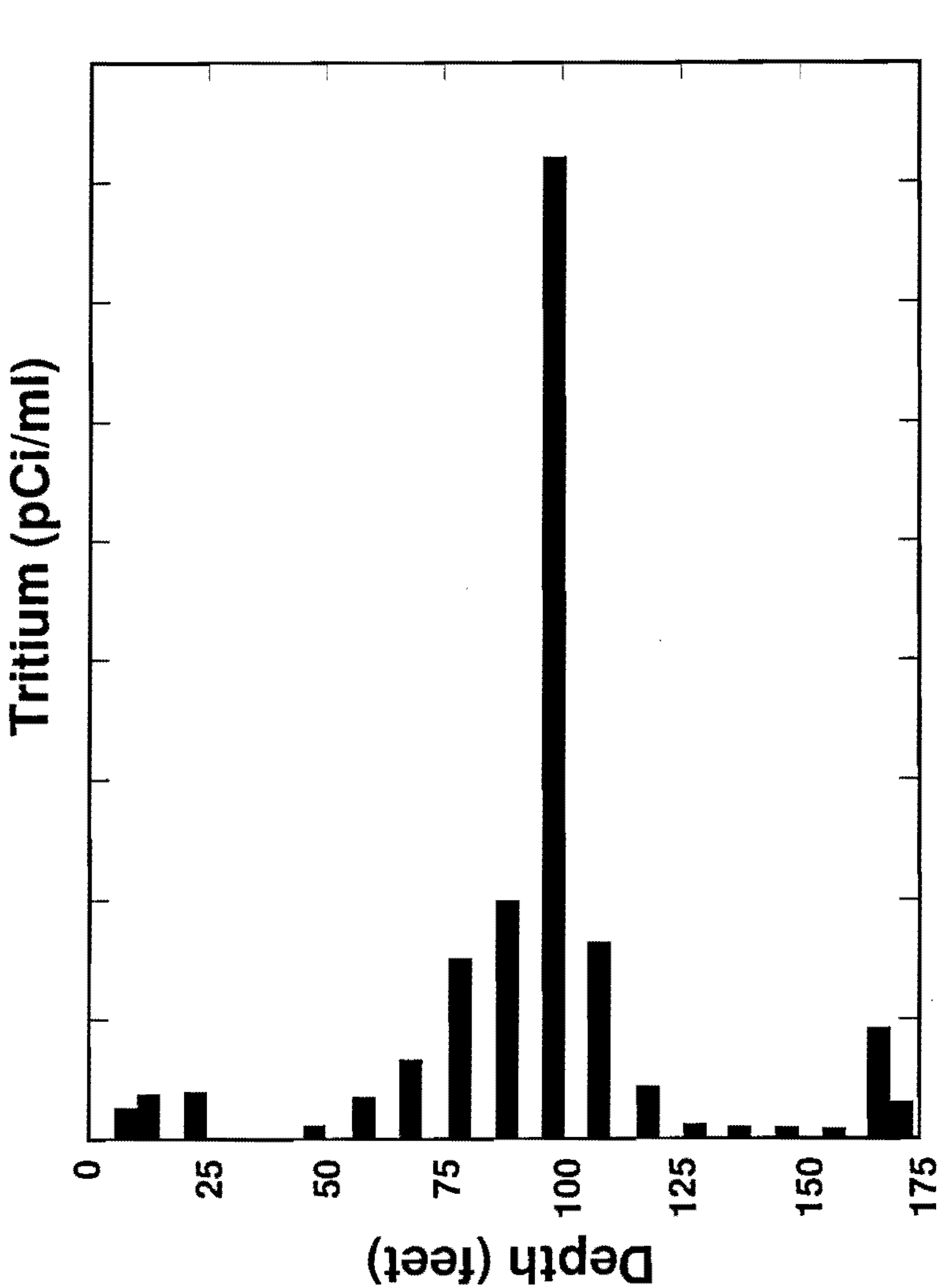

Fig. 3-6. Tritium concentrations by depth in borehole LAN 33-018.

Sampling Locations MDA-K (1986 Survey)

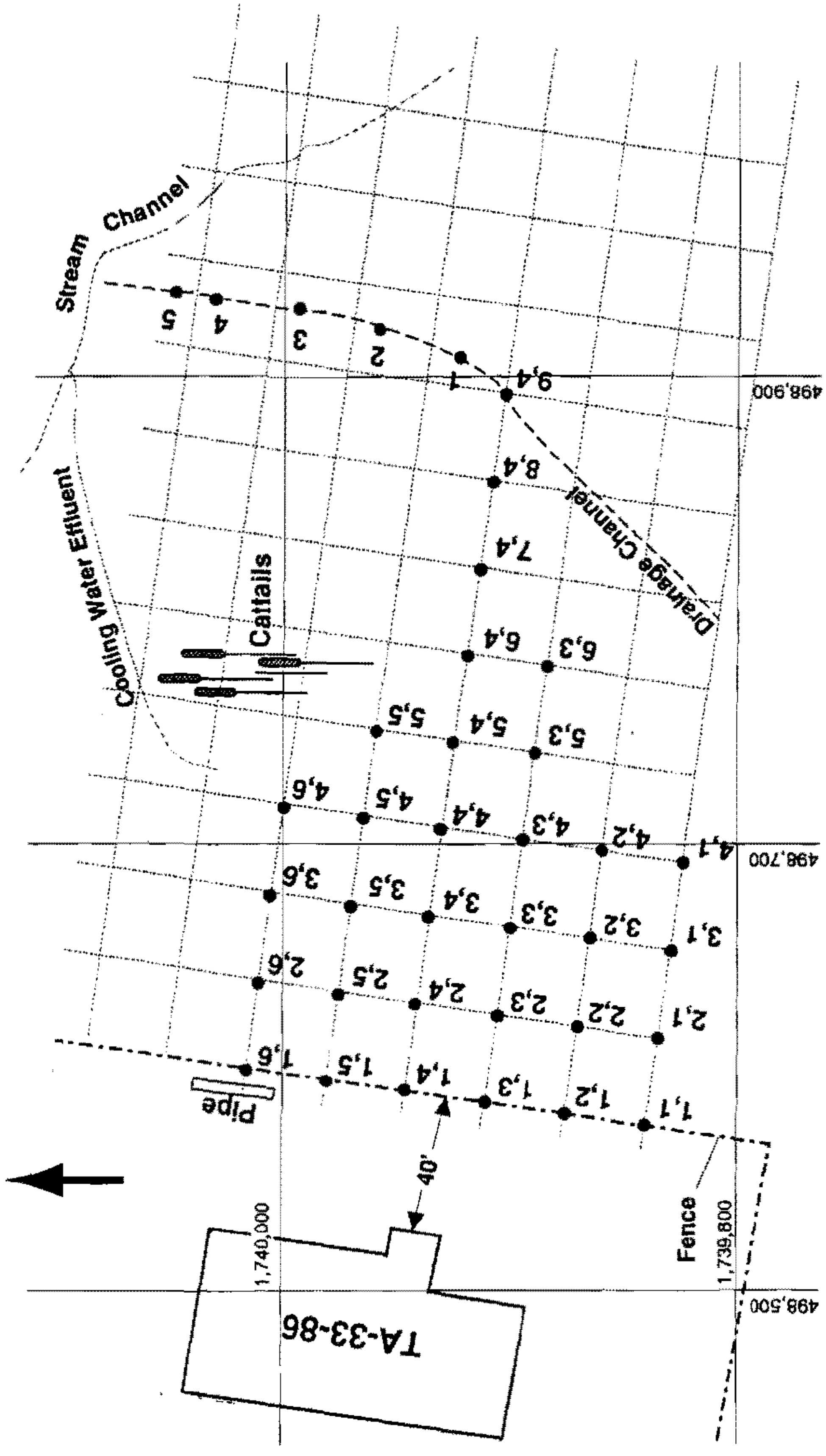

Fig. 3-7. LANL sampling points at MDA-K (1986).

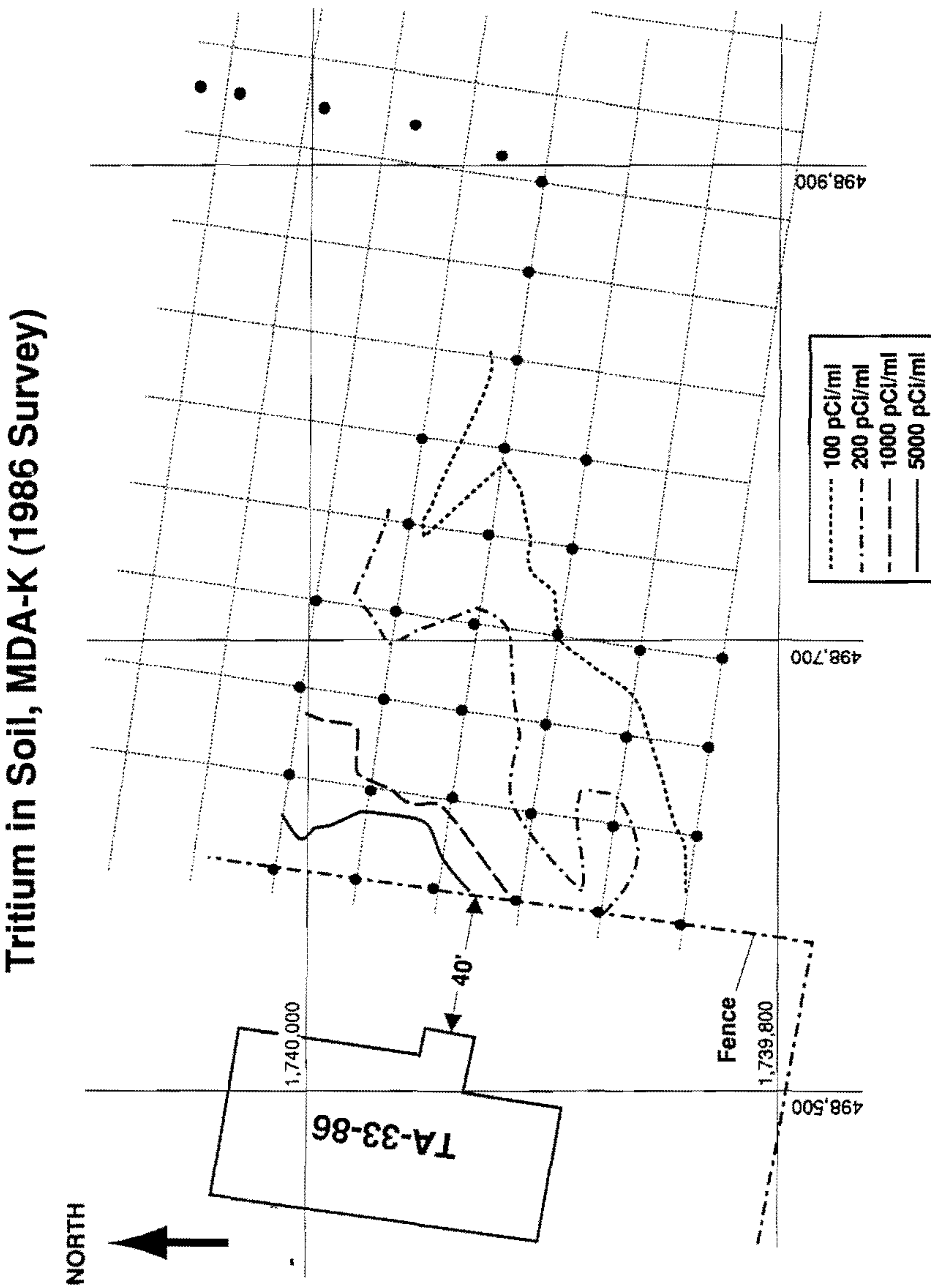

Fig. 3-8. Tritium in soil at MDA-K.

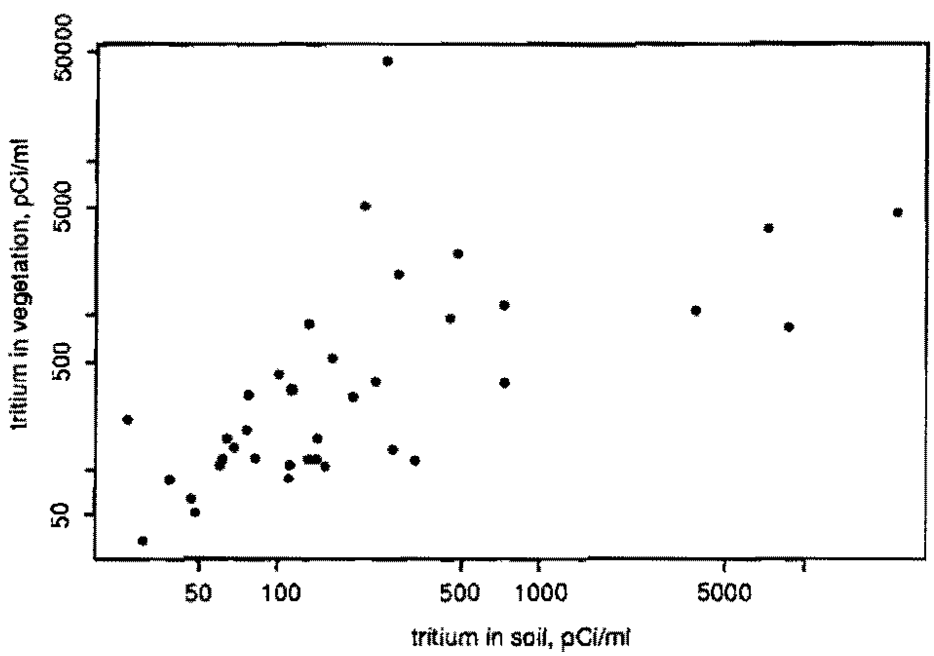

Fig. 3-9. Scatter plot of tritium concentrations in surface soil and vegetation in samples from the 1986 survey at MDA-K.

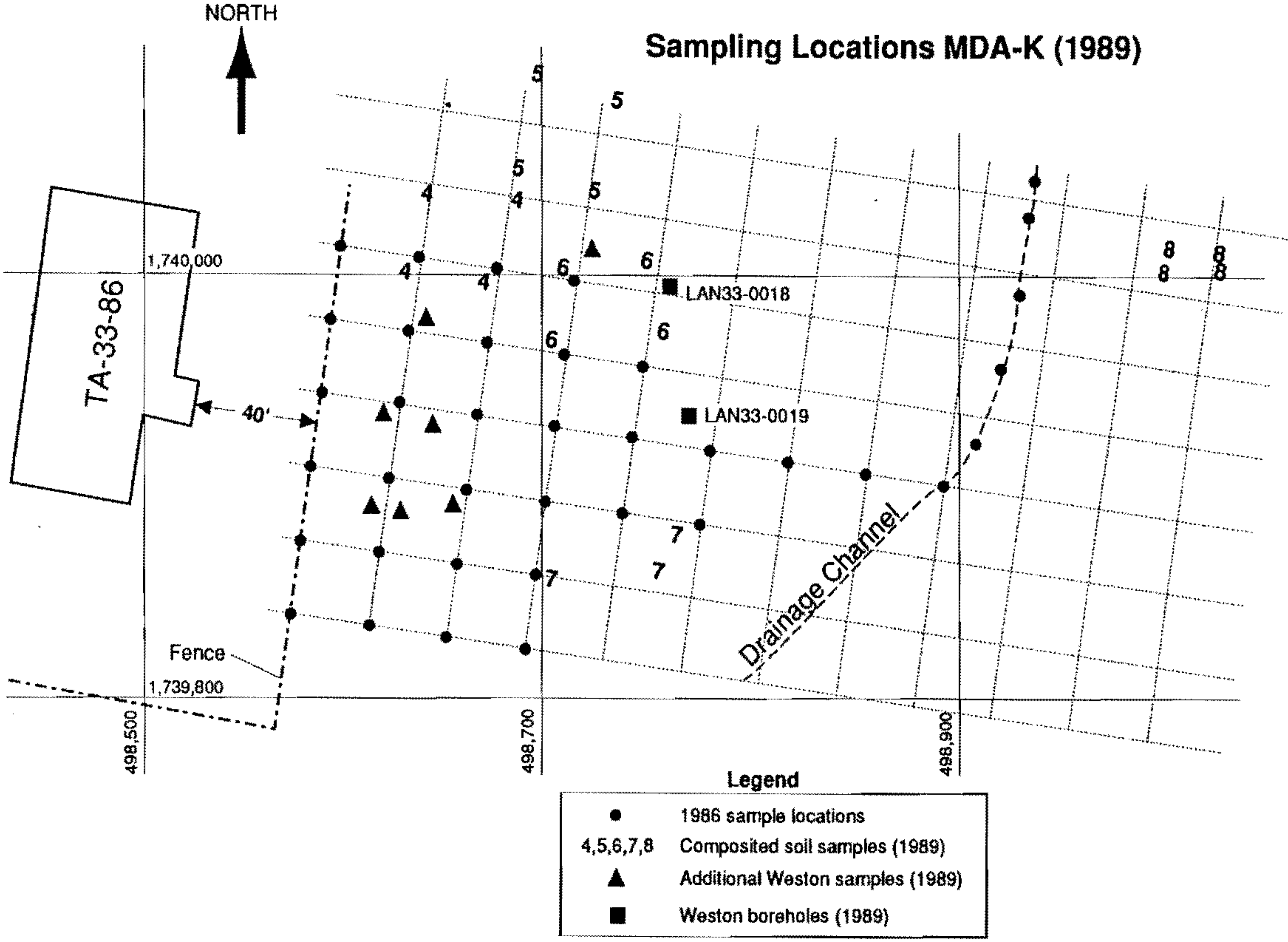

Fig. 3-10. Sampling locatons at MDA-K (1989).

Local areas of high surface contamination (asphalt, soil, and channel sediments) will be cleaned to meet risk-based standards.

3.2.5.2 Proposed Phase I Investigations

Because there is little information about secondary sources of contamination at Main Site, most of the data to be collected in the initial phase of the Main Site investigation will be used to test the hypothesis that one or more sources of contamination is present. Reconnaissance sampling will be carried out at former storage sites and surface disposal areas and at outfalls, drain fields, and seepage pits. VCA sampling approaches are proposed for sumps and septic systems.

General Main Site operational release areas may include not only the drainages and outfalls designated as SWMU 33-017 (Section 3.2.2.2), but also downwind areas where material vented from the machine shops and tritium facility would have been deposited. The Phase I investigations of Main Site operational releases therefore include extensive surface soil sampling across the site as well as channel sediment sampling along the main drainage to the east.

At the site of TA-33-21, Phase I activities will be designed to confirm that the 1975 cleanup removed hazardous and radioactive wastes. Data from these investigations will be used in a baseline risk assessment to determine whether further cleanup is necessary to meet risk-based cleanup standards at SWMU 33-005.

Weston's data show that tritiated water has reached a depth of at least 175 ft below MDA-K (Fig. 3-6), but high values were observed only in one of two drill holes (Section 3.2.4.3). The pattern of tritium values shown in Fig. 3-6 suggests that the tritiated water is moving downward along fractures forming a plume. Additional data will be collected to improve our understanding of both the depth and lateral extent of this plume and the hydrogeologic forces that control its expansion. The data will confirm existing data that suggests that tritium is the only contaminant being transported downward, and will determine if a perched water zone exists below the site, shallower than the main aquifer and potentially providing a shorter path to the accessible environment.

3.2.5.3 Potential Phase II Investigations

If contamination above action levels is found in the Phase I investigations of potential sources of contamination outlined above, this may trigger more extensive Phase II investigations. Phase II data collection activities will be designed to characterize the extent of contamination in order to complete a baseline risk analysis for the site and to evaluate remedial alternatives.

Additional sampling may be required to determine the extent of the plume in the underlying soil or tuff beneath former and active septic tanks, sumps, seepage pits, and drain fields. Additional drill holes at the site of each septic tank or sump, deeper holes at seepage pits, additional drill holes in each of the drain fields, and additional laboratory samples per hole may be required.

However, it is anticipated that corrective measures for most of these subsurface structures can be designed on the basis of Phase I information. Field-screening will be used during excavation to determine the extent of contaminated substrata, and samples will be submitted for laboratory analysis to confirm that applicable cleanup standards have been met.

Additional surface sampling may be required to determine the extent of contamination at the sites of surface contamination, including former surface storage or disposal areas and channel sediments. An alternative for small areas of contamination is removal of surface soil based on field-survey or field-screening measurements, followed by the collection of additional laboratory samples to confirm that cleanup standards have been met.

3.2.6 Phase I Data Quality Objectives

3.2.6.1 Preliminary Activities

Preliminary surveys are needed to delineate several Main Site SWMUs more accurately and to provide additional information necessary to complete specifications of sampling plans.

3.2.6.1.1 Land Survey

A land survey is needed to establish grids for electromagnetic and magnetic survey, a radiation survey, and surface sampling in the field. All points will be surveyed in the New Mexico State Planar Coordinate System and flagged in the field. This land survey will be used in conjunction with 1991 aerial orthophotographs (scale 1:7 200) and 2-ft contour maps to establish the grids.

The outfalls from TA-33-20 and TA-33-39 need to be located in the field, together with their drainage channels if they are still distinguishable. Their locations will be recorded in the New Mexico State Planar Coordinate System. The locations of the former drain and septic systems at TA-33-21, former drum storage areas, and former surface disposal areas need to be identified as accurately as possible and marked in the field.

3.2.6.1.2 Channel Mapping

Aerial orthophotographs and 2-ft contour topographic maps will be used to map the channels carrying surface runoff to both east and west, in order to locate sediment catchments suitable for sampling. (The orthophotographs and accompanying two-foot contour maps will be available by summer 1992.) The locations of such catchments will be surveyed in the New Mexico State Planar Coordinate System and flagged along first-order channels that originate in or pass through Main Site, to the points where they join the second-order tributary. Additional catchments will be surveyed and marked along the second-order tributary. Identified locations should be sufficiently numerous to trace the courses of the channels and to provide a representative subset of sediments below the Main Site sources.

3.2.6.1.3 Geophysical Surveys

Electromagnetic and magnetic surveys will be carried out to locate drain lines and to define the boundaries of the drain fields and local saturated conditions. This survey information will be used to define regions of interest for surface and subsurface sampling, as well as to determine the extent of the drain fields for potential remedial excavation.

3.2.6.1.4 Radiation Survey

A surface radiation survey will be carried out to define the major trends of radioactive contamination and to locate areas of locally-elevated activity that may require more intensive sampling. In addition to a wide-spaced grid covering the entire Main Site area, smaller grids are needed in the vicinity of SWMUs 33-002(a), 33-004(a), 33-005, 33-010(f), 33-011(d,e), 33-012(a), and SWMU 33-013. The area survey will be extended along transects to distances of several hundred feet from the center of Main Site, to obtain information for determining the extent of the operational release area. The radiation survey will also be carried down the second-order tributary draining Main Site to the east to provide information about trends in radioactivity along that channel. Observations will be made at mapped locations where sediments collect.

3.2.6.2 Surface Investigations

Surface samples at Main Site will be divided into three categories: localized SWMUs, channel sediments, and the remaining unpaved areas on the mesa top. The integrated surface sampling plan will provide data to address the following four objectives:

1) To determine whether local areas of elevated contaminant concentrations are associated with identified SWMUs.

Localized surface SWMUs are a surface disposal site (SWMU 33-010[f]), active storage areas (SWMUs 33-011[a,d,e], 33-012[a], and 33-013), and the incinerator (SWMU 33-015). Additional areas will be included as they are identified by the preliminary electromagnetic, magnetic, or radiation surveys. Reconnaissance sampling, biased by field indications (from the geophysical or radiation surveys, or by visual indications such as staining) whenever possible, will be carried out at each of these sites.

Each sample maximum will be compared with action levels to determine whether there are localized problems associated with any of the SWMUs. This information will be used to determine whether further characterization or remediation is required at individual SWMUs.

2) To investigate the transport of contaminants along stream channels.

Phase I sampling of channel sediments is a combination of reconnaissance *sampling at outfalls and extended sampling down the main drainage.*

Channel sediments will be sampled both in first-order channels below Main Site outfalls (SWMUs 33-002[d,e], SWMU 33-004[h,i], SWMU 33-005 [a,b], and SWMU 33-016) and down the second-order channel to the east for a distance of about 1/2 mile. (The second-order channel draining the TA-33-21 sites is considered in Sections 3.2.2.10 and 4.2.3.2, in conjunction with Area 6.) The target population for these samples consists of mobile sediments in these channels.

Data will be summarized by estimating average concentrations of contaminants as a function of distance from Main Site sources. This information will be used both to determine if concentrations of contaminants above action levels exist in channel sediments and to evaluate the importance of surface runoff as a transport pathway.

3) To estimate the average concentrations and trends with distance from the Main Site sources of contaminants in surface media.

In Phase I, data will be collected to estimate the range of contaminant concentrations in surface soil and tuff, and to investigate the existence of a plume (i.e., of a trend with distance) from Main Site sources. Sampling will be more dense near these sources but will also extend to the northwest, east, southeast, and south. The target population includes surface soil and exposed tuff, except sediments in channels and soil in areas associated with identified SWMUs and other localities identified by the field surveys, which are discussed separately above.

Data will be summarized by estimating spatial trends and local average concentrations as a function of distance from the sources. This will provide both a value to which localized SWMU data can be compared as well as information for a baseline risk assessment. In view of the proximity of current, onsite workers, the sample size should provide high probability of detecting contamination above action levels, even if it affects as little as 5 or 10% of the site.

4) To estimate spatial variability and predictability of contaminant concentrations.

Field duplicates and samples identified in the sampling and analysis plan as "neighbors" will provide additional data needed to estimate sampling variability; a prerequisite to designing efficient sampling plans for Phase II if more extensive surface investigations are required. Field duplicates will be provided at rates prescribed by the QAPjP for quality control purposes. Additional "neighbors" will be provided at comparable rates.

3.2.6.3 Subsurface Structures

Subsurface structures associated with Main Site SWMUs include:

- two sumps at MDA-K (SWMU 33-002[b,c], one at TA-33-23 (SWMU 33-016);
- the active septic system at MDA-K (septic tank, siphon tank,

drain field, and associated piping), SWMU 33-002(a); and,

- the active septic system serving the remainder of the site (septic tank, sampling box, two seepage pits, and a disconnected drain field), SWMU 33-004(a).

Phase I investigations will provide information needed to initiate voluntary corrective actions, as outlined in Section 3.2.5.1.

Levels of contamination will be measured on samples representative of the fluid (if any) and sludge in the structures. Holes will be drilled to the tuff/fill interface next to each structure to provide samples to determine whether a vapor phase plume is present. These data will be used to decide whether or not these structures are a continuing source of contamination, to determine the level of worker protection required during removal (if indicated), and to identify contaminants that can be used as indicators guiding removal of underlying soil and tuff.

Gamma logs to detect radioactivity in the seepage pits will be run down their central pipes. Levels of contamination will be measured on fluid and gravel samples from the base of the pipe. If contamination above levels for permitted discharges is found, migration will be investigated by drilling in the tuff near and below the seepage pits during RFI Phase 2.

Drill holes through the drain field at MDA-K and the disconnected drain field for septic tank TA-33-31 will provide samples to be measured for soil contamination and contamination of underlying materials. Holes may be sited on the basis of electromagnetic and radiation survey data or at points close to the top of the fields, to obtain samples that are expected to represent the largest concentrations present. Observations above action levels will lead to a baseline risk assessment, which may entail collection of additional data during Phase II investigations.

3.2.6.4 Subsurface Investigations at TA–33–21 Site

Phase I investigations at SWMU 33-005 will provide data for a baseline risk assessment.

Drill holes through the sites of the former leach field and septic tank will provide samples to be measured for soil contamination. Holes may be sited on the basis of the preliminary radiation survey if any radioactive locations are found. Data will be summarized by sample means of contaminant concentrations.

3.2.6.5 Subsurface Investigations at MDA-K

Phase 1 investigations below MDA-K will provide additional information on the transport of contaminants below the subsurface structures in MDA-K. Three boreholes will be drilled to provide information on the vertical and lateral extent of the tritium-bearing plume beneath MDA-K. The core will be screened for moisture and radioactivity, and sampled. The laboratory data will be compared with existing information which indicates that only tritium is being transported downward.

If no contaminants are detected which are long-lived relative to the rate of travel of the plume and its expected time of arrival at the first underlying aquifer (perched or regional), no remediation will be necessary. Other alternatives were outlined in Section 3.2.5.1 and evaluation of their potential effectiveness may require additional drilling and sampling, both to determine the extent of contamination more precisely and to provide data on local hydrogeologic properties controlling transport.

3.2.7 Field Sampling and Analysis Plans

Sampling and analysis plans for Main Site are presented in Chapter 4, Section 4.2.

3.3 Area 6

All SWMUs located at Area 6 are listed in Table 3-4. The location for each SWMU at Area 6 is shown in Fig. 3-11.

TABLE 3-4

SOLID WASTE MANAGEMENT UNITS (SWMUs) LOCATED AT TA-33, AREA 6

SWMU or AOC	Associated Type	Structure #	Chapter 3 Discussion: Description	Data	DQOs	Phase 1 Approach
33-004(d)	septic system	TA-33-121	3.3.2.2		3.3.6.3	VCA
	buried outfall		3.3.2.2		3.3.6.2	reconn
33-004(g)	outfall	TA-33-16	3.3.2.3		3.3.6.2	reconn
33-007(c)	firing site		3.3.2.1		3.3.6.2	reconn
	drainage		3.3.1		3.3.6.2	reconn
33-009	surface disposal		3.3.2.4	3.3.4	3.3.6.2	reconn
33-010(e)	surface disposal		3.3.2.5		3.3.6.2	reconn

3.3.1 Site Description

This small site lies about 400 ft west of the entrance gate to TA-33. The site is level and fenced on three sides; the southwest corner is unfenced. The eastern part of the site is paved. The western section lies within an excavated cinder cone. At the western edge a steep 90-ft slope drops down to a small tributary of Chaquehui Canyon. Another small tributary drains the eastern part of the site, below the road from the entrance gate to TA-33.

Two small wooden buildings (TA-33-1 and TA-33-2) and a steel building (TA-33-16) occupy the the eastern section of Area 6. Most natural vegetation has been scraped away and invasive shrubs and grasses cover unpaved areas.

3.3.2 SWMU Descriptions and Histories

This section discusses the physical description, historical use, present use, and identifies potential contaminants for all SWMUs at Area 6.

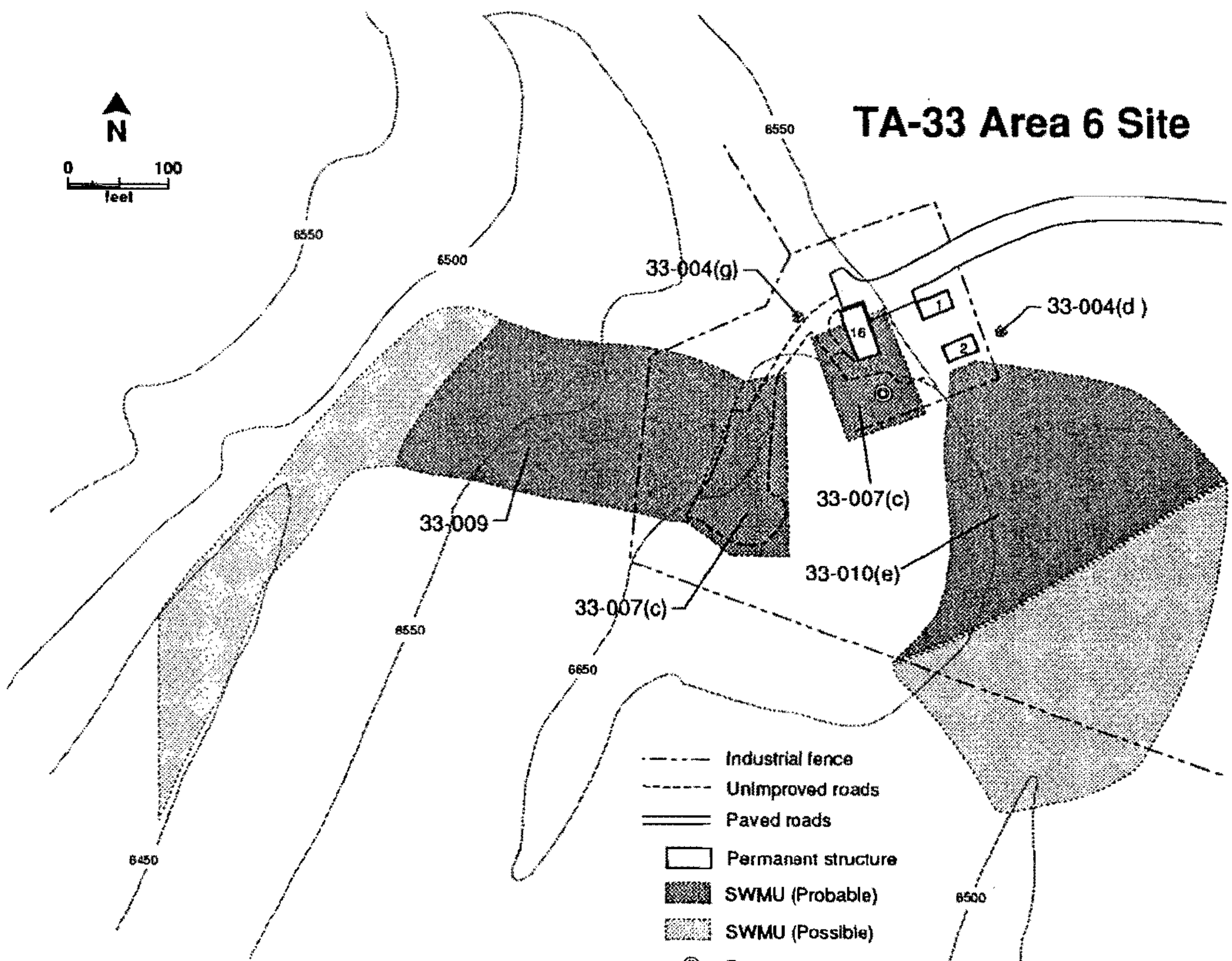

Fig. 3-11. Area 6 Site.

3.3.2.1 SWMU 33-007(c) Firing Areas

Three buildings remain at Area 6: TA-33-1, TA-33-2, and TA-33-16.

3.3.2.1.1 Physical Description

Two firing areas were used at Area 6. The first is south of the principal structure at Area 6, TA-33-16. Immediately to the west of TA-33-16 is a shot pad on which a large-bore gun was mounted. It is a 6 x 10-ft concrete pad surrounded by a concrete apron. South of TA-33-16 catcher boxes were built of timbers in two sections, each about 6 ft on a side. The catcher boxes were filled with soil, wood chips, and vermiculite. The timbers are rotting and disintegrating but still in place.

Area 6 was constructed adjacent to a basaltic cinder cone. The cone was excavated to provide space for a second shot pad. This shot pad lies 100 ft southwest of TA-33-16. Two wooden barricades, constructed of 8 x 8-in. timbers, lie to the north and east of the shot pad. The shot pad and barricades are still in place.

3.3.2.1.2 Historical Use and Potential Contaminants

Area 6 was developed in 1948 for initiator experiments. TA-33-16 (originally TA-33-6) was completed in March 1949. It first housed an air gun, then electronic equipment used to measure neutron production in "gun-type" initiators containing beryllium and polonium-210. Military guns, of 2 to 5 in. bore were also stationed on concrete pads around TA-33-16. Projectiles were fired at targets placed in front of barricades. Targets may have contained uranium and beryllium. Compressed air or high explosives were used to fire the guns. Projectiles often cracked open, contaminating the pads and surrounding area with polonium-210. Firing crews repeatedly painted contaminated parts of the guns and pad with lead paint to reduce surface contamination (Hoard 1990, 02-022). Shots were discontinued at Area 6 by 1955.

In 1956 TA-33-16 was used to make and machine laminating materials containing barium, titanium, lead, and zinc using epoxy resins. The building was supplied with an exhaust blower and stack (Milford 1956, 02-023). In 1957 it was noted that toxic fumes were being blown from the building (Hyatt 1957, 02-024). Fans were installed to protect personnel. TA-33-1, located 50 ft east of TA-33-16, housed experiments to make niobate crystals (Schulte 1958, 02-025). TA-33-2 was a shop. There is no record of hazardous material being used in this building.

In summary, potential contaminants include barium, lead, and projectiles containing uranium, beryllium, polonium-210, other metals, and high explosives.

3.3.2.1.3 Present Use

Area 6 has been decommissioned as a firing site. The cinder cone has been further excavated since gun weapon testing ceased. An aluminum tower, TA-33-192, used for atmospheric physics monitoring by the Atmospheric Sciences Group, SST-7, now occupies the area within the cinder cone. The buildings are empty.

3.3.2.2 SWMU 33-004(d) Septic Tank and Outfall

A 500-gal. septic tank lies 50 ft southeast of TA-33-1, a wooden laboratory building with inner walls containing asbestos. A small drain field lies 20 ft east of the tank; a 4-in. PVC pipe drains to an outfall in a side wash of Chaquehui Canyon. This outfall is buried.

TA-33-1 was originally built at East Site in 1948 and moved to its present site in 1948 or 1949. Work in the laboratory supported tests at Area 6.

The building is empty but the septic tank is still connected to utilities and is considered active.

Contaminants from TA-33-1 may include volatile organics and photoprocessing chemicals.

3.3.2.3 SWMU 33-004(g) TA-33-16 Outfall

A drain line from TA-33-16 runs 45 ft west to an outfall near the rim of a tributary of Chaquehui Canyon. The outfall itself is buried under a thicket of chamisa near the edge of the asphalt paving. Activities in the building are detailed in Section 3.3.2.1.1.

At present the building is empty.

In summary, this outfall may have received high explosives, uranium, beryllium, barium, lead, titanium, zinc, and organic compounds from TA-33-16.

3.3.2.4 SWMU 33-009 Surface Disposal

This disposal site lies along the west side of Area 6. It is 100 ft long and 75 ft wide with debris tailing 80 ft into the adjacent tributary of Chaquehui Canyon. Intermingled in the loose cinders are bits of operational debris.

Guns used at the firing pads were cleaned in preparation for the next shot and debris was bulldozed into the adjacent canyon (H-Division 1954, 02-026). In the 1960s uranium chips from machine shop TA-33-113 were disposed of at this site (Ahlquist 1983, 02-006). In the fall of 1967, this area was designated as a disposal site for defective capacitors from several Physics Division groups (Reider 1967, 02-027). About 100 capacitors from Project Sherwood were stored at this site. The capacitors remained at Area 6 until the site was cleaned in 1974.

When the site was cleaned in December 1974, several truck loads of material were taken to MDA-G at TA-54 (Bacastow 1974, 02-028). The slope was surveyed for radiation, but no counts above background were found (Smith 1974, 02-029).

In summary, potential contaminants include shot pad debris containing uranium, beryllium, and explosives residues; uranium-machining chips, and PCBs from spent electrical capacitors.

3.3.2.5 SWMU 33-010(e) Surface Disposal

SWMU 33-010(e) is located southeast of the Area 6 fence. Although this SWMU was reported in the SWMU Report, field visits to Area 6 have not been successful in locating any evidence of it. A conversation on December 14, 1990 with former site employee Harlow Russ indicated that a disposal site for firing debris might exist in the area (Hoard 1990, 02-022).

3.3.3 Conceptual Exposure Model

All of the activities at Area 6 that were primary sources of contamination for the SWMUs described in the preceding section have ceased. Residual contamination may remain in the septic system, in surface soils around the firing sites or at the surface disposal area, or in sediments in channels draining the area. Projectiles may remain in the berms.

Contaminants could be released from the septic tank or subsurface material by leaking or by infiltration and leaching. Contaminated surface soil or sediments might be suspended by wind or in surface runoff. Buried projectiles could be exposed and transported by erosion and mass wasting.

While all three of the major exposure scenarios outlined in Section 3.1.2 are applicable to Area 6, current use of the site is intermittent and casual. Future recreational use of the area may be the most restrictive of the three scenarios.

The Laboratory currently intends eventual transfer of DOE property to another government agency, such as Bandelier National Monument. Recreational use and limited construction might then occur on the site, but residential and agricultural use is not anticipated.

3.3.4 Review of Existing Data

The only quantitative information from previous Area 6 surveys is reported in a memo on the radiation survey at the Area 6 disposal area (SWMU 33-009) following its cleanup in 1974 (Smith 1974, 02-029). A radiation survey using a Ludlum Model 12-S gamma detection instrument, conducted on a 9.84 x 16.4-ft grid across the slope reported observations in the background range of 15 to 30 µR/hr. There are no prior estimates of contaminant variability except those based on area-wide and regional observations, generally of radionuclides and at background levels.

3.3.5 Decisions and Investigation Objectives

3.3.5.1 Potential Response Actions

Voluntary corrective action is proposed for the septic system and drain lines. Removal of the empty buildings, barricades, interior fences, and the debris at the bottom of the west slope of the cinder cone may also be recommended to comply with Laboratory ES&H goals for the disposal of surplus structures. The remainder of the site will be cleaned as required to meet risk-based cleanup standards. These remediation activities will be coordinated with D&D activities for this area.

3.3.5.2 Proposed Phase I Investigations

Because there is almost no information about the secondary sources of contamination at Area 6, the data to be collected in the initial phase of the investigation will be used to test the hypothesis that one or more sources of contamination is present.

Reconnaissance sampling will be carried out throughout the site, and down the two short drainages to the west and east of the cinder cone. A VCA approach to sampling will be used for the septic system.

3.3.5.3 Potential Phase II Investigations

More extensive Phase II investigations may be triggered by observations above action levels in Phase I. Phase II data collection activities will be designed to characterize the extent of contamination in order to complete a baseline risk analysis for the site and to evaluate remedial alternatives. These potential Phase II activities include:

Additional sampling may be required to determine the extent of a plume, if any, beneath septic tank TA-33-121.

However, it is anticipated that a corrective measure for this system can be designed on the basis of Phase I information. Field-screening will be used during excavation to determine the extent of contaminated substrata, and samples will be submitted for laboratory analysis to confirm that applicable cleanup standards have been met.

Additional sampling (surface samples and possibly some subsurface sampling) may be required to determine the extent of residual contamination in the Area 6 disposal sites.

Additional sampling (additional trenches or drill holes) may be required to determine the spatial and size distributions of remaining projectiles and the volume of contaminated soil in the berm. An alternative for the berm is to forego further characterization in favor of a corrective measure that would excavate the berm, extract remaining projectiles, and leave the soil, if uncontaminated, at the site.

Additional sampling to delineate surface areas requiring remediation, including firing areas, disposal sites, outfalls, and channels. An alternative for small areas of contamination is removal of surface soil based on field survey or screening measurements, followed by the collection of additional samples for laboratory analysis to confirm that cleanup standards have been met.

3.3.6 Phase I Data Quality Objectives

3.3.6.1 Preliminary Activities

Preliminary activities will provide additional information needed to complete the design of sampling plans.

3.3.6.1.1 Land Survey

A land survey is needed to establish grids for electromagnetic and magnetic surveys, a radiation survey, and surface sampling. All points will be recorded in the New Mexico State Planar Coordinate System and flagged. This land survey will be used in conjunction with 1991 aerial orthophotographs and 2-ft contour maps at appropriate scales to establish the grids.

The outfall from TA-33-16 needs to be located in the field, together with its drainage channel if it is still distinguishable. Its location will be recorded in the New Mexico State Planar Coordinate System.

The area including the buried outfall from septic tank TA-33-121 needs to be identified as accurately as possible and marked in the field.

3.3.6.1.2 Channel Mapping

Aerial orthophotographs and 2-ft. contour topographic maps will be used to map the channels carrying surface runoff to both east and west in order to locate sediment catchments suitable for sampling. The locations of such catchments will be recorded in the New Mexico State Planar Coordinate System and flagged along first-order channels to the points where they join one of the second-order tributaries to Chaquehui Canyon. Additional catchments will be surveyed and marked along these second-order channels. Identified locations should be sufficiently numerous to trace the courses of the channels and to provide a representative subset of sediments between the Area 6 sources and the bottom of Chaquehui Canyon.

3.3.6.1.3 Geophysical Surveys

Geophysical surveys, electromagnetic and magnetic, will be carried out over the berms to locate projectiles.

3.3.6.1.4 Radiation Survey

A surface radiation survey will be carried out to locate radioactive contamination within the firing sites and on the west slope of the cinder cone. (Following the 1974 cleanup of the disposal site, no elevated levels of radioactivity were reported, but it is not clear that this survey extended to the tributary channel.) On the east slope of the cone, the survey may help to determine the location of the former surface disposal area, SWMU 33-010(e). This survey information will be used to delineate areas of locally-elevated activity requiring more intensive sampling.

The radiation survey will be carried down the two tributary channels to the main Chaquehui Canyon channel to provide preliminary indications of contaminant trend with distance from the site. Observations will be made at mapped locations where sediments collect.

3.3.6.2 Surface Investigations

Surface sampling for Area 6 will include both surface soils from the mesa top and surrounding slopes and channel sediments. The integrated surface sampling plan at Area 6 will provide data to address several objectives.

1) To estimate the average concentrations of contaminants around the gun firing areas.

Broken projectiles or projectiles that strayed from their targets spread contamination around the gun firing sites. While large pieces were usually retrieved, and parts of the site have since been excavated, residual soil contamination may remain. Phase I will provide samples from the target population of soils around the shot pads and on the slopes behind target areas. The observations will be compared with action levels. A moderately extensive reconnaissance survey will be needed to cover the site, which includes two or more former firing areas.

2) To determine whether local areas of elevated contaminant concentration are associated with other identified SWMUs.

SWMUs that might have contributed to localized surface contamination are two former surface disposal areas SWMU 33-009 and SWMU 33-010(e). Additional areas will be included as they are identified by the preliminary radiation surveys. Reconnaissance sampling, biased by field indications wherever possible, will be carried out at each of these sites. Each sample maximum will be compared with action levels to determine whether there are localized problems associated with any of the SWMUs. This information will be used to decide whether further characterization or remediation is required at individual SWMUs.

3) To investigate the transport of contaminants along stream channels.

Phase I sampling of channel sediments is a combination of reconnaissance sampling at outfalls (SWMUs 33-004[d] and SWMU 33-004[g]) and extensive sampling down the main drainages.

The target population for these samples consists of mobile sediments in first and second-order channels down to the bottom of Chaquehui Canyon (a distance of about 1/4 mile). The data will be summarized by estimating concentration as a function of distance from the Area 6 and the west road sources. This information will be used both to determine if concentrations of contaminants above action levels exist in channel sediments and to evaluate the importance of surface runoff as a transport pathway.

4) To estimate spatial variability and predictability of contaminant concentrations.

Field duplicates and samples identified in the sampling and analysis plan as "neighbors" will provide the additional data needed to estimate sampling variability, a prerequisite to designing efficient sampling plans for Phase II if more extensive surface investigations are required.

3.3.6.3 Subsurface Investigations of the Septic Tank and Drain Field

Phase I investigation of the septic system serving TA-33-1 will provide information needed to initiate a voluntary corrective action, as outlined in Section 3.3.5.1.

Levels of contamination will be measured on samples representative of the fluid (if any) and sludge in the septic tank TA-33-121. Drill holes next to the tank and through the buried outfall will provide soil samples to be measured for contamination. These data will be used to decide whether the tank or underlying materials are a continuing source of contamination, to determine the level of worker protection required during removal (if indicated), and to identify contaminants that can be used as indicators guiding removal of underlying soil and tuff.

3.3.6.4 Subsurface Investigations at the TA-33-16 Berm

Reconnaissance sampling at the TA-33-16 berm will provide information on soil contamination and buried projectiles.

A trench through the berm will provide material to be sifted for buried projectiles. This trench will be dug directly opposite the south-facing door of TA-33-16 in order to maximize the probability of finding projectiles or contamination. Soil samples will be collected from the exposed sides of the trench. These data, together with the results of the geophysical surveys (Section 3.2.6.1.3), will be used to estimate the quantity and composition of projectiles and the level of soil contamination in the berm. Soil contamination will be compared with action levels, and a conservative scenario will be developed to evaluate the risk from buried projectiles.

3.3.7 Field Sampling Plans

Sampling and analysis plans for Area 6 are presented in Chapter 4, Section 4.3.

3.4 South Site

All SWMUs located at the South Site are listed in Table 3-5. The location for each SWMU at South Site is shown in Fig. 3-12.

3.4.1 Site Description

South Site is located about 2.8 miles south of the entrance gate to TA-33. The site lies on a spur of the mesa along the north rim of Chaquehui Canyon. It occupies a bowl-shaped depression about 600 ft in diameter. The northeast rim of the bowl has been artificially elevated by construction of a horseshoe-shaped berm. The site is drained by a shallow arroyo that exits at the canyon rim at the southern edge of the bowl. Most native vegetation has been removed. Except for bedrock outcrops, unpaved areas are covered with invasive shrubs, primarily chamisa. The site drains to the south into Chaquehui Canyon.

TABLE 3-5

SOLID WASTE MANAGEMENT UNITS (SWMUs) LOCATED AT TA-33, SOUTH SITE

SWMU or AOC	Associated Type	Structure #	Chapter 3 Discussion: Description	Data	DQOs	Phase 1 Approach
33-001(a)	pit	Pit #1	3.4.2.1	3.4.4	3.4.6.2	environ
33-001(b)	pit	Pit #2	3.4.2.1	3.4.4	3.4.6.2	environ
33-001(c)	pit	Pit #3	3.4.2.1	3.4.4	3.4.6.2	environ
33-001(d)	pit	Pit #4	3.4.2.1	3.4.4	3.4.6.2	environ
33-001(e)	shot chamber	TA-33-29	3.4.2.1	3.4.4	3.4.6.2	environ
33-004(b)	septic system	TA-33-33	3.4.2.2		3.4.6.4	VCA
	outfall		3.4.2.2		3.4.6.3	reconn
33-004(j)	outfall	TA-33-26	3.4.2.3	3.4.4	3.4.6.3	reconn
33-006(a)	shot pad	TA-33-26	3.4.2.4		3.4.6.3	extent
	drainage		3.4.1		3.4.6.3	extent
33-007(b)	firing areas	TA-33-26,85	3.4.2.5		3.4.6.3	reconn
	berms	TA-33-43,63	3.4.2.5		3.4.6.5	reconn
33-008(a)	landfill	TA-33-43	3.4.2.10		3.4.6.6	reconn
33-010(c)	canyon-side disposal		3.4.2.7	3.4.4	3.4.6.6	reconn
33-010(g)	canyon-side disposal		3.4.2.8		3.4.6.3	reconn
33-010(h)	surface disposal	TA-33-43	3.4.2.6		3.4.6.6	reconn
33-011(c)	blivit storage	TA-33-63	3.4.2.11		3.4.6.3	reconn
33-014	burn site		3.4.2.9		3.4.6.3	reconn

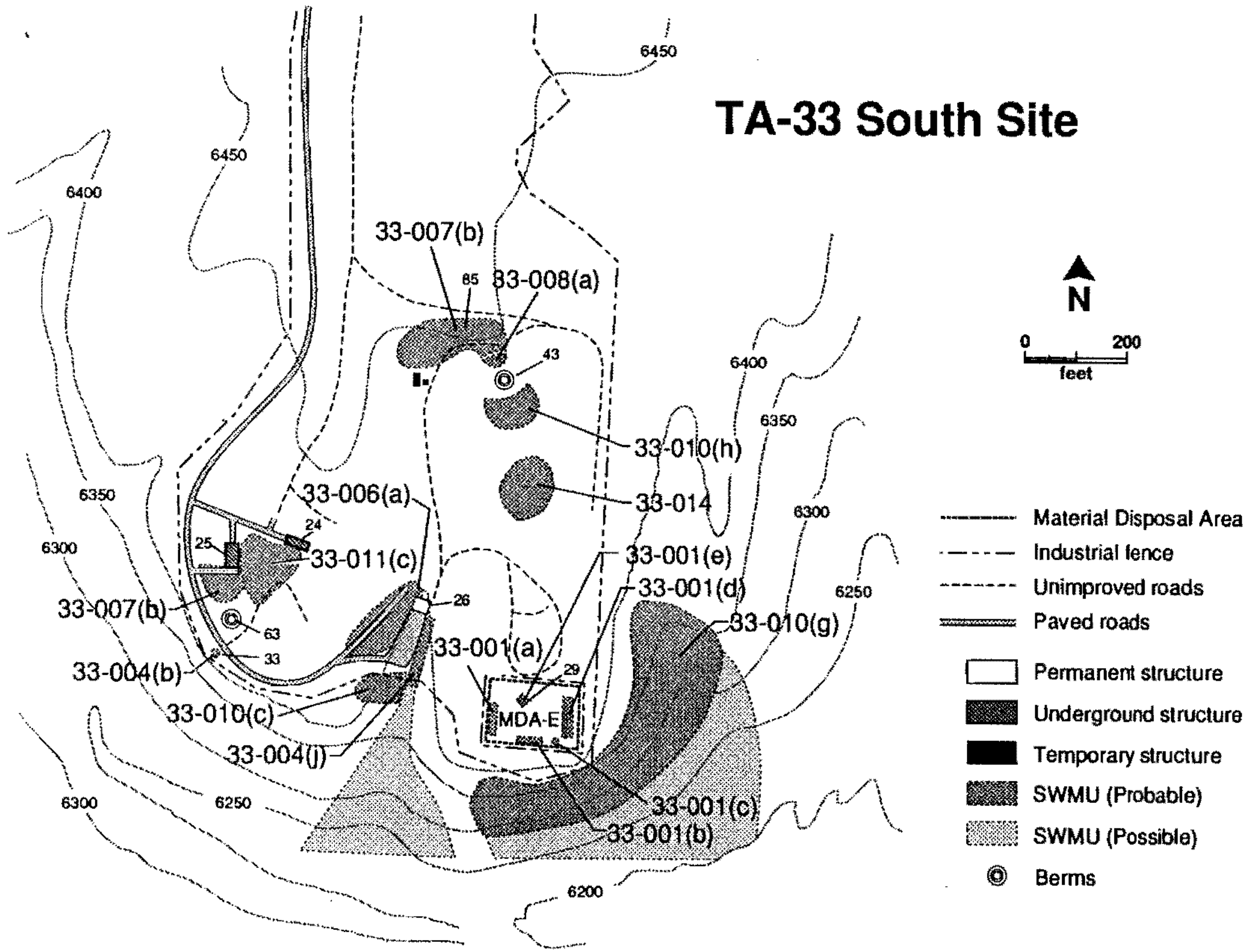

Fig. 3-12. South Site.

Three bunkered buildings TA-33-24, TA-33-25, and TA-33-26 occupy the site. In addition to the large horseshoe-shaped berm, a smaller berm is located just east of TA-33-25. An instrumented tower is located in a level area about 100 ft in diameter in the northern section of the bowl. In the southeastern quadrant is the fenced area containing MDA-E.

3.4.2 SWMU Descriptions and Histories

This section discusses the physical descriptions, historical use, present use, and identifies potential contaminants for all SWMUs at South Site.

3.4.2.1 SWMU 33-001(a-e) Material Disposal Area E (MDA-E)

3.4.2.1.1 Physical Description

MDA-E lies on the mesa top and is bounded by Chaquehui Canyon and one of its tributaries. Chaquehui Canyon, in turn, drains into the Rio Grande. MDA-E itself is relatively level, although its southern boundary is only about 50 to 60 ft from the cliff face. The MDA is surrounded by an 8 ft fence. The surface rock has been highly disturbed by the construction of an experimental chamber and six waste pits. There are piles of soil and broken tuff throughout the fenced area.

3.4.2.1.2 Historical Use and Potential Contaminants

Work began in November 1949 on the construction of TA-33-29 (underground Chamber #3). It was completed in February 1950. The chamber shaft was a 6 x 8 x 48 ft deep, with an octagonal test chamber to one side. This chamber was 14 ft in diameter, 11 ft high, and had 2-ft-thick concrete walls, floor, and ceiling. Testing in Chamber #3, SWMU 33-001(e), involved explosives, beryllium, and tungsten. This underground structure, which lies within the fenced area, collapsed during an experiment in April 1950. The residuals are still contained in the chamber.

The area around Chamber #3 was developed as a disposal area. It contains six pits used for disposal of varied items including spent projectiles, uranium components, beryllium, and shot debris. The contents of two of these pits are unknown. They may or may not have been used. Pits 1 to 4 contain materials contaminated with polonium-210 (now decayed), beryllium, and uranium. Pit 3 may also contain a can of beryllium dust immersed in kerosene; the compositions of the cans are not specified (Ahlquist 1983, 02-006). Use as a disposal area was discontinued in 1963. That year the pits were filled and compacted to mitigate erosion and infiltration of surface water (Zia Job Order #165991, 02-030). The area has been fenced and is designated Material Disposal Area E (MDA-E).

Ahlquist (1983, 02-006) reported that two trenches dug north of MDA-E were used from 1949 through 1973. These trenches, presently unlocated, are reported to contain uranium.

3.4.2.1.3 Present Status

MDA-E is securely fenced and monitored regularly by LANL Environmental Group (EM-8) surveillance.

3.4.2.2 SWMU 33-004(b) Septic Tank TA-33-33

A 6-in. steel pipe routes waste from TA-33-24, 300 ft south to a 730-gal. septic tank (TA-33-33). A similar pipe, 35 ft long, routes effluent from the tank to an outfall on the rim of Chaquehui Canyon. Two additional drain lines run within the same trench from the building to the canyon, bypassing the septic system.

TA-33-24 was completed in June 1950. It housed electronics in support of TA-33-26 and its firing pad, located 250 ft to the southeast. There is no record of any incident involving hazardous or radioactive material in TA-33-24, though photo developing may have taken place.

Presently, TA-33-24 is used for storage. The septic system is connected to utilities and is considered active. It has a permit, NMED LA-33.

3.4.2.3 SWMU 33-004(j) Outfall from TA-33-26

A 4-in. drain line exits TA-33-26, runs 75 ft southeast, then discharges into an open channel cut into the tuff. A surface runoff culvert also empties into this channel, which converges to an arroyo draining to Chaquehui Canyon (see Section 3.4.2.4).

TA-33-26 stored electronic devices to detonate initiators. There is no record of hazardous material being used in this structure.

TA-33-26 is presently empty.

3.4.2.4 SWMU 33-006(a) Shot Pad

South Site lies in a depression about 600 ft in diameter. The south end of this area drains to Chaquehui Canyon through a short drainage channel. The shot pad atop TA-33-26 is about 25 ft in diameter and is located within this valley.

The buildings at South Site were completed and testing began in June 1950. Structure TA-33-26 was the x-unit vault containing the electronic equipment to detonate implosion test devices. Uranium shells containing beryllium were used in implosion tests involving from 275 to 5 000 lbs of high explosives. The devices were often put into copper cans for electrical shielding (Hoard 1990, 02-022). The shots spread finely divided shot debris and shrapnel over the entire South Site; hence the entire area, including the drainage channel, may be considered SWMU 33-006(a). The shot pad is no longer used.

3.4.2.5 SWMU 33-007(b) Firing Area

SWMU 33-007(b) consists of two gun-firing areas at South Site. One area lies 600 ft north of TA-33-26, SWMU 33-006(a). This firing area consisted of the 6-ft square concrete pad of gun mount TA-33-85; a 125-ft-diameter half-circle berm, TA-33-43; and an area west of the berm used to test a free-recoil weapon. This site was excavated into bedrock tuff during construction, leaving a 10-ft vertical embankment at its north perimeter. The other gun-firing area of SWMU 33-007(b) is located west of TA-33-26 and included a gun building (TA-33-25) and a barricade (TA-33-63).

TA-33-43 was built in August 1950 and TA-33-85 was completed in June 1952. Shots fired here contained uranium, beryllium, some titanium, and tritium, all encased in thin steel shells. Penetrator tests were performed with a free-recoil weapon firing projectiles into the cliff (Ahlquist 1983, 02-006). Guns of 2-4 in. bore located in TA-33-25 fired projectiles south into TA-33-63. These projectiles contained uranium, beryllium, and tungsten. It is not recorded that any of these projectiles broke up and spread contamination in the area. It is not known how many of these projectiles were recovered.

Activities at South Site were discontinued in the late 1950s. The firing area is inactive. Group SST-7 presently maintains a tower, TA-33-203, erected in 1987 for atmospheric physics measurements in a level area 450-ft north of TA-33-26. Trailers TA-33-201 and TA-33-202 are associated with the tower.

3.4.2.6 SWMU 33-010(h) Surface Disposal

SWMU 33-010(h) occupies the northeast wedge within the bowl-shaped depression at South Site.

This surface disposal area was observed during a 1987 ER Program site reconnaissance south of TA-33-43 where discarded materials were scattered over the mesa surface. The OU 1122 team noted that the area appears to be covered with a layer of soil of unknown depth.

3.4.2.7 SWMU 33-010(c) Surface Disposal

The debris pile, SWMU 33-010(c), lies due south of TA-33-26 adjacent to the asphalt road and parking area. It is on a ridge rising about 10 ft higher than the vault. The west side of the debris pile slopes steeply into the small canyon draining South Site.

Debris from the shot pad atop TA-33-26 was quickly scraped away to clean the area for the next shot. Surface disposal area, SWMU 33-010(c), was probably the destination of the debris. Expected contaminants are uranium, beryllium, metals, and high explosives.

Surface disposal pile SWMU 33-010(c) was abandoned when activities ceased at the shot pad.

3.4.2.8 SWMU 33-010(g) Canyon-side Disposal

The debris of SWMU 33-010(g) is scattered on the rim and upper walls of Chaquehui Canyon east and south of MDA-E. Some cables and burned wood fragments are found in the disturbed area. The canyon is about 200 ft deep at this point, with a 40-ft cliff at the rim. SWMU 33-010(g) overlooks the confluence of main Chaquehui Canyon with a side canyon coming in from the northwest. A three-strand barbed wire fence runs along the east flank of the unimproved road adjacent to MDA-E, separating SWMU 33-010(g) from the rest of South Site.

Much of the debris appears to have originated from clearing the site. Contaminants from site activities could be uranium, beryllium, metals, and high explosives.

3.4.2.9 SWMU 33-014 Burning Pit

The burning pit is not a pit. It lies on the crest of the low ridge on which MDA-E is located. It is about 300 ft north of the fence surrounding MDA-E. The area has been scraped to bedrock, some parts of which show blackened sections from the burning.

Geophysical surveys conducted in the area of the suspected burning pit did not indicate the presence of a pit.

The burning pit was probably established in 1950 when South Site was built. Various types of materials were burned there including: whole buildings, timbers and sawdust used in catcher boxes, and black powder. These materials may have been contaminated with uranium, beryllium, propellant powders, and high explosives (LANL 1990, 0145).

The burning pit is presently inactive.

3.4.2.10 SWMU 33-008(a) Landfill

The berm, TA-33-43, is about 80 ft in inner diameter and 20 ft high. The landfill fills about half the space to a depth of 10 ft. Buried debris has been exposed on the surface.

The landfill was established in August 1984 as a disposal site for a major cleanup of the firing sites at TA-33. All debris was checked for radioactivity; radioactive material was sent to TA-54, MDA-G. Materials buried in the landfills may include timbers contaminated with small amounts of uranium, lead, beryllium, and high explosives.

3.4.2.11 SWMU 33-011(c) Blivit Storage Area

The blivit area lies between TA-33-63, TA-33-25, and TA-33-24. The blivit area is highly disturbed; in places it was gravelled. Remains of fencing line the boundaries of the SWMU.

Tritium reservoirs, called blivits, underwent acceleration tests at TA-33. After the tests, leaking blivits were set in this fenced storage area and allowed to discharge (Ahlquist 1983, 02-006). The physical form of the tritium was as a gas (Hoard 1990, 02-022). This practice was discontinued by 1972.

3.4.3 Conceptual Exposure Model

All of the historical activities at South Site that were primary sources of contamination for the SWMUs described in the preceding section have ceased. Residual contamination may remain in or beneath the septic system, in surface soils around the firing sites or at the canyon-side disposal areas, or in sediments in channels draining the area. Hazardous and radioactive materials are buried in MDA-E, and projectiles may remain in the berms. The shrapnel and debris which litters much of the area may be contaminated.

Contaminants might be released from the septic tank or subsurface material by excavation, by leaking, or by infiltration and leaching. Contaminated surface soil may be suspended by wind or surface runoff. Buried wastes, projectiles, and shrapnel could be exposed by erosion or landslide or transported downslope by mass wasting.

Although all three of the major exposure scenarios as outlined in Section 3.1.2 are applicable to South Site, current use of the site is intermittent and casual. Future recreational use of the area may be the most restrictive scenario, except for MDA-E where excavation during remediation or future construction could have serious impacts.

The disruption of MDA-E, by erosion or landslide, would end the isolation of hazardous materials buried there. This would increase, in some cases markedly, the source term for both the current and future land use scenarios.

The Laboratory currently intends continued institutional control over material disposal areas (MDAs) with eventual transfer of DOE property to another government agency, such as Bandelier National Monument. Recreational use and limited construction might then occur on the site, but residential and agricultural use is not anticipated.

3.4.4 Review of Existing Data

While some data for South Site can be found in several sources, most are poorly documented. Data on radioactive contamination has been collected on an irregular basis at MDA-E (SWMUs 33-001[a-e]) by the Laboratory Environmental Surveillance group (EM-8). These data, through 1984, are summarized in an unpublished draft (Mayfield et al. 1985, 02-031). In general, these surface data show no radioactive contaminants above background levels. The occasional elevated observations appear to be associated with uranium from shot pad implosion tests nearby.

The Weston study at TA-33 (LANL 1989, 02-020) collected data from several drill holes at MDA-E. These data suggest no subsurface migration of contaminants from MDA-E. Rather, elevated surface observations appear to be associated with shot pad implosion tests nearby or releases from the high-pressure tritium facility at Main Site.

Additional data have been collected on two different occasions at the shot pad (SWMU 33-006[a]) and the associated surface disposal area (SWMU 33-010[c]) and drainage (SWMU 33-004[j]). These unpublished and very poorly documented data do suggest elevated levels of radioactivity, depleted uranium, copper, and perhaps other metals in the vicinity of these sites (DOE 1989, 0450).

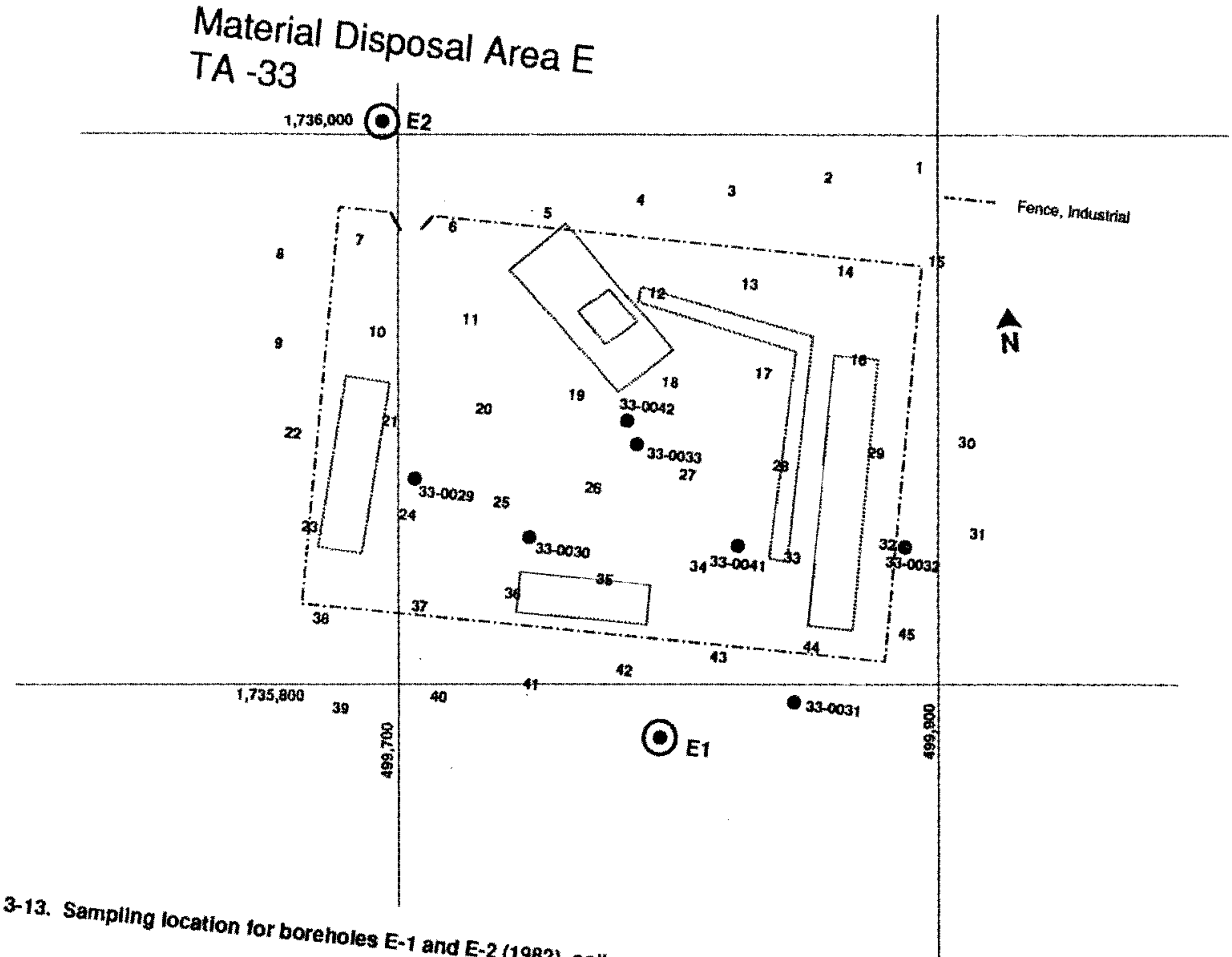

Fig. 3-13. Sampling location for boreholes E-1 and E-2 (1982), soil samples (1983), and Weston boreholes (1989).

There appears to be no information about the existing septic tank and adjoining drain lines from TA-33-24, for drain lines from TA-33-26, or for target areas and surrounding berms. Previous sampling has consisted of surface and subsurface samples in MDA-E and the area surrounding it.

3.4.4.1 Summary

The Weston study at TA-33 (LANL 1989, 02-020) collected data from several drill holes at MDA-E. These data suggest no subsurface migration of contaminants from MDA-E.

Additional data has been collected on two different occasions at the shot pad (SWMU 33-006[a]) and the associated surface disposal area (SWMU 33-010[c]) and drainage (SWMU 33-004[j]). These data are unpublished and poorly documented but they include observations above DOE guidelines and proposed Subpart S risk-based levels .

The following sections describe these results in more detail.

3.4.4.2 Surface Data at MDA-E

The most recent Environmental Surveillance Program study at MDA-E was conducted in 1983. Data were collected at 45 points on a randomly-oriented, 30-ft grid extending outside the fenced area (Fig. 3-13), with samples of soil being collected from the top 1 cm and from 1 cm to 10 cm. These samples were analyzed for tritium, cesium-137, and total uranium. Results are shown in Table 3-6.

Tritium measurements are slightly above background ranges of less than 10 pCi/ml. This agrees fairly well with the results of earlier surveys reported by Mayfield et al., although those authors note some temporal variability which they ascribe to variable releases from the high-pressure tritium facility (Mayfield et al. 1985, 02-031).

Uranium measurements, with the exception of one outlier at 39.2 ppm, are close to background concentrations of less than 5 ppm. Even the largest observation is small compared the DOE guideline (225 ppm). An earlier survey (1980) produced two samples from one location measuring 420 ppm (0-1 cm) and 200 ppm (1-10 cm) respectively, but this observation could not be repeated (Mayfield et al 1985, 02-031).

Finally, although cesium-137 measurements for the top 1 cm of soil ranged up to 4.56 pCi/g, above reported background ranges of less than 1.5 pCi/g, they are more than an order of magnitude below the DOE guideline (80 pCi/g) (DOE 1983, 02-039). In the 1 cm to 10 cm layer the maximum observation is 1.71 pCi/g. These observations are comparable to those made in 1977. The excess over background may come from the small amounts of cesium-137 used in some firing tests.

3.4.4.3 Subsurface Data at MDA-E

Prior to the Weston survey, the only subsurface data at MDA-E came from two holes drilled to about 50 ft in 1982 (holes E-1 and E-2 in Fig. 3-13). These observations are presented in Table 3-7. The 1989 Weston survey collected data from six additional holes (labeled 33-0029, -30, -31, -32, -33, and -41 in Fig. 3-13), which are

TABLE 3-6

DATA FROM SURFACE SOIL SAMPLES
1983 ENVIRONMENTAL SURVEY OF MDA-E

Location	Tritium (pCi/ml)		Uranium (ppm)		Cesium-137 (pCi/g)	
	(0-1 cm)	(1-10 cm)	(0-1 cm)	(1-10 cm)	(0-1 cm)	(1-10 cm)
1	10.3	17.0	6.43	4.35	0.78	0.20
2	13.3	39.0	5.49	4.86	1.09	0.36
3	28.0	26.0	6.60	3.44	1.20	0.20
4	24.0	28.0	4.72	7.31	1.23	0.67
5	51.0	115.0	10.88	7.99	1.12	0.65
6	35.0	74.0	5.49	2.94	0.89	0.03
7	33.0	67.0	3.33	3.50	0.49	0.11
8	63.0	19.0	11.58	7.40	1.86	0.63
9	45.0	20.0	6.82	39.20	0.17	1.71
10	19.0	48.0	6.37	2.92	1.10	0.01
11	22.0	7.2	6.35	4.15	1.98	0.32
12	8.7	19.0	3.42	4.71	2.08	0.36
13	11.0	29.0	5.62	4.75	1.15	0.25
14	28.0	24.0	4.84	4.69	1.75	0.16
15	5.8	6.4	6.43	4.36	1.20	0.06
16	23.0	12.6	4.60	4.64	2.55	0.31
17	25.0	17.2	4.26	4.47	0.92	0.21
18	23.0		3.45		0.54	
19	6.9		4.25		1.41	
20	18.2	12.0	4.53	3.30	0.55	0.03
21	10.8	15.6	7.94	4.13	3.71	0.46
22	13.1	17.3	7.87	4.45	1.45	0.10
23	20.0	25.0	3.80	2.43	0.70	0.06
24	33.0	13.3	8.13	4.43	1.26	0.44
25	24.0	26.0	3.68	7.18	1.01	0.26
26	29.0	26.0	1.88	2.10	0.69	0.15
27	8.7	15.3	3.88	3.53	0.64	0.56
28	34.0	15.5	4.40	4.31	0.41	0.01
29	31.0	39.0	4.54	4.35	0.65	0.03
30	23.0	10.5	5.07	4.13	1.32	0.30
31	11.9	13.8	4.82	4.02	1.58	0.05
32	28.0	31.0	4.43	4.43	0.53	0.12
33	48.0	48.0	4.05	4.44	0.64	0.07
34	16.3	27.0	4.13	3.03	0.09	0.50
35	12.2	11.8	4.08	4.36	0.46	0.10
36	51.0	9.3	3.11	4.21	0.92	0.18
37	11.7	13.6	4.69	3.28	1.29	0.16
38	61.0	19.0	3.34	2.81	0.89	0.03
39	10.4	21.0	4.42	4.96	4.56	0.98
41	10.3	16.2	4.22	3.94	2.45	0.18
42	15.8	6.2	4.56	3.98	1.20	0.07
43	7.7	7.5	4.15	3.66	0.44	0.00
44	12.4	10.8	7.48	6.14	2.23	0.49
45	29.0	42.0	5.10	4.91	0.78	0.15

summarized in Table 3-8.

Tritium observations from hole E-1, south of MDA-E very near the canyon rim, are in the range of 12 to 77 pCi/ml, but moisture contents were too low to make measurements in the lower half of this hole. Mayfield et al. are of the opinion that the accuracy of the existing measurements may be suspect because of the low moisture content of the rock near the mesa rim (Mayfield et al. 1985, 02-031). Measurements from E-2 are below 13.1 pCi/ml. Weston's 1989 observations are well within background ranges (under 8 pCi/ml) except for one observation at 110 pCi/ml that was not replicated by a second measurement at the same depth.

In 1982, only one cesium-137 observation was significantly above detection level, and this value of 0.46 pCi/g is within the background range. Weston reports no observations above detection level.

Total uranium ranges from values typical of Bandelier Tuff to 7 ppm below 35 ft in both 1982 holes. According to Mayfield et al., this could be as a result of "segregation of uranium in materials brought forth in sequential volcanic events" rather than to migration from the pits (Mayfield et al. 1985, 02-031). Weston's observations are uniformly below 5 ppm in all holes except hole 33 drilled near the chamber, TA-33-29, where one observation at 20 ppm is reported. Lead is also relatively high in this hole.

3.4.4.4 Other South Site Data

Other data from the vicinity of the South Site shot pad and the nearby landfill and drainage exist in nearly inaccessible locations.

A Phoswich survey performed in October 1985, shows observations 50% above background more than 348 ft from the shot pad (SWMU 006[a]) and up to five times background in the immediate neighborhood of the shot pad (Martinez 1985, 02-032). These observations are documented only on a sketch that indicates that all counts were taken for 100 seconds with a full window. "Background" was measured west of the road near septic tank TA-33-33.

"Environmental Problem 22" of the 1989 DOE Environmental Survey includes measurements on three composite samples taken from the base of the surface disposal area south of the shot pad (SWMU 33-010[c]) and three samples from the adjacent drainage below the outfall, (SWMU 33-004[b]) (DOE 1989, 0450). All samples were collected from the top 6 in. of soil. Results show very large excess amounts of depleted uranium (uranium-238) contributing to total uranium measurements from 172 to 380 ppm at the disposal area and 55 to 150 ppm in the drainage. Reported copper concentrations are also extremely high (thousands of parts per million compared to background below 20 ppm), and zinc is as much as twice background in some samples.

While all of these results require verification, the fact that some of these observations are above DOE guidelines and proposed Subpart S action levels suggests that data to support a comprehensive baseline risk assessment and possibly a corrective measures study will be required at this site.

TABLE 3-7

1982 SUBSURFACE DATA

Hole	Depth (ft)	Tritium (pCi/ml)	Cesium-137 (pCi/g)	Uranium (ppm)
E-1	0-3	12.3	0.46	4.37
	3-8	48.0	0.11	4.49
	8-13	77.0	0.06	4.53
	13-18	38.0	-	4.75
	18-23	-	-	4.69
	23-28	-	-	4.76
	28-33	-	0.12	4.85
	33-38	-	0.10	5.03
	38-43	-	-	7.07
	43-48	-	0.12	7.14
E-2	0-3	9.7	-	4.25
	3-8	8.1	-	4.31
	8-13	7.6	-	4.64
	13-18	8.4	-	4.82
	18-23	8.6	-	4.58
	23-28	7.9	-	4.58
	28-33	13.1	-	4.77
	33-38	10.0	-	4.62
	38-43	10.0	-	7.52
	43-48	9.0	-	7.22
	48-53	9.9	-	7.32

TABLE 3-8

1989 SUBSURFACE DATA

Hole	Depth (ft)	Tritium (pCi/ml)	Uranium (ppm)	Lead (ppm)
29	14	3	3.5	1.6
	29	0	3.6	2.4
30	14	8	3.0	3.7
	14	6	3.9	8.5
	29	0	3.5	4.4
	44	–	–	6.1
31	4	2	3.2	4.0
	9	5	4.0	–
32	13	2	3.7	1.4
	28	0	4.8	1.5
33	14	2	3.6	5.7
	29	0	20.0	5.7
	49	0	6.1	14.0
	54	0	5.9	10.0
	59	0	5.9	14.0
41	9	3	–	2.6
	14	3	3.0	1.7
	29	2	2.4	2.3
	29	110	1.7	2.8

3.4.5 Decisions and Investigation Objectives

3.4.5.1 Potential Response Actions

If MDA-E is found to be an unsuitable location for permanent burial of mixed waste, the pits and trenches will be excavated and their contents removed to a permanent disposal site. The alternative, given the historical record of disposal at MDA-E, requires upgrading and improved monitoring of the site.

The remaining, unfenced portions of South Site will be cleaned to meet risk-based cleanup standards. Voluntary corrective actions are planned for TA-33-24. The remainder of the site will be cleaned as required to meet risk-based cleanup standards.

3.4.5.2 Proposed Phase I Investigations

Phase I activities at MDA-E will be designed to evaluate the stability of this site and to determine whether MDA-E meets the requirements for a permanent disposal site. In particular, the feasibility of protecting the site from erosion by upgrading cover, fencing, and monitoring and the likelihood of major disruption by landslide will be evaluated.

There is little information about the secondary sources at South Site and most of the data to be collected in Phase I will be used to test the hypothesis that one or more sources of contamination are present.

Reconnaissance sampling will be carried out at surface storage and disposal sites, gun-firing areas, landfills, and outfalls. A voluntary corrective action (VCA) approach will be used for the septic system. The implosion tests carried out at the shot pad spread material throughout the site. Therefore, an extensive survey of soil contamination on the mesa-top and surrounding benches will be undertaken. The extent of transport of contamination by runoff will be investigated by sampling the main drainage through the center of the site toward Chaquehui Canyon to the south.

3.4.5.3 Potential Phase II Investigations

Should preliminary investigations for MDA-E demonstrate that it is not suitable as a site for long-term disposal of the materials known to have been placed there, then limited Phase II investigations may be necessary to plan the removal of those materials. These investigations might include more accurate determination of pit locations and volumes, and sampling to confirm the contents which were gleaned from historical information.

If, at the conclusion of Phase I, maintenance of the site as a permanent disposal facility remains a viable and cost-effective alternative, Phase II activities will be directed toward upgrading the site to meet appropriate standards. In particular, potential migration pathways will be investigated, to verify that contamination remains contained in the site, to evaluate alternative techniques for site stabilization, and to locate sites for monitoring holes. Additional site parameters may have to be evaluated to complete a baseline risk assessment for the site.

More extensive Phase II investigations elsewhere at South Site may be triggered by observations above action levels in Phase I. These Phase II data collection activities will be designed to determine the extent of contamination in order to complete a baseline risk analysis for the site and to evaluate remedial alternatives.

Additional subsurface sampling may be needed to determine the extent of a plume, if any, beneath TA-33-33. However, it is anticipated that a corrective measures study for this system can be designed on the basis of Phase I information. Field-screening methods will be used during excavation to determine the extent of contaminated substrata and samples will be submitted for laboratory analysis to verify attainment of risk-based cleanup standards.

Additional subsurface sampling may be required to determine the extent of contamination in debris piles (SWMU 33-010[c]) and one landfill (SWMU 33-008[a]).

An alternative for these two sites, neither of which is large, is to remove all filled material and perform additional sampling to verify that the site has been cleaned to risk-based cleanup levels.

Additional sampling (additional trenches or drill holes in the berm or target area) may be needed to determine the spatial and size distributions of remaining projectiles and the volume of contaminated soil.

An alternative is to forego further characterization of the berms in favor of a corrective measure that would excavate these structures, remove remaining projectiles, and leave the soil at the site if it is uncontaminated.

Additional surface sampling may be required around the shot pad, at each of the gun firing areas, at the burning pit, and at each of three surface storage/ disposal areas to delineate surface areas requiring remediation.

Small areas may be cleaned based on field-survey or field-screening measurements before collecting additional samples to confirm that cleanup standards have been met.

3.4.6 Phase I Data Quality Objectives

3.4.6.1 Preliminary Activities

Preliminary activities will map the area and provide additional information needed to complete the design of sampling plans.

3.4.6.1.1 Land Survey

A land survey will establish grids for electromagnetic and magnetic surveys, a radiation survey, and surface sampling. All points will be recorded in the New Mexico State Planar Coordinate System and flagged. The location of some SWMUs, including a temporary surface disposal site (SWMU 33-010[h]) and the blivit storage area (SWMU 33-011[c]), need to be identified as accurately as possible and marked in the field.

3.4.6.1.2 Channel Mapping

The first-order channel running south through the center of the site will be mapped using aerial orthophotographs and 2-ft. contour topographic maps in order to locate sediment catchments suitable for sampling. The locations of such catchments will be surveyed in the New Mexico State Planar Coordinate System and flagged from the tower area down to the drop-off approximately 200 ft south of the outfall from TA-33-26.

3.4.6.1.3 Geophysical Surveys

Electromagnetic and magnetic measurements will be made at the nodes of a 5 x 5-ft grid established over the berms to assist in the location of unrecovered projectiles.

3.4.6.1.4 Radiation Survey

A surface radiation survey will be carried out to define trends in radioactive contamination around the shot pad and to delineate areas of locally-elevated activity requiring more intense sampling. In addition to a wide-spaced grid covering the entire South Site area, including benches, smaller grids are needed near the shot pad, in the gun-firing areas, and over the blivit storage area. Additional observations will be made in the drainage channel through the site, where sediments collect, as mapped above.

3.4.6.2 Phase I Investigations at MDA-E

Historical information concerning the nature of the materials buried at MDA-E, and recent data addressing surface and subsurface releases from the site, are sufficiently complete to indicate both that hazardous materials are buried there, and that little or no contamination is being released at present. Thus, the principal questions for RFI Phase I deal with the stability of the site.

Because MDA-E is close to the edge of a mesa, a geomorphological study is necessary to assess the long-term stability of the site. Large-scale landsliding in the White Rock Canyon area is the dominant process responsible for retreat of the canyon rims. Estimations of the probability of a landslide affecting a specific site at a given distance from the canyon rim requires regional data on the size and frequency of landslides and the relationship of these landslides to variations in the underlying bedrock.

The reconnaissance mapping of landslides using aerial photo analysis, with supplemental field checks of selected sites in an extensive area of White Rock Canyon will provide a sufficiently large sample of landslides to quantify the variability in landslide size as it relates to bedrock variations. This mapping will allow evaluation of whether the characteristics of landslides near TA-33 are similar to elsewhere in the canyon or whether they indicate unique local conditions.

Detailed investigations will focus on a few sites near TA-33 to better characterize the style of landsliding that could affect sites of concern and to constrain landslide frequency. It will be necessary to evaluate the configuration of the failure surface in relation to bedrock variations and to evaluate the style of failure, e.g., slow, discontinuous slumping in contrast to rapid debris flow or rock avalanching. Ages of landslides will be estimated using a variety of techniques to allow estimates of landslide frequency to be made. The ages may help determine whether the landslides are scattered through time or, alternatively, whether the landslides show a temporal clustering that would suggest a strong climatic and/or seismic trigger.

Regional data will be acquired in a two-phase study: 1) reconnaissance mapping of landslides in White Rock Canyon to determine general relations between landslide size and bedrock characteristics, and 2) detailed investigations of selected landslides in the vicinity of TA-33 to characterize failure conditions and bound landslide frequency.

The report of these investigations will provide data to determine if MDA-E should be upgraded to meet the standards applied to permanent material disposal areas at the Laboratory. Nonenvironmental considerations, such as probable future use of the site and a comparison of the costs of upgrading and monitoring the site as opposed to simply removing the buried material, will strongly influence this decision.

3.4.6.3 Surface Investigations

Surface sampling at South Site includes samples from three strata: localized SWMUs, channel sediments, and remaining mesa top and bench areas.

The integrated surface sampling plan at South Site will provide data to address several objectives.

1) To determine whether local areas of elevated contaminant concentrations are associated with identified SWMUs.

Localized surface SWMUs include, in addition to the shot pad (SWMU 33-006[a]), several gun-firing areas (SWMU 33-007[b]), three surface disposal sites (SWMUs 33-010[c,g,h]) the storage area for blivits (SWMU 33-011[c]), and the burning site (SWMU 33-014). Reconnaissance sampling, biased by field indicators wherever possible, will be carried out at each of these sites. Each sample maximum will be compared with action levels to determine whether there are localized problems associated with any of the SWMUs. This information will be used to determine whether further characterization or remediation is required at individual SWMUs.

2) To investigate the concentration of contaminants in the first-order channel bisecting the site.

Reconnaissance sampling of mobile sediments in the first-order drainage channel through the center of the site will include observations below the TA-33-26 outfall (SWMU 33-004[j]) as well as data below the firing sites, shot pad, and surface disposal area (SWMU 33-010[c]). Concentrations of contaminants in these sediments will be compared with action levels, both to determine it locally-elevated concentrations of contaminants exist in these sediments and also to evaluate the importance of surface runoff as a transport pathway.

3) To estimate the average concentrations and trends with distance from the central South Site sources (primarily the shot pad but also perhaps the burn site) of contaminants in surface media.

In Phase I, data will be collected to estimate the range of contaminant concentrations in surface soil and tuff at South Site and to investigate the existence of such a plume (i.e., of a trend with distance from the South Site sources). Sampling will be denser near these sources but will also extend to the north and will include benches. The target population includes surface soil and exposed tuff outside of areas associated with identified SWMUs and other localities that may be identified by the radiation survey, which were described separately above.

The data will be summarized by estimating spatial trends and local average concentrations as a function of distance from the center of the site. This will provide a value to which localized SWMU data can be compared as well as information for a baseline risk assessment.

4) To estimate spatial variability and predictability of contaminant concentrations.

Field duplicates and samples identified in the sampling plan and analysis (Chapter 4) as "neighbors" will provide the additional data needed to estimate sampling variability, a prerequisite to designing efficient sampling plans for Phase II, if more extensive surface investigations are required. Field duplicates will be provided at rates prescribed by the QAPjP, and additional neighbors at comparable rates.

3.4.6.4 Subsurface Investigations of the Building 24 Septic System

Phase I investigation of the septic system serving TA-33-24 will provide information needed to initiate a voluntary corrective action as outlined in Section 3.4.5.1.

Levels of contamination will be measured on samples representative of the fluid (if any) and sludge in the septic tank TA-33-33, SWMU 33-004(b). A drill hole next to the tank will provide soil or tuff samples to be measured for contamination. These data will be used to decide whether the tank or underlying materials are a continuing source of contamination, to determine the level of worker protection required during removal (if indicated), and to identify contaminants that can be used as indicators guiding removal of underlying soil and tuff.

3.4.6.5 Subsurface Investigations of Berms and Target Areas

Because the topography of the berms may impair geophysical measurements, a single trench through each of these target areas will provide material to be sifted for buried projectiles to complete the Phase I reconnaissance investigation of these sites. These trenches will be dug at the centers of the targets, as nearly as can be estimated, to maximize the probability of finding projectiles or contamination. Soil samples will be collected from the exposed sides of the trenches. These data will be used to estimate the quantity and composition of projectiles and the level of soil contamination in the berms. Soil contamination will be compared with the action levels, and a conservative scenario will be developed to evaluate the risk from buried projectiles.

3.4.6.6 Subsurface Investigations of Debris Piles

Apart from MDA-E, three areas at South Site contain mounded and buried debris: the 1984 landfill (SWMU 33-008[a]), the southwest slope of berm TA-33-43 (SWMU 33-010[h]), and the slope below the shot pad (SWMU 33-010[c]). The landfill is expected to contain very low levels of contamination, if any. The shot pad dumping area contains shrapnel and miscellaneous, small pieces of debris mixed with soil and pumice. The contents of SWMU 33-010(h) are unknown.

The volume of these piles will be estimated, including some drill holes to determine presence and depth of fill material. Trenches will be excavated at each of these sites to characterize the nature of the contamination in them.

Observations exceeding action levels will trigger additional investigations as outlined in Section 3.4.5.3.

3.4.7 Sampling and Analysis Plans

Sampling and analysis plans for South Site are presented in Chapter 4, Section 4.4.

3.5 EAST SITE

All SWMUs located at East Site are listed in Table 3-9. The location of each SWMU at East Site is shown in Fig. 3-14.

3.5.1 Site Description

East Site is located at the end of a paved road about two miles east of the entrance gate. The site lies at the easternmost point of the mesa overlooking the confluence of Ancho Canyon and White Rock Canyon. The cliffs and steep slopes forming the mesa rise to 1,000 ft above the Rio Grande. The mesa top on which the site sits is level. All native vegetation has been scraped away.

The developed area is about 0.4 square mile in area. Three bunkered structures and a large w-shaped berm are the only permanent installations. Several trailers are parked at the site. The main drainage through the former firing area leads eastward off the end of the point. A smaller channel has formed to the north of the w-shaped berm.

3.5.2 SWMU Descriptions and Histories

This section discusses the physical descriptions, historical use, present use, and identifies potential contaminants for all SWMUs at East Site.

TABLE 3-9

SOLID WASTE MANAGEMENT UNITS (SWMUs)
LOCATED AT TA-33, EAST SITE

SWMU or AOC	Associated Type	Structure #	Chapter 3 or 5 Discussion: Description	Data	DQOs	Phase 1 Approach
33-003(a)	shot chamber	TA-33-4	3.5.2.1	3.5.4	3.5.6.2	reconn
33-003(b)	shot chamber	TA-33-6	3.5.2.1	3.5.4		NFA
33-004(c)	septic system	TA-33-96	3.5.2.2		3.5.6.3	VCA
	leach field		3.5.2.2		3.5.6.3	reconn
33-004(k)	outfall	TA-33-87	3.5.2.3		3.5.6.2	reconn
33-004(l)	outfall	TA-33-89	5.3			NFA
33-006(b)	shot pads	TA-33-97,98	3.5.2.4	3.5.4	3.5.6.2	reconn
	berm		3.5.2.4	3.5.4	3.5.6.4	reconn
33-007(a)	firing site	TA-33-116	3.5.2.4		3.5.6.2	reconn
	berm		3.5.2.4		3.5.6.4	reconn
	drainage		3.5.1		3.5.6.2	reconn
33-008(b)	landfill		3.5.2.6		3.5.6.5	reconn
33-010(a)	canyon-side disposal		3.5.2.5		3.5.6.2	reconn
33-010(b)	canyon-side disposal		3.5.2.5		3.5.6.2	reconn
33-010(d)	canyon-side disposal		3.5.2.5		3.5.6.2	reconn
	drainage		3.5.1		3.5.6.2	reconn
C-33-002	transformer	TA-33-95	3.5.2.7		3.5.6.2	reconn

3.5.2.1 SWMUs 33-003(a,b) Material Disposal Area D

3.5.2.1.1 Physical Description

MDA-D consists of two areas, each approximately 20 x 30 ft and each containing an underground concrete chamber; Chamber #1, TA-33-4 and Chamber #2, TA-33-6 (SWMUs 33-003[a,b]). TA-33-4 lies east of TA-33-6. MDA-D lies on the east end of the mesa formed by Ancho and White Rock Canyons. These canyons drain into the Rio Grande. The elevation is approximately 6 430 ft and the MDA is relatively level. Very steep cliff faces, 80 to 130 ft high lie to the north and east of the MDA.

Chamber #1 was octagonal with dimensions of 16 x 18 ft x 11 ft high. Chamber #2 was also octagonal with dimensions 18 x 18 ft x 16 ft high. Both chambers are about 30 ft below grade. Each chamber had an elevator shaft. The shafts were 4 x 6 ft and 46 ft deep shored with 2 x 2 x 12 ft timbers.

3.5.2.1.2 Historical Use and Potential Contaminants

Construction of Chamber #1 was completed January 21, 1948, and the chamber was used in an experiment April 14, 1948. The experiment did not vent to the surface. No alpha activity was detected in the air or ground immediately after the shot or 24 hours later. This shot probably destroyed the chamber. A berm was later built over the chamber.

Chamber #2 was completed October 8, 1948. A polonium-210 bearing experiment was performed in December 1948 (Buckland 1949, 02-033). The chamber was

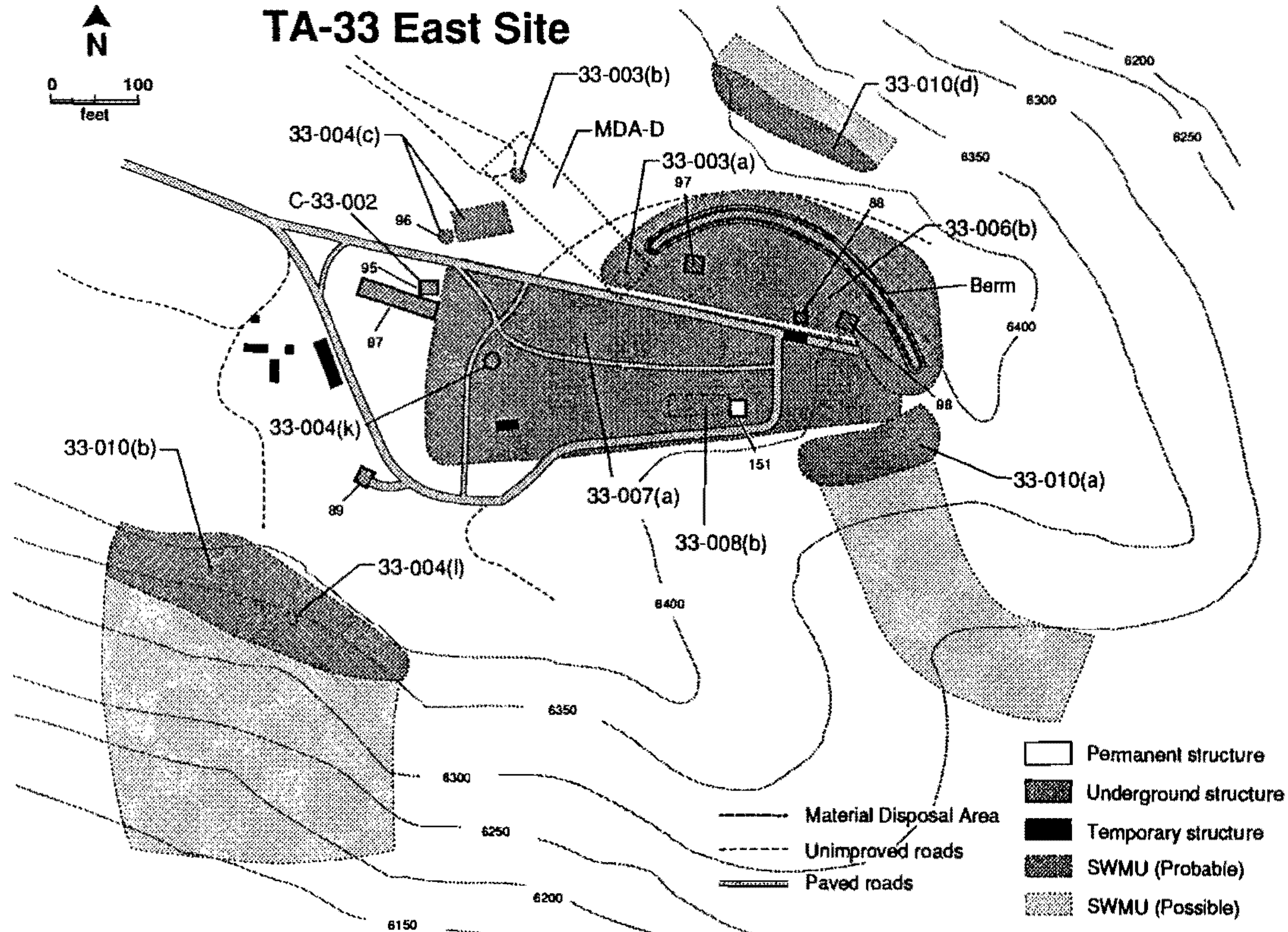

Fig. 3-14. East Site.

destroyed in an experiment in April 1952 (Blackwell 1952, 02-034). Debris was ejected from the shaft and a 10-ft crater formed. In preparation for the construction of new buildings in the area, MDA-D underwent another radioactivity survey in August 1953. Although the ground showed no detectable alpha counts, timbers and some soil around the crater and soil to a depth of 2 ft gave readings of 500 counts/min. The contaminated material was bulldozed into the crater and covered with uncontaminated soil. Another radiation survey was made and no radioactive contamination was found (Blackwell 1953, 02-035). The depression above Chamber #2 was refilled in 1963 (Zia Job Order #165991, 02-030).

A review of classified reports describing the experiments conducted in these chambers was performed to verify the constituents used in each experiment. This review revealed that uranium was not used in these experiments but beryllium, polonium-210, and high explosives were present.

3.5.2.1.3 Potential Contaminant Summary

Materials likely to be present include beryllium and high explosives. Any polonium has long since decayed to insignificant levels.

3.5.2.1.4 Present Status

A portion of a berm that was covering Chamber #1 was removed in 1989 for subsurface sampling. The shaft areas to both chambers exhibit depressions typical of soil settling.

3.5.2.2 SWMU 33-004(c) Septic Tank TA-33-96

A 4-in. diameter vitrified-clay pipe routes waste from TA-33-87 100 ft northeast to the 768-gal. septic tank (TA-33-96). A similar pipe, 30 ft long, routes effluent from the tank to a small drain field. The system is operational under NMED Permit LA-34; the tank has been active since 1955 and appears to be operating properly.

TA-33-87 was completed in June 1955 to support W-3 shot testing at East Site. There is no record of radioactive or hazardous materials being used or stored in this building (LANL 1990, 0145), though photoprocessing chemicals may have been disposed into this system (Hoard 1990, 02-022).

During the Task 2 Reconnaissance at underground Chamber #2 near the drain field, photovac analyses indicated volatile organic contamination of soils (DOE 1988, 02-036). Because Chamber #2 was used only for shot tests, organic contamination was not expected. It is suspected that the organics could have originated from septic system TA-33-96.

TA-33-87 is used as a laboratory support building.

3.5.2.3 SWMU 33-004(k) TA-33-87 Outfall

Two drain lines exit TA-33-87. They run parallel to each other and merge before reaching daylight near TA-33-116, where they discharge to an outfall. The outfall area is served by open asphalt channels, which converge to an arroyo draining to White Rock Canyon about 700 ft to the east. The outfall is hidden in a dense thicket of chamisa.

TA-33-87 was completed in June 1955 to support shot testing at East Site. There is no record of radioactive materials being used or stored in this building (LANL 1990, 0145). However, photoprocessing may have occurred.

3.5.2.4 SWMU 33-006(b) Shot Pad SWMU 33-007(a) Firing Area

Two SWMUs, 33-006(b) and 33-007(a), may conveniently be aggregated because of their physical similarities and similarities of use, time span, migration pathways, and potential public health and environmental impacts.

3.5.2.4.1 Physical Description

Shot facility SWMU 33-006(b) consists of two adjacent crescent-shaped berms, each 10 ft high and 200 ft across the face. In the center of each crescent is a concrete shot pad, TA-33-97 and TA-33-98, from west to east.

SWMU 33-007(a) lies south of the berms. It is a large area, about 550 x 150-ft. Gun mounts TA-33-116 and TA-33-135 are located at the west end of the area. The mounts are concrete pads. TA-33-151 is 330 ft east of the mounts; a 25 x 35-ft metal box filled with sand is adjacent to the building on the west. A narrow asphalt road runs the length of the SWMU, as does an asphalt drainage ditch.

East Site firing range is currently inactive.

3.5.2.4.2 Historical Use and Potential Contaminants

The buildings at East Site were completed in June 1955. Gun-type, rather than implosion-type, initiators were tested. Uranium projectiles containing beryllium and polonium-210 (half-life 138 days) or cobalt-60 (half-life 5.26 yr) were used in gun tests. The projectiles were not detonated: some were shot into berms and others were shot into catcher boxes for recovery and later sectioning.

Various methods were used to investigate results of the experiments. In one series, neutrons were measured in a large, doughnut-shaped, liquid scintillation counter. In another series, the projectile was x-rayed as it was shot past a recording setup. Projectiles were shot into elaborate catcher boxes, TA-33-118 and TA-33-136. These boxes were 10-ft square on the face and 80-ft deep, filled with sawdust. Cobalt-60 needles were included in the test device to facilitate location of the projectile within the boxes.

During a test firing on June 4, 1962, a projectile apparently disintegrated in the gun barrel. Cobalt-60 needles and 30 kg of depleted uranium were lost. Fires were ignited in the canyons surrounding the site. A 5-day search by 10 people of the canyon walls and bottoms failed to located more than the front-end piece and a few fragments of the projectile (Russ 1962, 02-037).

During the summer of 1984, debris and radioactive contamination were cleaned from selected areas of the firing site. Contaminated material was taken to TA-54, MDA-

G. Nonradioactive material was buried in landfill SWMU 33-008(b) near TA-33-151 (Buhl 1986, 02-038).

3.5.2.4.3 Potential Contaminant Summary

Contaminants present may include uranium, cobalt-60, tritium, beryllium, lead, cadmium, high explosives, and oil.

3.5.2.5 SWMU 33-010(a) Canyon-side Disposal, SWMU 33-010(b) Canyon-side Disposal, SWMU 33-010(d) Surface Disposal

These three canyon-side disposal sites lie on the steep slopes and cliffs of Ancho and White Rock Canyons. SWMU 33-010(a) debris is scattered at the rim and within 15-ft below the rim on the steep slope. Timbers and foam are visible. SWMU 33-010(b) lies on a shelf below the 60-ft cliff that lines the rim of the canyon at the south edge of the site. Timbers and a large ball of metal turnings and strapping strips are prominent in the debris. The third SWMU, 33-010(d), lies north of the berms. Some debris from this area was removed during the cleanup of 1984.

Debris from the shot pads in the berm areas was quickly scraped away to clean the area for the next shot. Surface disposal area SWMU 33-010(a) was probably the destination of the debris. It may contain uranium and small amounts of hazardous metals. SWMUs 33-010(b and c) may have been general disposal areas for construction and operational debris.

3.5.2.6 SWMU 33-008(b) Landfill

The landfill is immediately west of the sandbox of TA-33-151.

The landfill was established in August 1984 as a disposal site for a major cleanup of the firing sites at TA-33. All debris was checked for radioactivity and radioactive material was sent to TA-54, MDA-G. All material of any value was sent to salvage. Materials buried in the landfills may include timbers, sawdust, and vermiculite contaminated with small amounts of lead, beryllium, and high explosives.

After being filled with nonradioactive debris from the cleanup, the area was well compacted. Not even a bulge remains.

3.5.2.7 Area of Concern Number C-33-002

This area of concern is located inside the transformer vault, TA-33-95, located at East Site. The berm-covered transformer vault is constructed of thick concrete walls with a thick steel door to withstand explosive blast effects and protect the power transformer. The power transformer is mounted on the concrete floor of the vault. The vault floor exhibits evidence of old stains. No active leaks were noted during a LANL transformer assessment. The transformer site was inspected March 19, 1992, and no evidence of active leaks was observed. This tranformer is scheduled to be replaced during the summer of 1992. The transformer pad will be sampled and cleaned as required during the replacement operation (Morales 1992, 02-040).

3.5.3 Conceptual Exposure Model

All of the activities at East Site that were primary sources of contamination for the SWMUs described in the preceding section have ceased. Residual contamination may remain in or beneath the septic system, in surface soils around the firing sites, at the canyon-side disposal areas, or in sediments in channels draining the area. Projectiles may remain in the berms.

Contaminants could be released from the septic tank or subsurface material by excavation, by leaking, or by infiltration and leaching. Contaminated surface soil or sediments might be suspended by wind or in surface runoff. Buried projectiles could be exposed and transported by erosion and mass wasting.

Although all three of the major exposure scenarios outlined in Section 3.1.2 are applicable to East Site, current use of the site is intermittent and casual. Future recreational use of the area may be the most restrictive scenario.

The Laboratory currently intends continued institutional control over material disposal areas (MDAs) with eventual transfer of DOE property to another government agency, such as Bandelier National Monument. Recreational use and limited construction might then occur on the site, but residential and agricultural use is not anticipated.

3.5.4 Review of Existing Data

East Site surface data comes from a 1977 survey by the Laboratory's Environmental Surveillance Program and from Weston's 1989 survey.

In 1977, 26 surface soil samples were collected around the west end of the berms at the east end of the site and to the northwest of the berms (Fig. 3-15). These samples were analyzed for tritium, uranium, and cesium-137. Total uranium concentration for one of two samples selected on the basis of high Phoswich readings, next to shot pad TA-33-97, was measured at 460 ppm. Uranium measurements were within background ranges for the other 25 samples. One sample showed a slightly elevated tritium concentration (16.3 pCi/ml); the rest were below 9 pCi/ml.

Leachate from three surface samples from the berm at the west end of shot pad TA-33-97 (Fig. 3-15) was analyzed by Weston for radioactive contaminants and hazardous metals. Beryllium was detected but only at concentrations of 15 to 20 ppb, similar to observations of a fourth, background sample taken two miles to the north.

Existing subsurface data for East Site are specific to the two chambers in MDA-D.

Roy F. Weston, Inc. (LANL 1989, 02-020) drilled six boreholes, three around each of the two chambers. One borehole at each chamber was drilled to the floor of the elevator shaft, one each to the concrete roof of the chamber, and one each into the tuff below the level of the chamber floor.

Samples ranging in depth from 0 to 50 ft were analyzed for hazardous metals (12 samples), radionuclides (15 samples), and explosives (12 samples). Three samples were analyzed for the volatile organic compounds listed in LA-11333-MS, Appendix B (Purtymun et al. 1988, 0213).

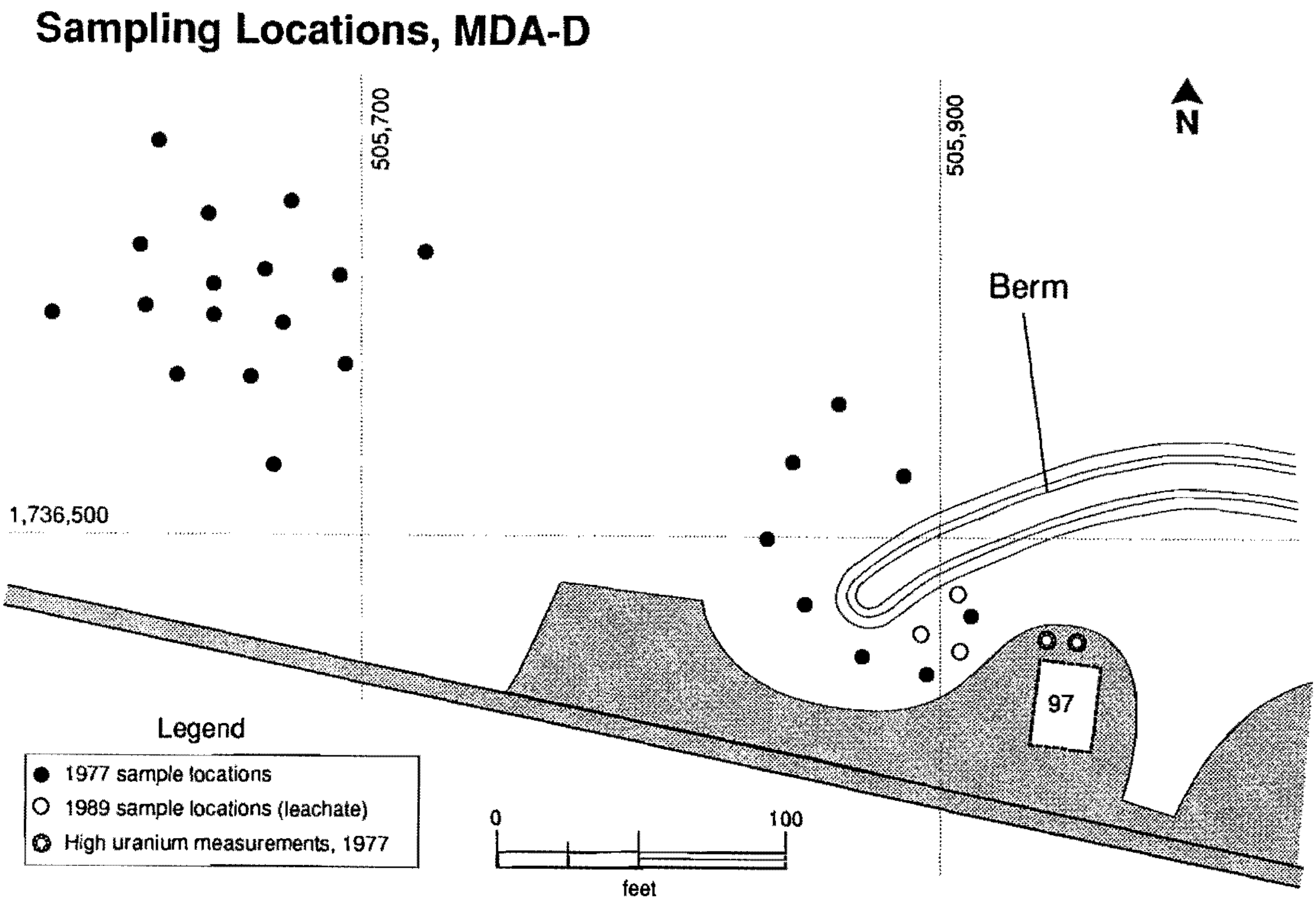

Fig. 3-15. Soil and leachate sampling locations at MDA-D.

No volatile organic compounds or explosives were detected in any sample. Barium results ranged from 51 to 125 ppm and lead from 1.9 to 3.3 ppm. Silver, arsenic, and cadmium were below detection levels. Of the radionuclides, none was elevated. Uranium results were within background range.

3.5.5 Decisions and Investigation Objectives

3.5.5.1 Potential Response Actions

Because the available information suggests that the risk due to contamination remaining in the unbreached shot chamber at MDA-D is very small, and Weston's data revealed no significant subsurface contamination migrating away from either chamber, no further action is proposed at the subsurface of MDA-D. The surface, like the remainder of East Site, will be cleaned as required to meet risk-based cleanup standards. Voluntary corrective action (VCA) is proposed for the septic system serving TA-33-87.

3.5.5.2 Proposed Phase I Investigations

The data to be collected in the initial phase of the East Site investigation will be used to test the hypothesis that one or more sources of contamination are present.

Reconnaissance sampling will be carried out at surface disposal areas, gun-firing areas, in the landfill, at outfalls, and along drainages. A VCA approach will be used for the septic system.

3.5.5.3 Potential Phase II Investigations

More extensive Phase II investigations elsewhere at East Site may be triggered by observations above action levels in Phase I. These Phase II data collection activities will be designed to determine the extent of contamination in order to complete a baseline risk analysis for the site and to evaluate remedial alternatives.

Additional subsurface sampling may be needed to determine the extent of a plume, if any, beneath TA-33-96 and of contamination at the drain field. However, it is anticipated that a corrective measure for this system can be designed on the basis of Phase I information. Field screening methods will be used during excavation to determine the extent of contaminated substrata and samples will be collected for laboratory analysis to verify attainment of risk-based cleanup standards.

Additional subsurface sampling may be required to determine the extent of contamination in the landfill (SWMU 33-008[b]). An alternative is to excavate the site and perform additional sampling to verify that risk-based cleanup standards are attained.

Additional sampling may be required to determine the spatial and size distributions of remaining projectiles and the volume of contaminated soil.

Additional surface sampling may be required around the two shot pads, in the central gun firing area, or at each of the canyon-side disposal areas to delineate surface areas requiring remediation. Small areas may be cleaned based on field-survey or field-screening measurements before collecting additional samples for laboratory analysis to verify the attainment of risk-based cleanup standards.

3.5.6 Phase I Data Quality Objectives

3.5.6.1 Preliminary Activities

Preliminary activities will map the area and provide additional information needed to complete the design of sampling plans.

3.5.6.1.1 Land Survey

A land survey will establish grids for an electromagnetic survey, a radiation survey, and surface sampling. All points will be recorded in the New Mexico State Planar Coordinate System and flagged. The outfall from TA-33-87 must be located, surveyed, and flagged. The boundaries of the landfill (SWMU 33-008[b]) must be located, surveyed, and flagged. The geophysical surveys (Section 3.4.6.1.3) may help to locate this landfill.

3.5.6.1.2 Channel Mapping

The first-order channel draining the central part of the site will be mapped using aerial orthophotographs and 2-ft. contour topographic maps in order to locate sediment catchments and other sites suitable for sampling. A few sediment catchments will also be mapped in the small drainage behind the berm that passes through SWMU 33-010(d). The locations of such catchments will be surveyed in the New Mexico State Planar Coordinate System and flagged from the TA-33-87 outfall to below the canyon-side disposal area at the east end of the site (SWMU 33-010[a]).

3.5.6.1.3 Geophysical Surveys

A 5 x 5-ft grid will be surveyed over the berms, leach field, and landfill to locate points for electromagnetic and magnetic measurements. The surveys will assist in locating pipes in the leach field and metallic objects in the landfill.

3.5.6.1.4 Radiation Survey

A radiation survey will be carried out to locate radioactive contamination around the shot pads and gun firing sites and to look for surface radioactivity at other surface sites. This survey information will be used to delineate areas of locally-elevated activity requiring more intensive sampling. The radiation survey will extend down the first-order channel draining the central part of the site to the east.

3.5.6.2 Surface Investigations

Surface sampling at East Site will include both samples of surface soils from the mesa top and upper slopes, and channel sediments. The integrated surface sampling plan at East Site will provide data to address several objectives.

1) To estimate the average contaminant concentrations around the shot pads and firing sites and MDA-D.

Broken projectiles, or projectiles that strayed from their targets, spread contamination around the gun firing sites. While large pieces were usually retrieved, residual soil contamination may remain. Phase I will provide samples from the target population of surface soil and exposed tuff around the shot pads, gun mounts, and locations of former catcher boxes. A moderately extensive reconnaissance survey will be needed to cover the site, as it includes several firing areas.

2) To determine whether local areas of elevated surface contaminant concentrations are associated with other surface SWMUs.

Other, more localized SWMUs at East Site include three surface disposal areas SWMUs 33-010(a), 33-010(b), and 33-010(d). Reconnaissance sampling, biased by field indications wherever possible, will be carried out in each of these areas. Each sample maximum will be compared with action levels to determine whether there are localized problems associated with any of the SWMUs. This information will be used to determine whether further characterization or remediation is required at individual SWMUs.

3) To investigate the concentration of contaminants in the first-order channel down the center of the site.

The target population for these samples consists of mobile sediments in the first-order drainage channel draining the firing areas, as well as the outfall from TA-33-87, which is SWMU 33-004(h). Concentrations of contaminants in these sediments will be compared with action levels, both to determine if locally elevated concentrations of contaminants exist in these sediments and to evaluate the importance of surface runoff as a transport pathway.

4) To estimate spatial variability and predictability of contaminant concentrations.

Field duplicates and samples identified in the sampling plan (Chapter 4) as "neighbors" will provide the additional data needed to estimate sampling variability, a prerequisite to designing efficient sampling plans for Phase II, if more extensive surface investigations are required.

3.5.6.3 Subsurface Investigations of the TA-33-87 Septic System

Phase I investigation of the septic system serving TA-33-87 will provide information needed to initiate a voluntary corrective action, as outlined in Section 3.5.5.1.

Levels of contamination will be measured on samples representative of the fluid (if any) and sludge in the septic tank TA-33-96. A drill hole next to the tank and two in the drain field will provide soil samples to be measured for contamination. These data will be used to decide if the tank, the underlying materials, or the soils and tuff at the drain field are a continuing source of contamination, to determine the level of worker protection required during removal (if indicated), and to identify contaminants that can be used as indicators guiding removal of underlying soil and tuff.

3.5.6.4 Subsurface Investigations of the Berms and Target Areas

Reconnaissance sampling at the target areas will provide information on soil contamination and buried projectiles. A single trench through each of these target areas will provide material to be sifted for buried projectiles. These trenches will be dug at the centers of the targets, as nearly as can be estimated, to maximize the probability of finding projectiles or contamination. Soil samples will be collected from the exposed sides of the trenches. These data will be used to estimate the quantity and composition of projectiles and the level of soil contamination in the berms. Soil contamination will be compared with action levels, and a conservative scenario will be developed to evaluate the risk from buried projectiles.

3.5.6.5 Subsurface Investigation of Landfill

The landfill, SWMU 33-008(b), was constructed during the 1984 cleanup at TA-33 and is expected to contain at most low levels of non-radioactive contamination. The volume of the landfill will be estimated, including as necessary some preliminary drill holes to determine presence and depth of fill material. A trench will provide a representative volume of material to be examined for contamination. Observations exceeding action levels will trigger additional investigations as outlined in Section 3.5.5.3.

3.5.7 Sampling and Analysis Plans

Sampling and analysis plans for East Site are presented in Chapter 4, Section 4.5.

3.6 NATIONAL RADIO ASTRONOMY OBSERVATORY (NRAO) SITE

All SWMUs located at the NRAO Site are listed in Table 3-10. The locations for each SWMU at the NRAO Site are shown in Fig. 3-16.

3.6.1 Site Description

The NRAO complex is located about one mile from the main entrance just off the road to East Site. It lies northeast of South Site on a mesa top adjacent to a northern tributary of Chaquehui Canyon. An 82-ft diameter radiotelescope antenna and a support building occupy the site. The radiotelescope is controlled remotely from the National Radio Astronomy complex near Magdalena, New Mexico.

3.6.2 SWMU Descriptions and Histories

This section discusses the physical descriptions, historical use, present use, and identifies potential contaminants for all SWMUs at the NRAO complex.

TABLE 3-10

SOLID WASTE MANAGEMENT UNITS (SWMUs) LOCATED AT TA-33, NRAO SITE

SWMU or AOC	Associated Type	Structure #	Chapter 3 Discussion: Description	Data	DQOs	Phase 1 Approach
33-004(m)	septic system	TA-33-179	3.6.2.1		3.6.6.3	reconn
	leach field					reconn
33-011(b)	general storage		3.6.2.2		3.6.6.2	reconn

3.6.2.1 SWMU 33-004(m) Septic Tank TA-33-179

Septic tank TA-33-179, installed in 1987, lies outside the northeast corner of the fenced compound of the NRAO site. It has a capacity of 1 000 gal. and discharges to a leach field. The system is operational under Permit SF-89032. It serves TA-33-178, a support building for the radiotelescope.

The NRAO complex was completed in 1987. There is no record of radioactive or hazardous materials being used or stored in TA-33-178. Technicians assigned to the facility have indicated that solvents have been used to clean equipment and some of these solvents could have been discharged to the septic system.

3.6.2.2 SWMU 33-011(b) Storage Area

SWMU 33-011(b) is located just west of the NRAO fenced complex. The SWMU occupies a 200 x 300-ft area. About three-quarters of the site has been scraped and leveled. A few bits of scrap and debris still litter the area.

In the 1950s the area became the principal nonradioactive disposal area at TA-33 (Hoard 1990, 02-019). It was also used to store equipment used at the firing sites. In addition, it was used as a holding area to store strategic materials such as tungsten, uranium, and beryllium until enough accumulated to be shipped out. This site was cleaned in 1984 (Buhl 1988, 02-038). At that time, no analyses were performed for hazardous metals or organic compounds.

3.6.3 Conceptual Exposure Model

The NRAO site is no longer used as a storage or disposal area but residual contamination may remain in surface soils.

Much of the NRAO site was scraped and leveled before construction of the telescope began in 1985 and existing surface contamination, if any, might have been spread across the site by these site preparation activities. The existing septic system at that site is operated in accordance with current waste management practices.

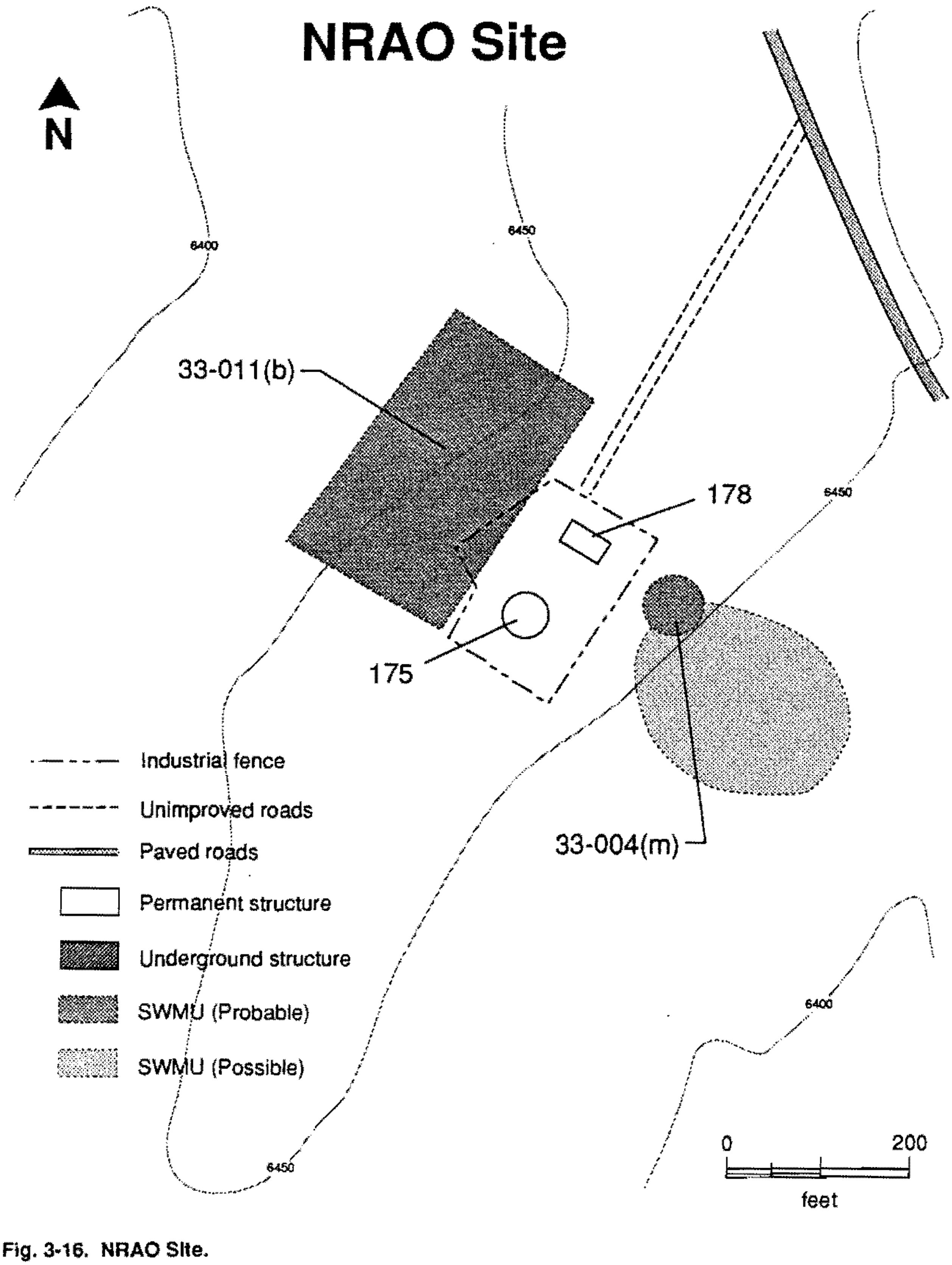

Fig. 3-16. NRAO Site.

Contaminants might be released from the NRAO drain field by excavation, by leaking, or by infiltration and leaching. Residual contamination may exist in surface soils at the storage area (SWMU 33-011[b]). Contaminated surface soil may be suspended by wind or surface runoff.

While all three of the major exposure scenarios outlined in Section 3.1.2 are applicable to this site, current use is intermittent. Future recreational use of the area may be the most restrictive scenario.

3.6.4 Review of Existing Data

There are no existing data for sources at the NRAO Site.

3.6.5 Decisions and Investigation Objectives

3.6.5.1 Potential Response Actions

The area surrounding the NRAO telescope will be cleaned to meet risk-based cleanup standards. Regulations concerning disposal of liquid wastes to active septic tanks will be actively enforced.

3.6.5.2 Proposed Phase I Investigations

There is no information about the existing sources at the NRAO Site, and the data to be collected in Phase I will be used to test the hypothesis that one or more sources of contamination are present. Reconnaissance sampling will be done for both SWMUs.

3.6.5.3 Potential Phase II Investigations

It is anticipated that the Phase I investigations will provide data necessary to complete a baseline risk analysis for the site and to evaluate remedial alternatives.

3.6.6 Phase I Data Quality Objectives

3.6.6.1 Preliminary Activities

Preliminary surveys will map the area and provide additional information needed to complete the design of sampling plans.

3.6.6.1.1 Land Survey

A land survey will establish grids for a radiation survey and surface sampling. All points will be recorded in the New Mexico State Planar Coordinate System and flagged.

3.6.6.1.2 Radiation Survey

A radiation survey will be carried out to look for surface radioactivity at surface sites. This survey information will be used to define the extent of the area that should be covered by sampling, as well as to delineate areas of locally-elevated activity requiring more intense sampling.

3.6.6.2 Surface Investigations

Surface contamination, if any, at the former storage area now occupied by NRAO may have been disturbed or distributed by the construction of the telescope. Phase I reconnaissance sampling of the area will be designed to estimate the range of contaminant concentration in surface soil and tuff across the site.

3.6.6.3 Subsurface Investigation of NRAO Septic System

The Phase I reconnaissance investigation will provide samples of the fluid and sludge in the septic tank, TA-33-179. A drill hole next to the tank and two in the drain field will provide soil samples to be measured for contamination. These data will be used to decide whether the tank, the underlying materials, or the soils and tuff at the drain field are a continuing source of contamination.These data will be used to assess the compliance of this system with current regulations and as a basis for corrective action if necessary.

3.6.7 Sampling and Analysis Plans for the NRAO Site

Sampling and analysis plans for the NRAO Site are in Chapter 4, Section 4.6.

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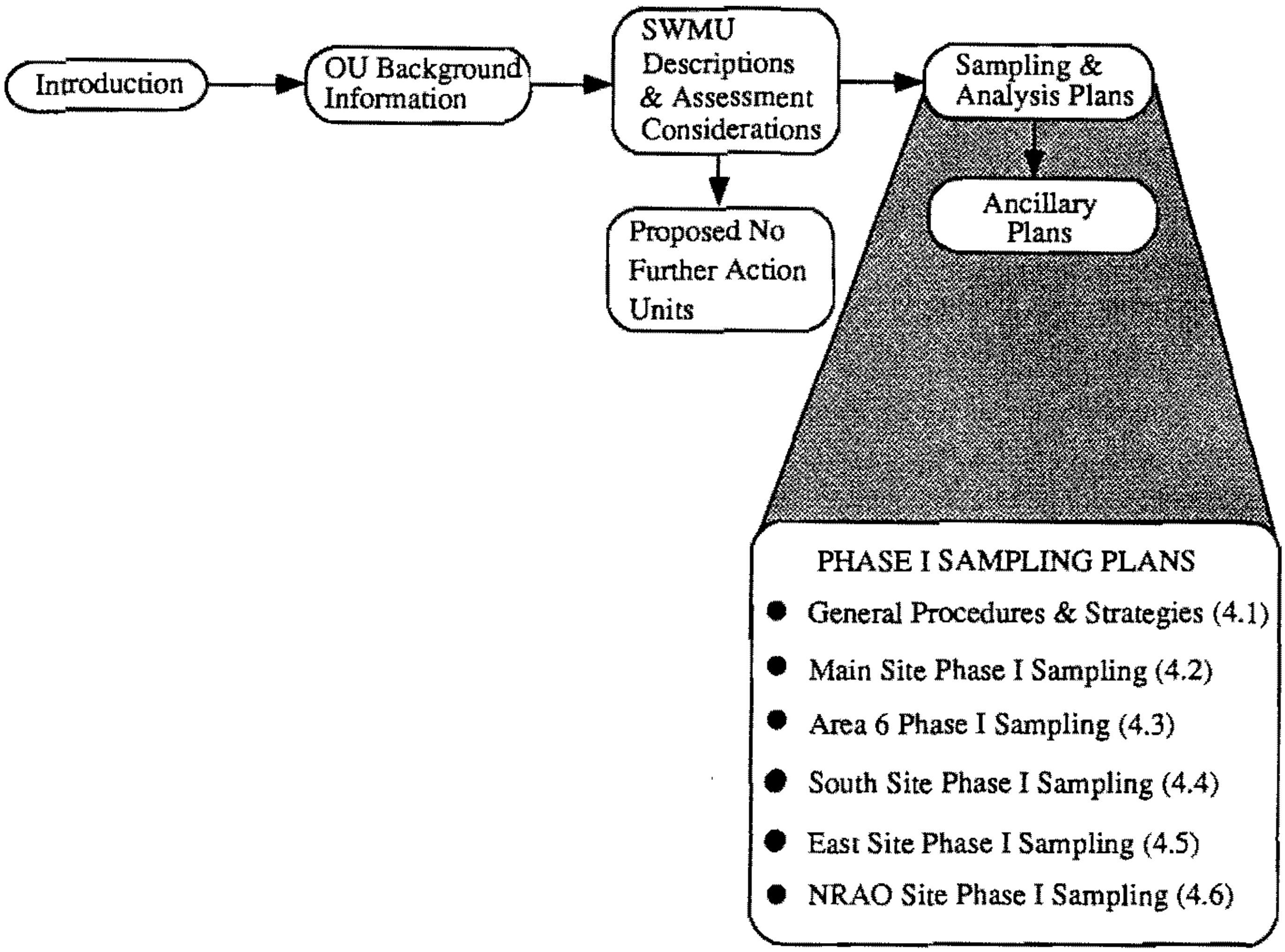
CHAPTER 4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4.0 PHASE 1 SAMPLING PLANS

4.1 General Procedures and Strategies

4.1.1 Field Sampling

Field sampling procedures that will be referenced repeatedly in subsequent sections of Chapter 4 are described in this section. The ER Program's Standard Operating Procedures (LANL 1992, 0688) will be followed during OU 1122 field work when appropriate. Specific SOP numbers, if known, are shown in Table 4-1. These procedures give operational definitions to what are later referred to simply as "electromagnetic surveys," "surface soil samples," etc. In addition to procedures that are explicitly enumerated below, many other SOPs apply, such as general instructions for sample control and documentation, field quality assurance/quality control, blank samples, and general drill site management. In addition, a number of field-screening procedures are called for in the Health and Safety Plan (Annex III).

Many of the plans in this chapter call for preliminary surveys: geomorphic characterization of drainage channels for the purpose of determining locations that can provide samples representative of the mobile or fine-grained sediments in the channels; magnetic and electromagnetic measurements to locate buried drain lines and outfalls and to detect buried projectiles in berms at firing areas; and *in-situ* radiation surveys to define surface areas that may be contaminated by radioactive elements. SOPs for geomorphic characterization, surface geophysics, and low-energy gamma surveys called for here (using an instrument of the Phoswich type) will be provided.

Extensive surface sampling is planned, and near-surface samples will be obtained by drilling in several locations. ER Program SOPs describe procedures for collecting surface and near-surface samples of soils, sediments, and tuffs.

Lithologic logs will be provided for the few deeper holes. Field screening of cores for radioactivity or explosives is called for in some plans. Gamma logs are required for two deep seepage pits. Gamma and neutron logs will be used at MDA-K.

Finally, a few samples will be collected from within existing subsurface structures (septic tanks, sumps, seepage pits). ER Program SOPs will be followed.

Quality control samples will be provided as specified in the generic QAPjP (LANL 1991, 0412). These will include field, reagent, rinsate, and trip blanks as appropriate. In the following sections only field duplicates are mentioned explicitly, because data from these will be used together with other field data in estimating means, trends, and variability of contamination levels, as well as sampling variability.

Complete field records are extremely important. Formal logging procedures are provided for drill core (lithologic logging), but this sampling plan also assumes that good field notes will be kept for other types of samples. For surface samples the medium selected for sampling (soil, tuff, sediment) and the local vegetation cover (bare, thick chamisa, juniper, grass, etc.) will be noted. For channel sediments the extent and depth of the sampled catchment will be recorded. For samples from subsurface structures the condition of the interior of the structure, including the presence of standing water, depth of sediments, and apparent flaws in the containment if any, will be described. Information of this type is essential in interpreting the resulting data.

No field work will be allowed to start until the cultural and biological resource reports and maps have been consulted to ensure that the proposed work does not have any adverse impact on identified sensitive areas (wetlands, archaeological sites, and sites containing threatened or endangered species). EM-8 will be notified to evaluate and approve proposed work located in or near any identified sensitive area.

TABLE 4-1

STANDARD OPERATING PROCEDURES

	Activity	Procedure Number	Procedure Title
Surveys	Channel mapping		Geomorphic Characterization
	Magnetic		General Surface Geophysics
	Electromagnetic		General Surface Geophysics
	Radiation		Phoswich-family instruments (SOP by EM-8)
Field Screening	Gross gamma		*In situ* Gamma Ray Measurements using a Shielded Delta-Gamma Detector
	Gross alpha		Screening Soil Samples for Alpha Emitters
	Organic vapor		Portable Gas Chromatography for Field Screening of Volatile Organic Compounds
	Combustible gas/oxygen		Monitoring of Combustible Gas Levels
	Explosives	27.05.011	Field Spot Tests for Cast and PBX Explosives Containing TNT, HMX, TATB
Logging	Lithologic		Soil and Rock Borehole Logging and Sampling Methods
	Gamma		Borehole Gamma Logging
Sampling	Surface soil sample	06.09	Spade and Scoop Method for Collection of Soil Samples
	Sediment sample (from tank)	06.15	Coliwasa Samples for Liquids and Slurries
	Sediment sample (from stream)	06.14	Sediment Material Collection
	Water sample (from tank)	06.19	Weighted Bottle Sampler for Liquid and Slurries in Tanks
	Water sample (from stream)	06.13	Surface Water Sampling
	Soil sample (from auger hole)	06.10	Hand Auger and Thin-Wall Tube Sampler
	Tuff sample (from auger hole)	06.10	Hand Auger and Thin-Wall Tube Sampler
	Tuff sample (from drill hole)		Soil and Rock Borehole Logging & Sampling Methods
	Trenching		Excavating Methods

4.1.2 Selection of Sampling Locations

Several of the surface sampling plans call for selecting sampling locations on a regular grid with given spacing between the nodes. For the purposes of illustration, the corners of some of these grids have sometimes been specified in this work plan. As these corners were selected because they happen to correspond to round numbers in the New Mexico State Planar coordinate system, rather than according to any more site-specific criterion, the sampling locations generated in this way are expected to be "unbiased" with respect to contaminant distributions or any other important feature under study. However, in order to further guarantee unbiased choice of sampling locations, randomization can be incorporated into these grid sampling plans in two ways, either at the time the field sampling plan is finalized or in the field:

1) A starting point and an orientation can be selected at random, and the remainder of the grid can be laid out starting from this point parallel and perpendicular to the selected direction, using the grid spacing specified in this work plan. Approximately the same areas should be covered as shown in the figures in this chapter.

2) In addition to, or instead of, randomizing the starting point and the orientation of the grid, each grid point can be treated as a reference point, and the exact sampling point can be located using a randomization method at each one.

If field randomization is done, it is essential that an explicit protocol be followed in order to avoid the introduction of subtle biasing factors such as the accessibility of a sampling location, the visual appearance of the soil, etc. The following protocol is taken from an EPA guidance document, "Methods for Evaluating the Attainment of Cleanup Standards, Volume 1, Soils and Solid Media."

> Let M be 1/2 the grid spacing. Choose a random distance between -M to M feet to move away from the reference point parallel to the grid orientation direction, and a second random distance between -M and M feet to move perpendicular to that direction (EPA 1989, 02-041).

If the location thus selected is not sampled for some reason, perhaps because it is inside a building or it falls in a channel, then the fact of and reason for its elimination should be recorded in the field notebook and the procedure repeated with a new pair of random numbers to find an alternate sampling location. The fact that the method allows for the random replacement of sampling locations that turn out to be unusable is one of its advantages over prespecified sampling locations, provided that the protocol is followed. The main disadvantages are the additional surveying time required and the increased opportunity for recording errors.

A similar form of randomization can be employed in the selection of depths to sample, that is, depths specified in this work plan can be treated as reference depths only, and the actual sample selected a random distance above or below that point. However, where the plan calls for a surface sample (that is, a sample from the top six inches of the core) or a sample from the tuff/fill interface, these instructions should be followed.

If for some reason, the sample cannot be treated as a random sample, special methods are available for estimating population means and variances based on a systematic (grid) sample. These methods are discussed in Section 6.5 of "Methods for Evaluating the Attainment of Cleanup Standards" (EPA 1989, 02-041). At TA-33 there is no reason to anticipate periodic patterns of contamination that could invalidate the use of a grid for selecting sampling locations. A more serious problem in analyzing data collected on a grid is that the grid fails to provide pairs of observations that can be used to estimate variability on a scale smaller than the grid spacing, which becomes important in determining if enough data has been collected to proceed with risk assessment or remediation. However, this problem can be addressed using field duplicates and "neighbors," discussed below.

For several of the reconnaissance sampling plans, Chapter 3 specifies that the selection of sampling locations should be deliberately biased, using field indications such as anomalous radiation measurements or soil staining. In each of these cases the statistic of interest is the sample maximum (see Section 4.1.4) and the goal in choosing a sample is to maximize the probability of detecting contamination if it is present.

For these sampling plans, and for several other cases where the target areas require better delineation during preliminary site mapping, exact sampling locations will not be determined before field work commences. If the use of field indications to make the final selection of sampling locations is not indicated, or if no field anomalies are observed, the following protocol may be followed to make a random selection.

> Determine a range of X (Xmin to Xmax) and Y (Ymin to Ymax) coordinates defining a rectangle that circumscribes the target area. To select a sampling location, move a random fraction of the distance from Xmin to Xmax, and another random fraction of the distance from Ymin to Ymax. If the resulting location (X,Y) lies inside the target area, sample there. If it lies outside the target area (even though it must be inside the circumscribed rectangle by definition), start over again. Repeat until the required number of samples have been taken. (EPA 1989, 02-041).

All field-determined sampling locations, including field-randomized choices and "neighbors," as well as locations based on field indications, must be accurately recorded in the field notebook.

Field duplicates are important, not only for quality control, but also because they provide data to estimate local sampling variability. Standard operating procedures for sample collection specify the method to be used to select a field duplicate. Note that a field duplicate is a separate sample, collected from a location very near to the first sample, not merely a second measurement on the first sample.

An additional type of sample called for in some OU 1122 surface sampling plans is called a "neighbor." Neighbors of surface soil samples will be selected from locations up to 50 ft away from the first sample and from the same type of soil. (One satisfactory method for selecting neighbors is a field randomization procedure similar to the one described above for randomizing grid points. Use the location of the first sample as the reference point, and take M to be approximately one-half of the grid spacing.)

4.1.3 Analytical Procedures

The following types of analyses are proposed for OU 1122: field surveys, field-screening measurements, field laboratory measurements, and laboratory analyses. The selection of analytes depends on the contaminants of concern, which were enumerated for each OU 1122 SWMU in Table 3-1. In addition, a subset of the surface samples, primarily samples from locations near roads, buildings, and firing sites will be analyzed for herbicides or pesticides.

Field surveys and field-screening procedures, which were enumerated in Table 4-1, provide data at Analytical Levels I and II. Analytical levels are discussed in the EPA guidelines for the DQO process (EPA 1987, 0086). Table 4-2 summarizes EPA's recommendations concerning the analytical level of data required for different purposes such as site characterization, risk analysis, and monitoring. In this chapter, field surveys will be described where they will be used to refine subsequent sample selection, as outlined in Section 4.1.2. Field surveys and field-screening procedures are also required to implement the OU 1122 Health and Safety Plan, described in Annex III.

Table 4-3 lists the analytical methods to be used for field and offsite laboratory analyses. Those analytical methods may be superceded by new, approved methods. Field laboratory measurements provide data at Analytical Levels II and III, and offsite laboratory analyses will meet the requirements for Analytical Level III or higher. Field laboratories provide quick turnaround for some procedures and make it possible to identify sites where additional samples might be needed. Risk assessment and selection of remedial alternatives will be based on analytical data of Level III or higher quality.

4.1.4 Sampling and Analysis Strategies

Phase I sampling objectives were developed in Chapter 3. The diagrams in this section illustrate the proposed flow of investigation and decisions, from the preliminary site mapping activities to the end of the RCRA Facility Investigation (RFI). These diagrams summarize the context within which the Phase 1 investigations, the focus of the remainder of this chapter, will be carried out.

In all cases, RFI Phase I concludes with a decision point, leading to baseline risk assessment, to voluntary corrective action, to a corrective measures study, or to no further action. In most cases, this decision requires a comparison between site observations and Subpart S (or comparable) action levels. The choice of a statistic to be used for this comparison is a function of the Phase I approach selected in Chapter 3. For "reconnaissance" samples, where the objective is to detect contamination if present, the sample maximum will be compared with action levels. Where more extensive sampling is proposed, the sample mean may be a more relevant measure of contamination level. If trends exist within a sample representing a large area, the mean of a subsample may be appropriate, in order to avoid diluting the result by including observations from uncontaminated areas.

Additional regulations may be applicable or relevant for some contaminants if these are identified in OU 1122. Baseline risk assessment may suggest trigger levels which are more appropriate for this site than Subpart S action levels.

TABLE 4-2

SUMMARY OF ANALYTICAL LEVELS APPROPRIATE TO DATA USES*

Data Uses	Analytical Level	Limitations	Type of Analysis	Data Quality
Site characterization, monitoring during implementation	Level I	Field screening for organic vapor and radiological detection using portable instruments	Instruments respond to naturally occurring compounds	If instruments calibrated and data interpreted correctly, can provide indication of contamination
		Field test kits		
Site characterization, evaluation of alternatives, engineering design monitoring during implementation	Level II	Variety of organics by GC, inorganics by AA, XRF	Tentative identification	Dependent on quality assurance/quality control steps employed
		Tentative identification, analyte specific	Techniques/instruments limited mostly to volatiles, metals, some radionuclides	Data typically reported in concentration ranges
		Field laboratory analyses for some radiological constituents	Tentative identification and quantification	Dependent on quality assurance/quality control steps employed
		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	Specific identification; tentative identification in some cases	Similar detection limits to CLP
		RCRA characteristic tests	Can provide data of same quality as Level IV	Less rigorous quality assurance/quality control
		Radiological constituent	Specific identification; detection limits below background; with suitable QC, gives comparable quality to SW846 methods	Quality assurance/quality control is comparable to SW846 methods
Risk assessment, evaluation of alternatives, engineering design	Level IV	TCL/TAL organics/ inorganics by GC/MS, AA, ICP	Tentative identification of non-TCL parameters	Goal is data of known quality
		Low ppb detection limit	Some time may be required for validation of packages	Rigorous quality assurance/quality control
Risk assessment	Level V	Nonconventional parameters	May require method development modification	Method-specific
		Method-specific detection limits	Mechanism to obtain services requires special lead time	
		Modification of existing methods		

AA - atomic absorption
GC - gas chromatography
RCRA - Resource Conservation and Recovery Act
CLP - Contract Laboratory Program
ICP - inductively coupled plasma
TAL - Target Analyte List
XRF - X-ray fluorescence
EPA - Environmental Protection Agency
MS - mass spectrometry
TCL - Target compound list

*EPA (1987)

TABLE 4-3

ANALYTICAL METHODS

	Measurement	Applicable Procedure
Field Laboratory	Gross Alpha	Gas Flow Proportional Counter
	Gamma spectroscopy	Gamma spectroscopy
	Tritium	Distillation and liquid scintillation
	Volatile Organics	Portable Gas Chromatography in Field Screening of Volatile Organic Compounds
	PCBs	SOP 10.01, Screening of PCBs in Soil
	Soil moisture	Soil Moisture Measurement
	Explosives	USATHAMA - Liquid Chromatography
Laboratory	Gamma spectroscopy	Gamma spectroscopy
	Tritium	Distillation and Liquid Scintillation
	Total uranium	ICPMS or Delayed Neutron Assay
	Isotopic uranium	Radiochemical Separation and Alpha Spectrometer
	Isotopic plutonium	Radiochemical Separation and Alpha Spectrometer
	VOA	EPA SW-846 Method 8240
	Semivolatiles	EPA SW-846 Method 8270
	Metals	EPA SW-846 Method 6010
	PCBs	EPA SW-846 Method 8080
	Explosives	USATHAMA - Liquid Chromatography

The ER Program is currently conducting a pilot study on local soils and the Bandelier Tuff. That study will determine the background concentration ranges of target list metals and radionuclides, as well as collecting data on some physical and chemical parameters that control mobilities of the constituents. Initial results of the study will be presented in the 1992 version of the Installation Work Plan, and will be available prior to analysis of OU 1122 data. Background concentration ranges will provide an additional point of comparison for OU 1122 data.

Figures 4-1 through 4-6 illustrate six types of sampling plans that are widely applied throughout OU 1122.

Surface sampling:

> Surface sampling is used at all five of the major TA-33 sites, either to estimate mean area contamination levels (as well as trends, if above-background levels are found), or as part of a reconnaissance investigation of individual SWMUs with which surface releases could be associated, or both. Surface sampling is always preceded by field surveys, both to identify or delineate areas requiring detailed examination and also to collect Analytical Level II information that may be useful to supplement limited laboratory results. Phase I laboratory observations will be compared with action levels. If a formal baseline risk assessment is needed, additional data may be collected, as outlined in Sections 3.#.5.3. The general approach to surface sampling is diagrammed in Fig. 4-1.

Channel sediments:

Sampling of sediments in first- and second-order channels, both below individual outfalls and general site drainages, is proposed to investigate transport of surface contamination away from the sites. Phase I results will also be compared with action levels to determine if there are locally contaminated areas in the channels. Geomorphological surveys precede these sampling activities. If a formal baseline risk assessment is needed, additional data may be collected. This approach to channel sampling is diagrammed in Fig. 4-2.

Subsurface structures:

Several active septic systems, as well as inactive septic tanks and sumps, remain at TA-33. The goal of RFI Phase I characterization of these structures is to provide information to guide their removal or replacement. This requires determining whether the structures themselves are contaminated, as well as limited assessment of the potential extent of contamination in the surrounding media. Contamination of the structures will determine their appropriate disposition, if excavated. Indication of the extent of additional contamination, if any, is needed to define preliminary remediation goals. Scheduling of subsequent voluntary corrective actions will depend on the availability of an appropriate disposal facility. The general approach is diagrammed in Fig. 4-3.

Near-surface sampling:

Buried outfalls or tiled leach fields are associated with several of the septic systems. These are generally constructed 4-8 ft below grade. Surface geophysics may be useful in determining their boundaries and the locations of tiles. Drill holes will provide samples from the depth of the outfall or tiles down to the bottom of the disturbed area. A flow diagram illustrating the proposed investigations is shown in Fig. 4-4. The site of TA-33-21, where the former septic and drainage systems have been removed, will be investigated similarly.

Landfills:

TA-33 includes two landfills that were established during the 1984 site cleanup. Radioactive materials were not buried in these landfills, but it is possible that some of the buried materials may have been contaminated with low levels of hazardous contaminants. The approach to determining contaminant levels in these landfills is diagrammed in Fig. 4-5. A similar approach will be used for the debris pile near the South Site shot pad and at a possible shallow burial disposal site near berm TA-33-43 at South Site (SWMU 33-010[h]).

Berms:

Each of the three former firing sites at TA-33 includes barricades of soil and tuff and the remains of catcher boxes into which projectiles were fired. It is not known whether all of these projectiles were removed, although most were recovered for post-shot analysis. Many of these inert projectiles were made from depleted uranium. Both the

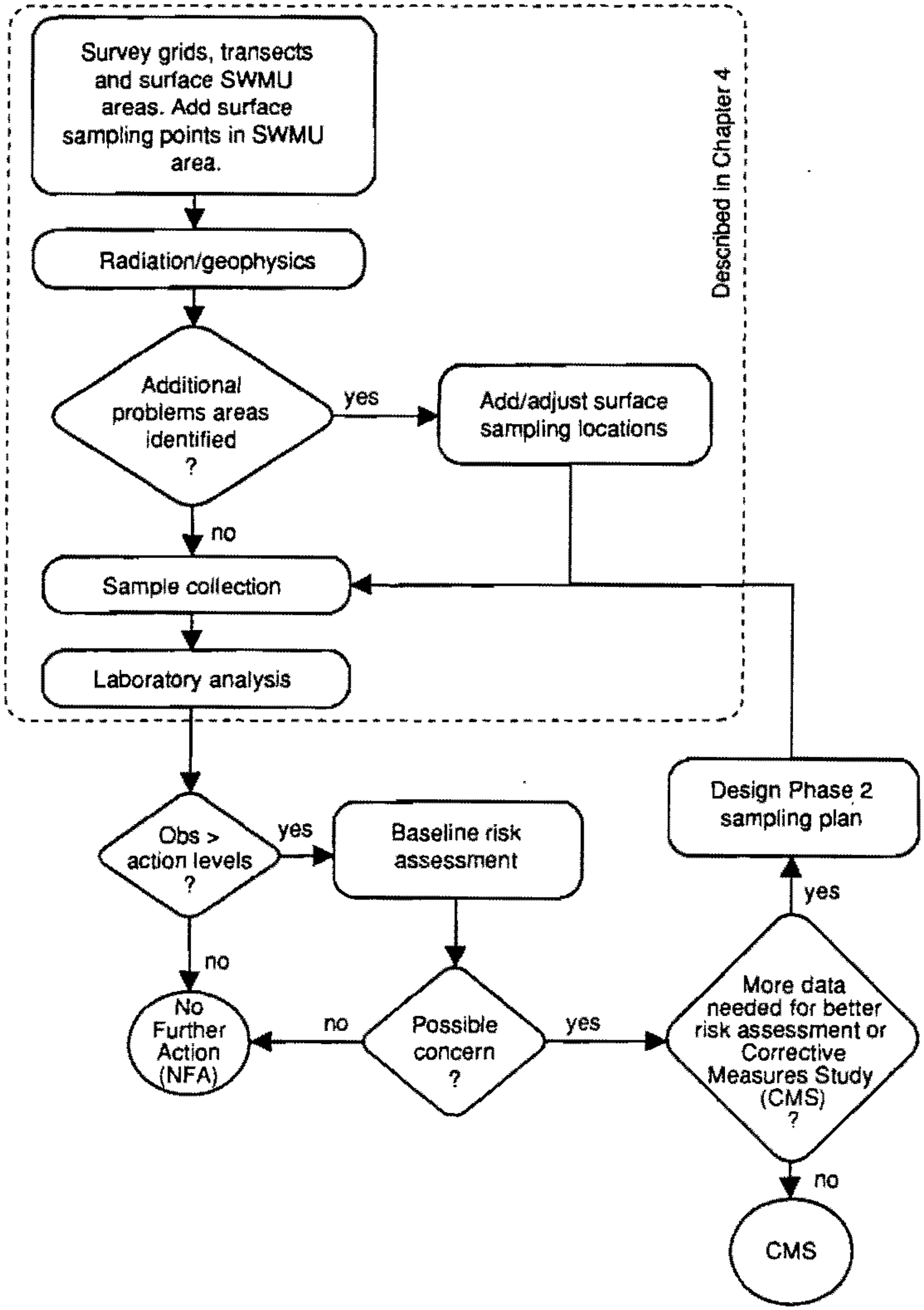

Fig. 4-1. Sampling logic and flow: surface sampling.

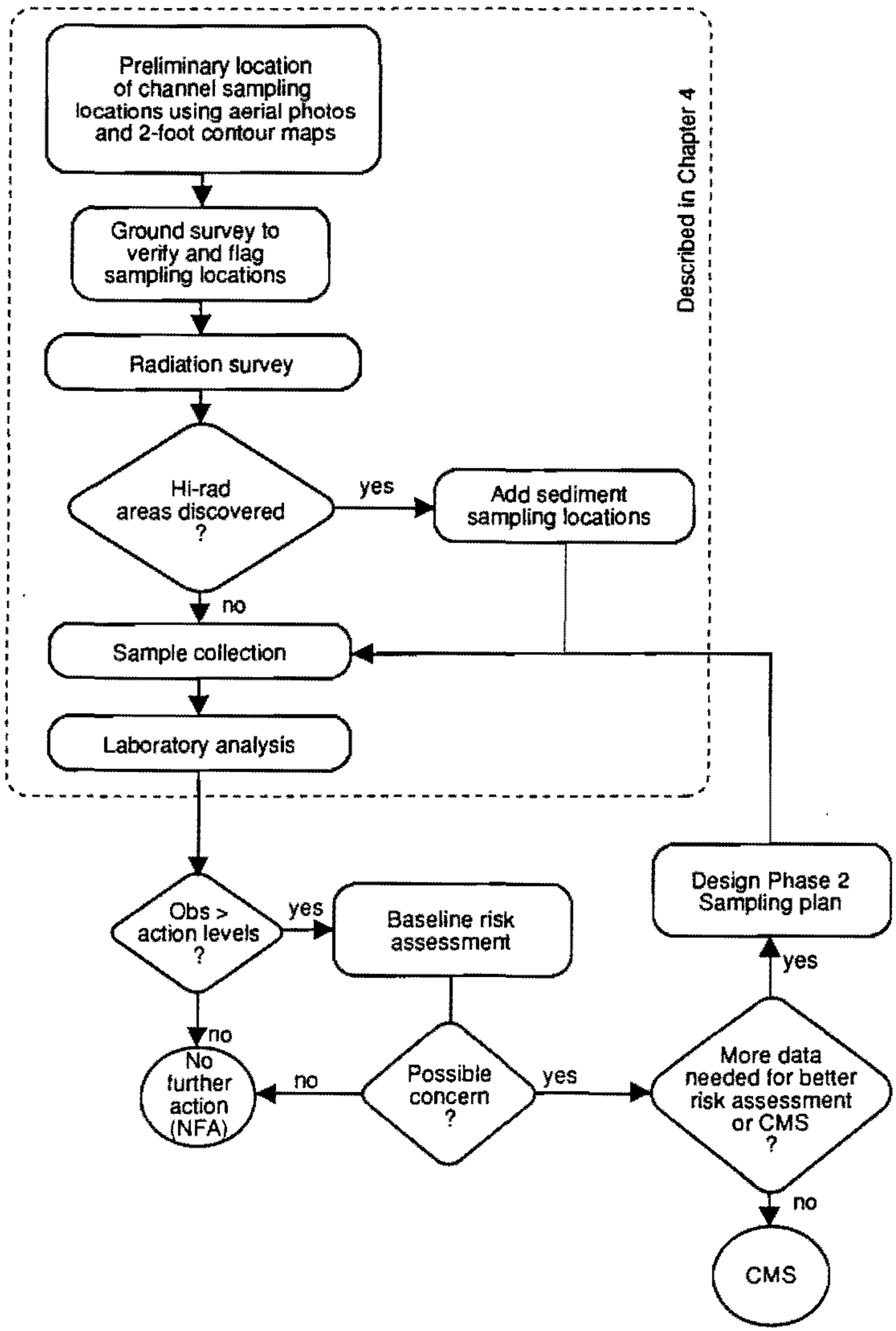

Fig. 4-2. Sampling logic and flow: channel sediments.

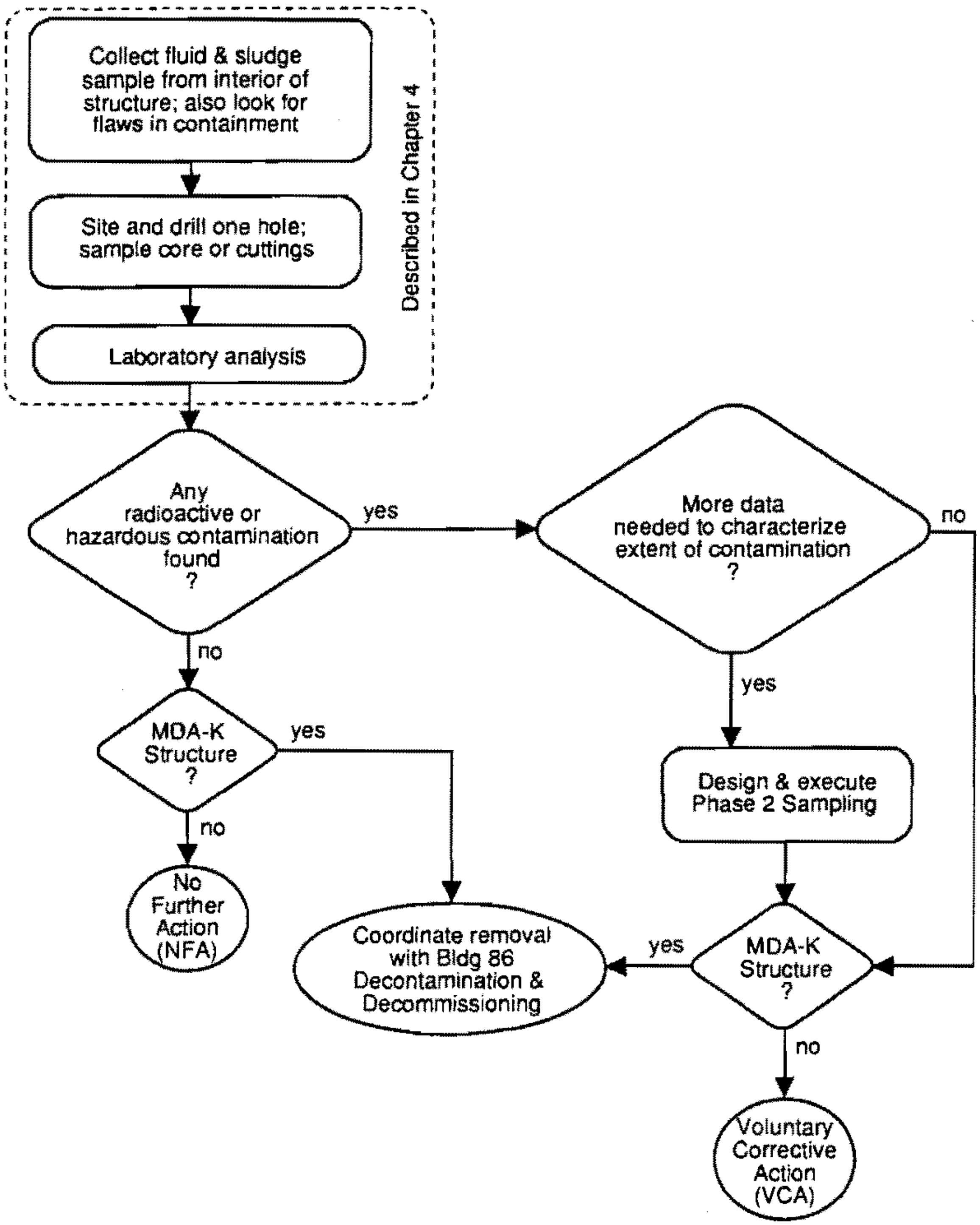

Fig. 4-3. Sampling logic and flow: subsurface structures.

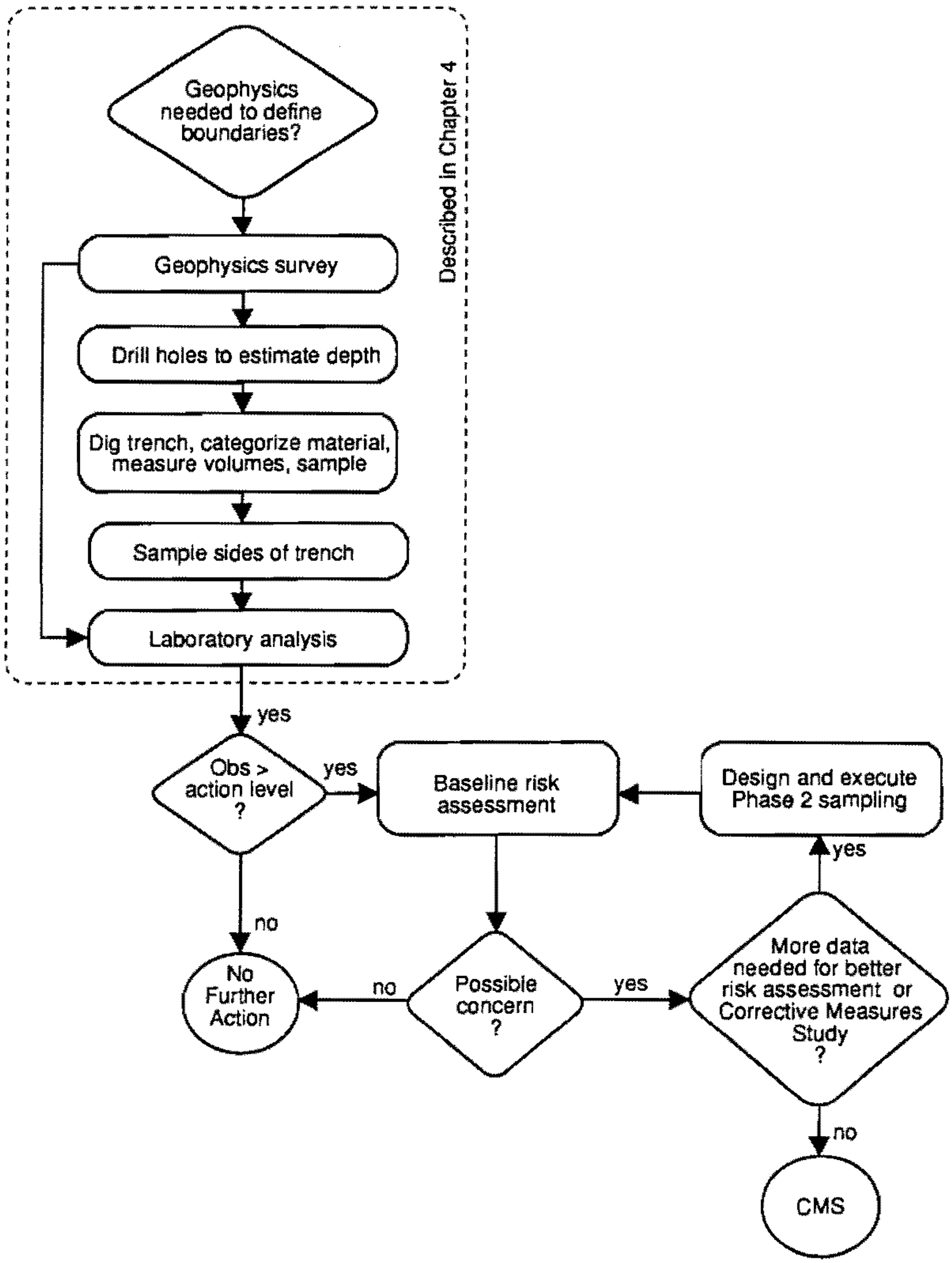

Fig. 4-4. Sampling logic and flow: near-surface sampling.

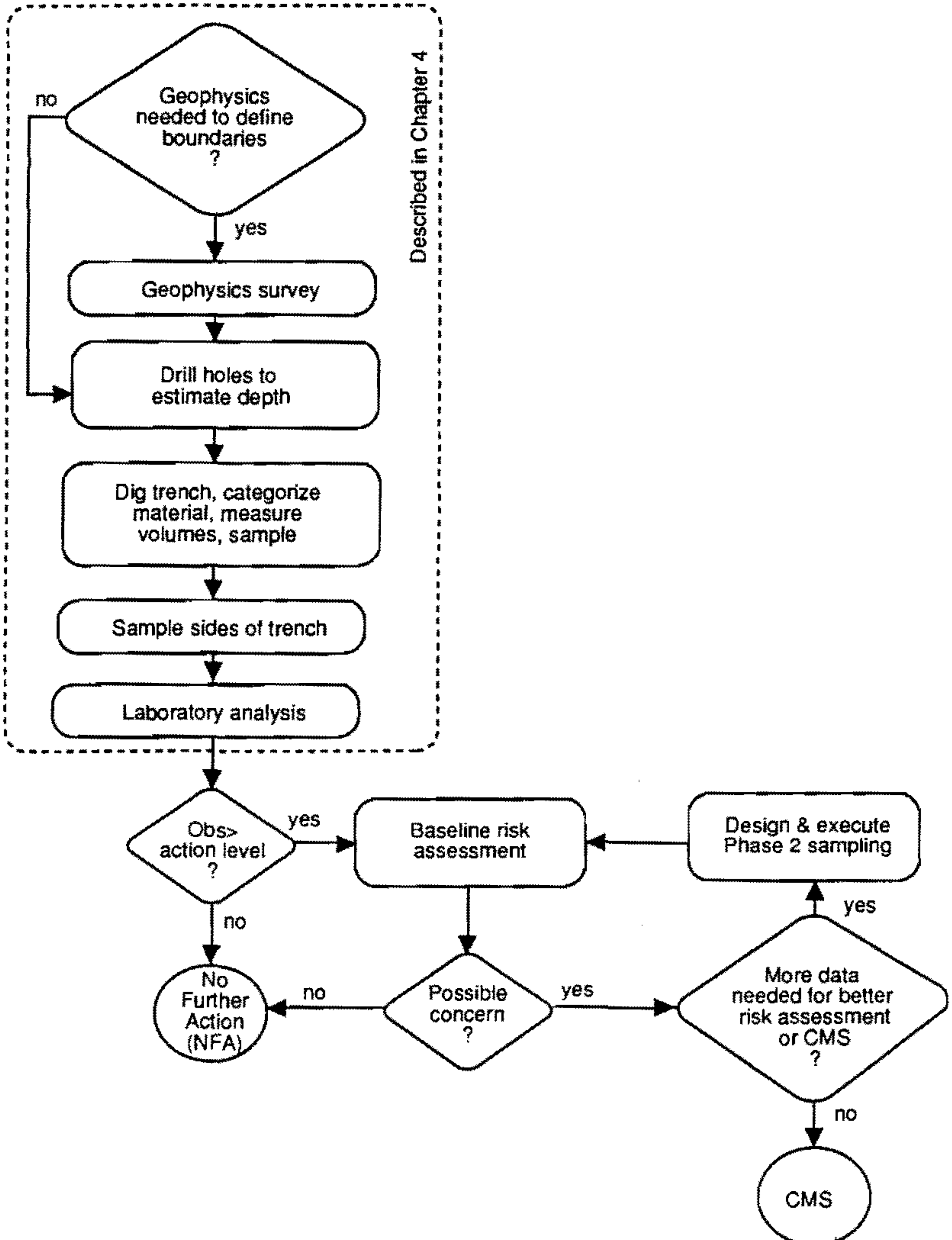

Fig. 4-5. Sampling logic and flow: landfills.

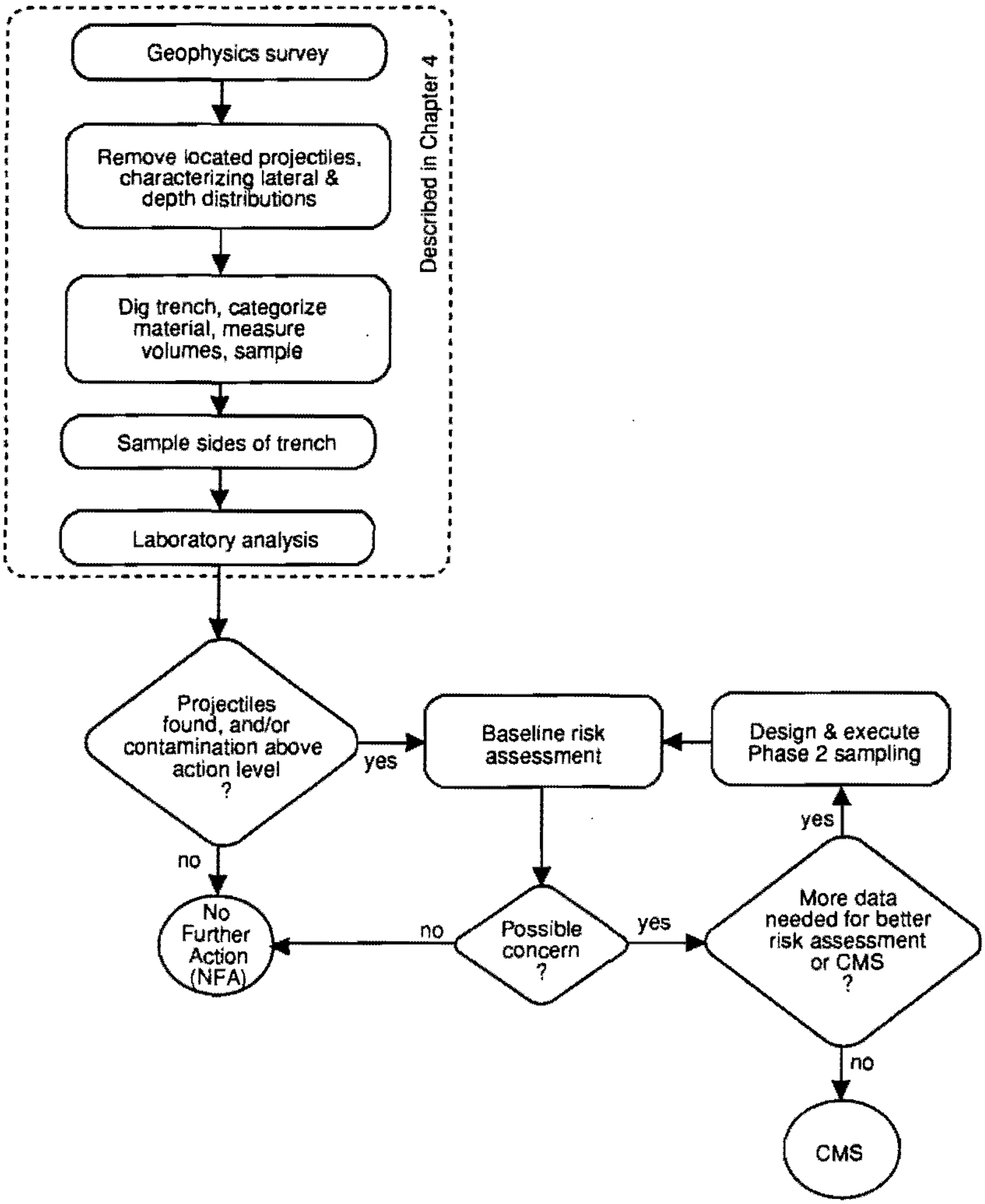

Fig. 4-6. Sampling logic and flow: berms.

quantity of depleted uranium present as projectiles in the berms and the level of contamination in the soil will be estimated. These investigations are diagrammed in Fig. 4-6.

In addition to the generic sampling approaches outlined above, there are some sites with unique problems. These are:

MDA-K:

Surface soil contamination and outfalls will be addressed by surface and channel sampling plans (Figs. 4-1 and 4-2). The two sumps and the septic system with its leach field will be investigated as illustrated in Figs. 4-3 and 4-4. The remaining uncertainties at MDA-K concern the deep plume of tritiated water observed in one of the holes drilled by Weston (Section 3.2.4). Because this hole reached a depth of only 175 ft (the maximum accessible by the drilling rig used) the depth of this plume is unknown, nor has subsurface hydrology been explored at this site. Additional investigations to complete the model of subsurface transport of tritium (and possibly other, slower moving contaminants), on which the choice of a corrective measure (if any) must be based, are diagrammed in Fig. 4-7.

MDA-E:

As outlined in Section 3.4.5.1, the suitability of MDA-E for a disposal site for mixed waste is uncertain. Some of the studies proposed to address this uncertainty will be carried out in TA-70, where a large landslide can be observed. Additional geologic characterization is required near MDA-E itself, and some decisions of a purely regulatory or administrative nature will also need to be made. These investigations are summarized in Fig. 4-8.

Seepage pits:

Finally, the two active Main Site seepage pits pose some unusual problems. Being of relatively recent construction, they may not have received either hazardous or radioactive material. Borehole logging methods will be applied to detect radioactivity in the fill material. Fluid and gravel from the bottoms of the pits will be sampled. Limited assessment of the migration of contaminants beyond the pits may also be undertaken, as shown in Fig. 4-9.

4.2 Main Site Phase I Field Sampling Plans

4.2.1 Site Mapping

Detailed site mapping is needed to accurately locate SWMUs in the field and lay out grids for geophysical and radiation surveys, as well as locations for drilling and surface sampling.

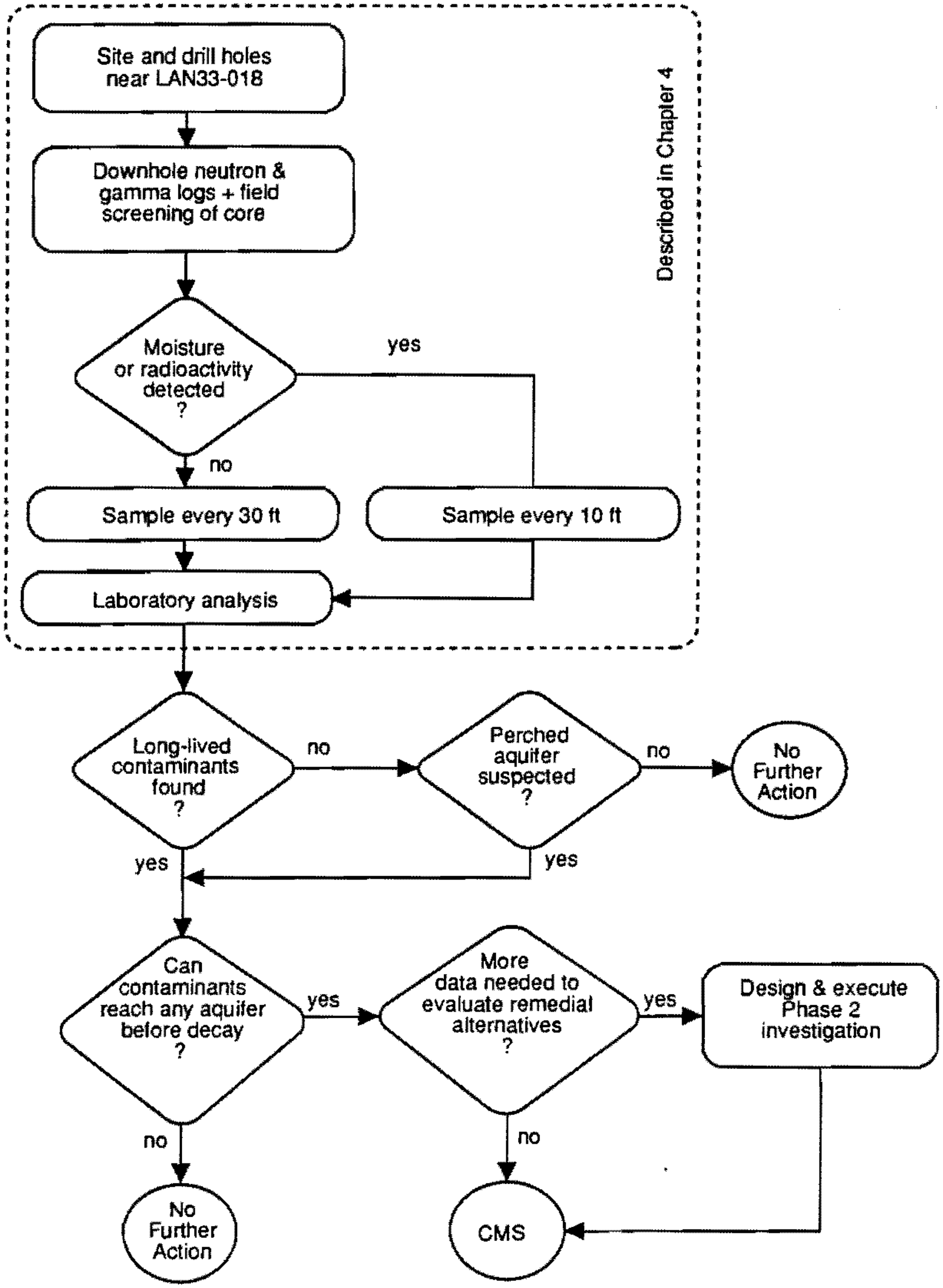

Fig. 4-7. Sampling logic and flow: MDA-K boreholes.

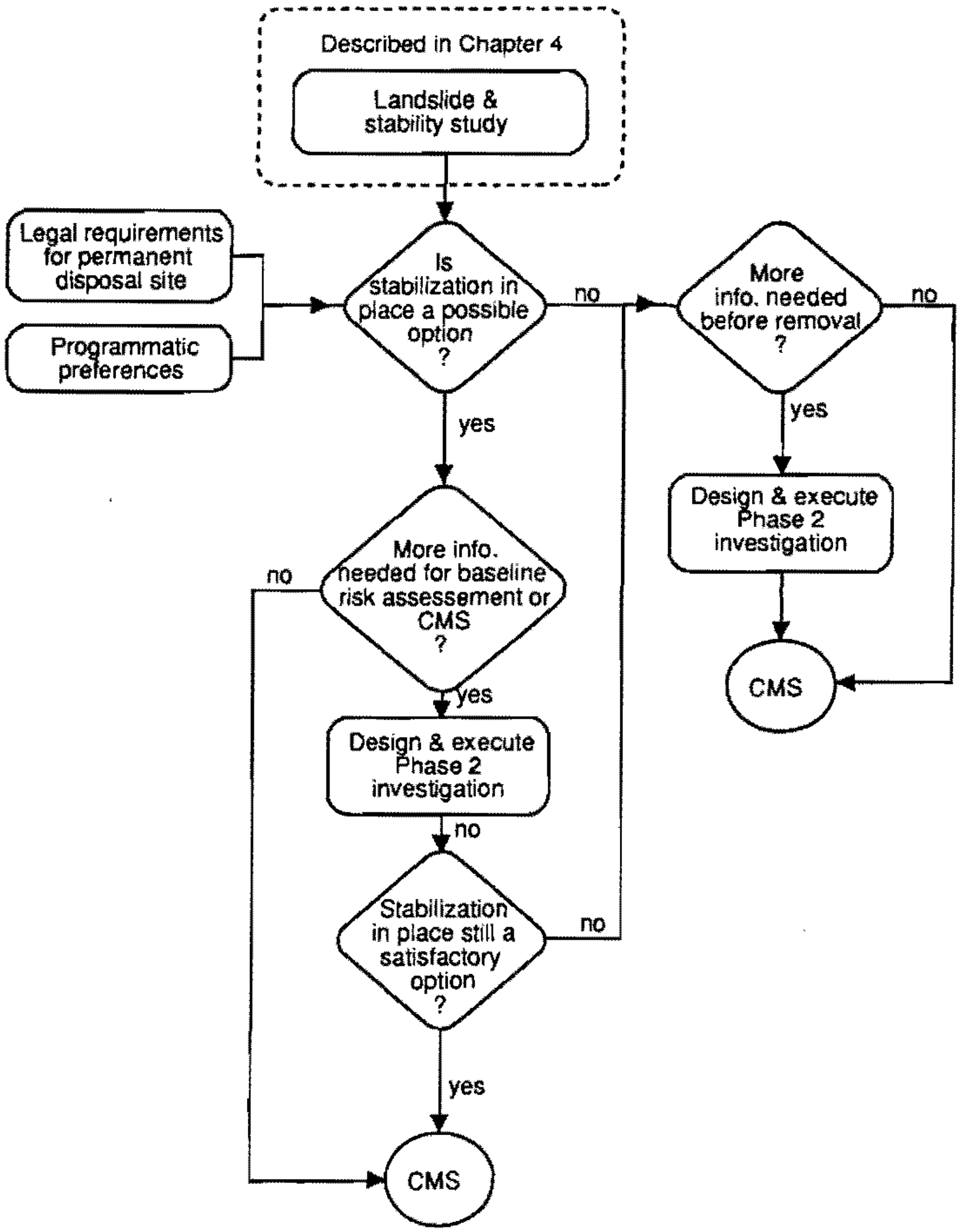

Fig. 4-8. Sampling logic and flow: MDA-E.

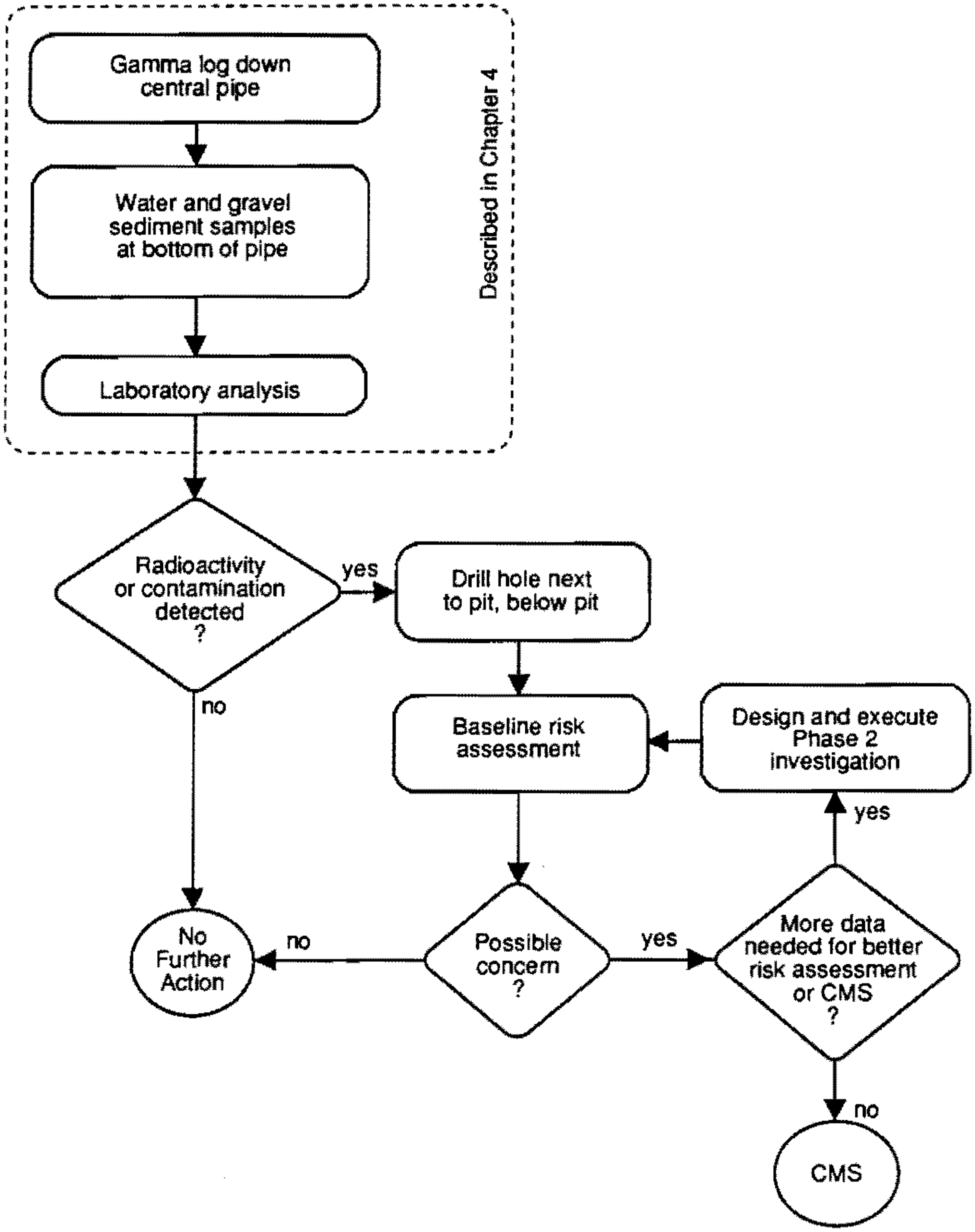

Fig. 4-9. Sampling logic and flow: seepage pits.

4.2.1.1 Field Identification of SWMUs

The following outfalls will be located, surveyed, and flagged:

33-002(d) Noncontact cooling water drain from TA-33-86;

33-002(e) Roof drain from TA-33-86;

33-004(h) Drain line from TA-33-20;

33-004(i) Two drain lines from TA-33-39;

33-005(a) Channel from outfall from former septic tank TA-33-32;

33-005(b) Outfall from former contamination-free drain line from TA-33-21; and

33-016 Outfall from sump TA-33-23.

Other drainage points from the paved areas, notably points near septic tank TA-33-31 and east of TA-33-20, will also be surveyed and flagged.

The boundaries of the following sites will be mapped as accurately as possible on the basis of present information;

33-002(a) The leach field for septic tank TA-33-93. The geophysical survey, Section 4.2.2.1, may pinpoint this area more precisely and determine the location of the pipes within the leach field;

33-004(a) The drain field for septic tank TA-33-31. The geophysical survey, Section 4.2.2.1, may pinpoint this area more precisely and determine the location of the pipes within the leach field;

33-005(a,c) The site of the former septic tank and the leach field from the industrial waste drain from TA-33-21;

33-010(f) Surface disposal site in MDA-K, about 330 ft southeast of the TA-33-93 signs;

33-011(a) The former drum storage area at TA-33-21;

33-011(d) The former storage area south of TA-33-20;

33-011(e) The former drum storage area behind TA-33-22;

33-012(a) The former drum storage area behind TA-33-39;

33-013 The former drum storage area behind TA-33-86; and

33-017 The vehicle maintenance area east of TA-33-39.

4.2.1.2 Grids for Geophysical Surveys

The areas for the geophysical survey are shown in Fig. 4-10. North-south lines will be surveyed at 10-ft intervals across a quadrant east of the pavement surrounding the Main Site office complex, with corners at approximately:

Corner	East	North
Southwest	498,550	1,739,750
Northwest	498,550	1,740,450
Northeast	498,800	1,740,450
Southeast	498,800	1,739,750

Measurement points will be flagged at 10-ft intervals along these lines. Over the drain fields, this spacing will be halved to 5 ft. This includes the former drain field for TA-33-31, within:

Corner	East	North
Southwest	498,650	1,740,300
Northwest	498,650	1,740,450
Northeast	498,800	1,740,450
Southeast	498,800	1,740,300

and the leach field for TA-33-93 in MDA-K, within:

Corner	East	North
Southwest	498,600	1,739,750
Northwest	498,600	1,740,050
Northeast	498,800	1,740,050
Southeast	498,800	1,739,750

4.2.1.3 Grid for Radiation Survey

A radiation survey will be carried out over a 100-ft grid encompassing the central area of Main Site; along four extensions to the northeast, east, southeast, and parallel to the west road; at additional points near TA-33-20; and in the main channel draining the site to the east (Fig. 4-11). The 100-ft square grid is bounded by:

Corner	East	North
Southwest	497,900	1,739,600
Northwest	497,900	1,740,600
Northeast	499,100	1,740,600
Southeast	499,100	1,739,600

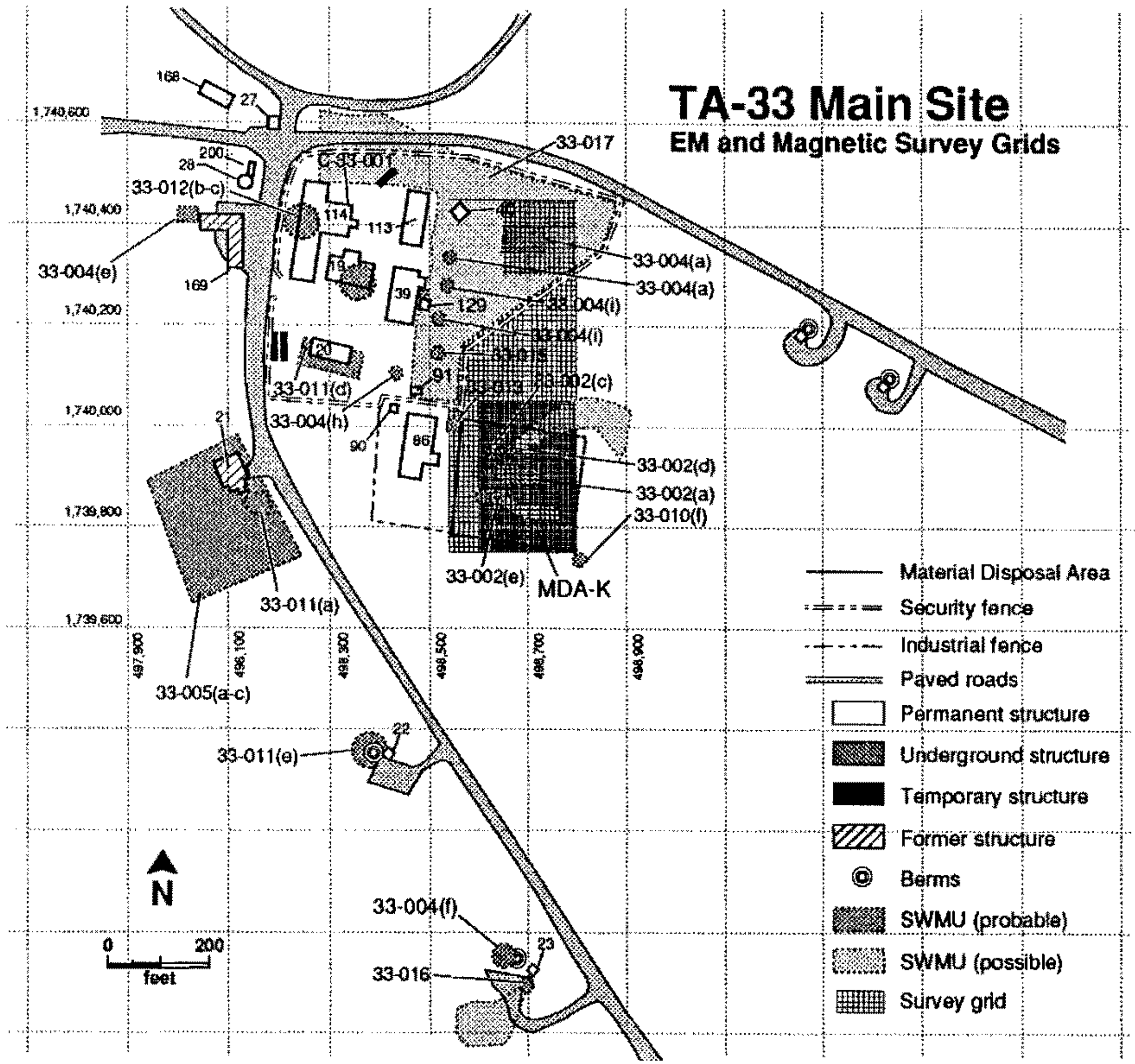

Fig. 4-10 Electromagnetic and magnetic surveys at Main Site.

(The grid shown in Fig. 4-11 can be randomized using either or both of the methods discussed in Section 4.1.2, but the grid should cover approximately this area and include approximately 130 points.)

Several extensions will be surveyed as follows:

- An east extension, starting at approximately 499,100E, 1,739,900N and surveyed for 1 000 ft to the east, with measurement points flagged at 100-ft intervals.
- A southeast extension, starting at approximately 499,100E, 1,739,600N and surveyed for 1 000 ft to the southeast, with measurement points flagged at 100-ft intervals.
- A northeast extension, starting at 499,100E, 1,740,600N and surveyed for 1 000 ft to the northeast (to approximately the bottom of Ancho Canyon), with measurement points flagged at 100-ft intervals.
- An extension starting at 498,200E, 1,739,600N and surveyed parallel to the west road (approximately south-southeast) to TA-33-23, with measurement points flagged at 100-ft intervals.

Additional small scale grids (approximately 10-ft spacing) will be surveyed over the following localized SWMUs:

- over the drain field of SWMU 33-002(a) and surface disposal site, SWMU 33-010(f) in MDA-K;
- over the drain field of SWMU 33-004(a);
- over the paved area south of TA-33-20 (SWMU 33-011[d]); and,
- over SWMU 33-011(e), SWMU 33-012(a), and SWMU 33-013.

4.2.1.4 Channel Mapping

A sampling location will be selected in the largest sediment catchment within 5 ft of each of the outfalls and within 10 ft of the drainage points located in Section 4.2.1.1. (If there is no sediment catchment within the prescribed distance, a surface soil sampling location should be selected below the outfall or drainage point.) Additional sediment catchments (or soil sampling locations) will be flagged along the first-order channels at approximately 50-ft intervals for 250 ft or until the first-order channel merges with the nearest second-order tributary of Chaquehui Canyon. To the east of the paved area, surveying and flagging of this second-order tributary will continue at approximately 200-ft intervals for a distance of approximately one-half mile. (The second-order tributary to the west, which also drains Area 6, is treated in Section 4.3.1.4.)

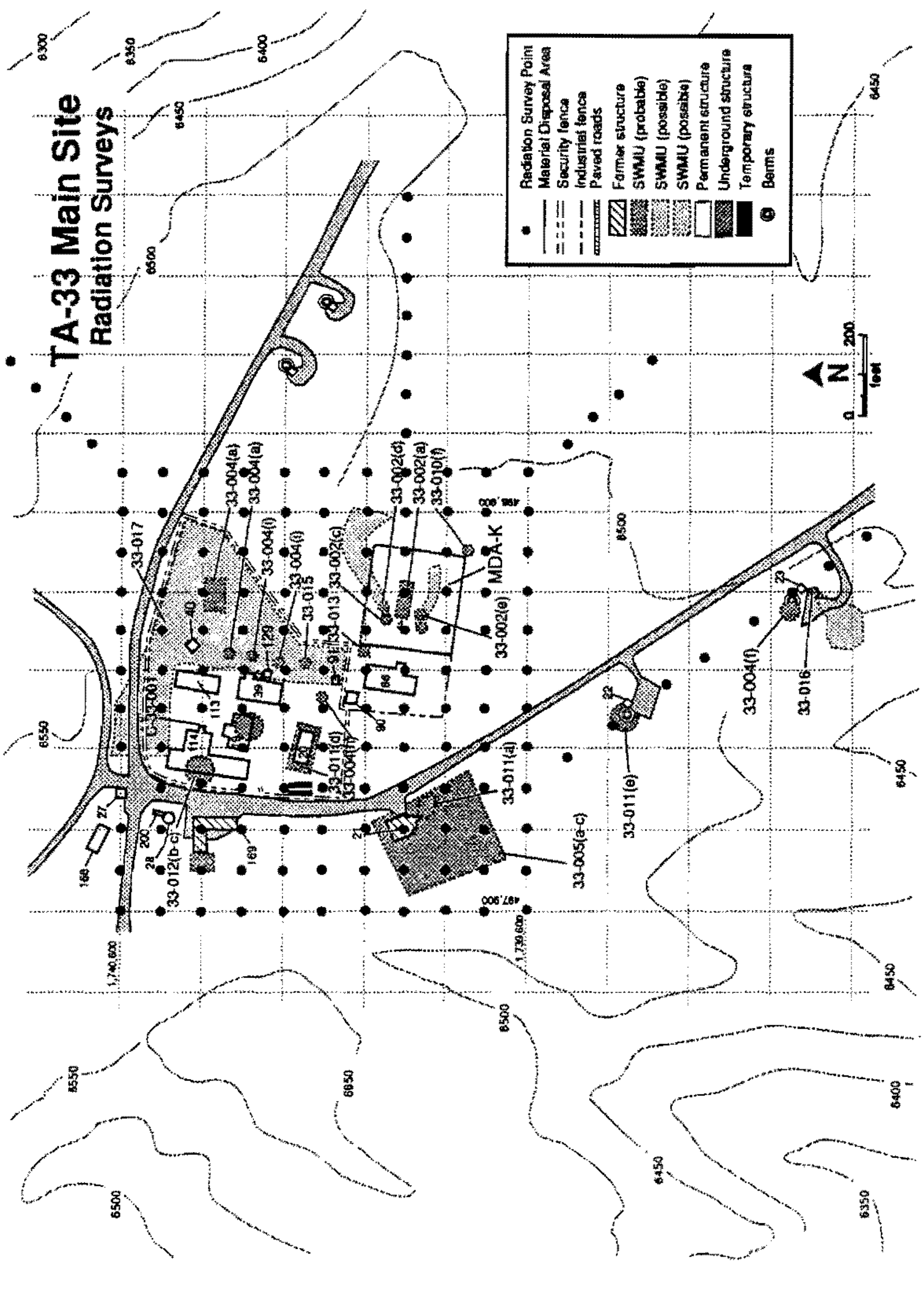

Fig. 4-11. Radiation surveys at Main Site.

4.2.2 Field Surveys

4.2.2.1 Geophysical Survey

Electromagnetic and magnetic readings will be reported at each node of the 5- and 10-ft grid in Fig. 4-10. These data will be used to delineate drain fields, locate drain lines, and define saturated areas.

4.2.2.2 Radiation Survey

Low-energy gamma radiation measurements for the detection of uranium, plutonium, and americium will be reported at each point of the 100-ft grid described in Section 4.2.1.3 (Fig. 4-11). The survey will also be carried out along the four extensions, with observations every 100 ft to determine if trends in activity with distance from the site exist.

Low-energy gamma radiation measurements will be made at the centers of the sediment catchments flagged by the channel mapping activity, both to locate areas of concentration and to look for trends with distance from the site.

Radiation measurements will be made at the nodes of the finer grids over SWMUs 33-002(a), 33-004(a), 33-010(f), 33-011(d), 33-012(a), and 33-013 to look for local anomalies to guide sample selection as described in Section 4.2.3.1.

4.2.3 Surface Sampling

4.2.3.1 Samples from Identified SWMUs

Several localized SWMUs, as well as the area behind TA-33-39 believed to have been used for vehicle maintenance and storage, are potentially contaminated.

Surface samples taken at septic systems are not necessarily intended to characterize the septic systems but are an economical means of collecting surface samples. Two to five soil samples will be collected within each of these small areas, as follows:

33-002(a) (Septic tank TA-33-93 and drain field) Five surface samples will be collected. Three will be the top six inches of drilled holes next to the septic tank and in the drain field (see Section 4.2.4). The other two may be sited above the drain field, randomly, or on the basis of the geophysical or radiation survey.

33-004(a) (Septic tank TA-33-31 and drain field) Six surface samples will be collected. Three will be the top six inches of holes drilled next to the septic tank and in the drain field (see Section 4.2.4). The others (which include a field duplicate) may be sited randomly or on the basis of the geophysical or radiation survey.

33-005 (Excavated drain field area for TA-33-21) Five surface samples will be provided by the top six inches of the drilled holes (see Section 4.2.5). Additional surface samples at this site are provided by the grid, Section 4.2.3.2.

33-010(f) (Surface disposal site in MDA-K) Two surface samples will be collected. These will be sited on the basis of visual evidence or radiation anomalies, if any.

33-011(a) (Former drum storage area near TA-33-21) Three samples will be collected in this area. These will be sited on the basis of visual evidence of past leaks, such as stained soil, if any.

33-011(d) (Former storage area south of TA-33-20) Three samples will be collected, by drilling through the pavement on the south side of the warehouse and collecting specimens from the top six inches of the underlying soil or tuff. If anomalies are observed during the radiation survey over this SWMU, two chip samples will be collected from the pavement and analyzed for radionuclides and metals.

33-011(e) (Former drum storage area behind TA-33-22) Three samples, including one field duplicate, will be collected. These may be sited on the basis of radiation anomalies or visual evidence of leaks, if any.

33-012(a) (Former drum storage area behind TA-33-39) Four samples will be collected in this area. If the area is paved, two will be collected by drilling through the pavement and collecting specimens from the top six inches of the underlying soil or tuff, and two from the downslope edge of the pavement. The samples will be sited on the basis of radiation anomalies or visual evidence of leaks, if any.

33-013 (Former drum storage area at TA-33-86) Three samples will be collected. If the area is paved, one will be collected by drilling through the pavement and collecting specimens from the top six inches of the underlying soil or tuff, and two from the downslope edge of the pavement. The samples will be sited on the basis of radiation anomalies or visual evidence of leaks, if any.

33-015 (Incinerator) Two samples will be collected adjacent to the concrete pad on which the incinerator sits. The samples will be sited on the basis of visual evidence, such as stained soil or residual ash, if any is noted.

33-017 (Vehicle maintenance area behind TA-33-39) Three surface samples, including a field duplicate, will be collected from this area. These will be sited on the basis of soil staining, if any.

Additional localized areas may be sampled (at the rate of approximately 2 samples per 100 or 200 ft^2) as identified by the geophysical or radiation survey. Sample sizes, field duplicates, and sample analyses for these localized surface SWMUs are indicated in Table 4-A (included at the end of Chapter 4). Sample maxima will be compared with action levels.

One additional surface area of concern (33-C-001, transformer behind TA-33-114), is noted in the SWMU report. PCB analyses will be performed on some sediment samples in the main drainage below this area (Section 4.2.3.3). The sample maximum will be compared with the regulatory limit for recording PCB contamination.

4.2.3.2 Outfall and Channel Sediment Samples

Six outfalls from drain lines have been identified as SWMUs. The east-sloping paved area around the Main Site office complex, on which several SWMUs are located, drains into the east-flowing tributary to Chaquehui Canyon. Sediment (or soil) will be sampled at the flagged locations near the ends of the pipes and the edges of the pavement and additional samples will be collected in the first-order channels, as follows.

33-002(d) (Non-contact cooling water from TA-33-86; this outfall is usually running) One sediment sample and one water sample will be collected within three feet of the end of the pipe, two sediment samples and one water sample (if possible) from the saturated zone where cattails grow, and one more sediment sample and one more water sample (if possible) above the point where this first-order channel merges with the second-order tributary.

33-002(e) (Roof drain from TA-33-86) One sediment (or soil) sample will be collected within three feet of the end of the pipe and two more along the channel between this point and the point where it merges with second-order tributary.

33-004(h) (Outfall from TA-33-20, to be located) One sample and one field duplicate will be collected within three feet of the end of the pipe. Two more samples will be collected in the drainage below this outfall, one of which will be below the incinerator.

33-004(i) (Outfalls from TA-33-39, to be located. Channels may not be well defined.) One sample will be collected within two feet of the end of each pipe, and two more in each channel, if still distinct.

33-005(a,b) (Channels below former outfalls from TA-33-21) The channels below the septic system and drain line outfall will be sampled at three points, once near the outfall and twice below (but above the second-order tributary draining Area 6).

33-016 (Outfall from TA-33-23 sump) Two samples will be collected within 2 ft of the end of the pipe, and one more about 100 ft below.

33-017 (The second-order channel to the east of Main Site that starts near septic tank TA-33-31) Two samples will be collected below the edge of the pavement, two additional samples between the pavement and the security fence to the east, two more samples between the fence and joining where this channel merges with the channels below the outfall from TA-33-86. Near this point, where sediments are quite deep, three samples will be collected, one from a depth of 6 to 18 in. Thereafter samples will be collected every 400 ft as mapped in Section 4.2.1.4.

Sample sizes, field duplicates, and sample analyses are tabulated in Table 4-A. Sample maxima will be compared with action levels.

4.2.3.3 General Operational Releases

Operational releases from Main Site will be addressed by the drainage samples discussed at the end of Section 4.2.3.2 and by an extensive sample of surface soils, discussed in this section.

Surface soil samples will be collected at 25% of the points of the surface radiation grid; that is, on a 200-ft subgrid, for a total of about 36 samples. A small number of these may fall within areas associated with localized SWMUs such as SWMUs 33-002 or 33-005. Surface soil samples will not be collected at points that fall in paved areas. The four extensions of the surface radiation grid, to the northeast, east, southeast, and parallel to the west road, will be sampled at 300-ft intervals, for a total of about 16 samples. Sample sizes, field duplicates, neighbors, and sample analyses are shown in Table 4-A, under SWMU 33-017, "operational release." Observations will be summarized by overall means, trend estimates, and/or local means. Neighbors and field duplicates will be used in estimating the variability and spatial predictability of contaminant distributions.

4.2.4 Samples from Subsurface Structures

One fluid sample and one sludge (or soil) sample will be taken from each of the sumps in MDA-K (TA-33-134 and TA-33-133), from the sump at TA-33-23, and from each of the active septic tanks (TA-33-31 and TA-33-93), assuming both components are present. An additional fluid sample will be collected from the sampling box associated with TA-33-31. The material will not be homogenized. A hole will be drilled next to each sump and tank, and samples will be collected from the depth of the bottom of the structure and at the soil/tuff interface or three feet below that point, whichever is shallower.

One fluid sample will be collected from the central pipe of each seepage pit in SWMU 33-004(a) and one gravel sample will be collected from the base of each pipe. Gamma logs will also be run down the central pipe.

Two holes will be drilled through each of the drain fields associated with septic tanks TA-33-31 and TA-33-93. The holes will be drilled to three feet below the tiles, or to the soil/tuff interface, whichever is shallower. A specimen from the top six inches of each hole will be included in the surface sample (Section 4.2.3.1). Additional samples will be taken from just below the tiles and from the bottom of the hole.

Sample sizes, field duplicates, and sample analyses are summarized in Table 4-A. Sample maxima will be compared with action levels, and also (for active septic systems) with regulatory levels.

4.2.5 Subsurface Sampling at TA-33-21 Site

Four holes will be drilled to the soil/tuff interface in the former drain field area of the TA-33-21 site and a fifth hole at the site of the former septic tank. A specimen from the top six inches of each hole will be included in the surface sample (Section 4.2.3.1). Additional samples will be collected at two and one-half foot intervals to the bottom of the hole. Sample size, field duplicates, and sample analyses are summarized in Table 4-A. Observations will be summarized by their means, possibly as a function of depth.

4.2.6 Subsurface Sampling at MDA-K

Three boreholes will be drilled at MDA-K at locations to be determined based on results from geophysics surveys. The anticipated depth is 200 ft, but if contaminants are still present at this depth, drilling will continue. The core will be field screened for radioactivity, and neutron and gamma logs will be run to determine the presence of moisture and radionuclides. The core will be sampled at 30-ft intervals throughout its length, and at 10-ft intervals within the regions identified by these field-screening activities. Twenty-five per cent of the sample will be analyzed for radionuclides, metals, and organics. The remainder will be analyzed only for tritium. Sample analyses are summarized in Table 4-A

4.3 Area 6 Phase I Field Sampling Plans

4.3.1 Site Mapping

Detailed site mapping is needed to locate SWMUs accurately in the field, as well as to lay out grids for geophysical and radiation surveys and locations for surface and subsurface sampling.

4.3.1.1 Field Identification of SWMUs

The outfall from TA-33-16 (SWMU 33-004[g]) and the buried outfall of septic tank TA-33-121 (SWMU 33-004[d]) will be located and flagged. Pavement drainage points and, in particular, the point at which the area around the buildings drains out to the northwest-facing slope, will be surveyed and flagged.

4.3.1.2 Grid for Geophysical Survey

The only geophysical survey at Area 6 will be conducted over the hillside south and east of the firing areas, within:

Corner	East	North
Southwest	497,500	1,740,250
Northwest	497,500	1,740,450
Northeast	497,700	1,740,450
Southeast	497,700	1,740,250

and excluding the leveled area inside the cinder cone. A five-foot grid will be laid out in this area, as shown in Fig. 4-12.

4.3.1.3 Grid for Radiation Survey

A 50-ft grid covering Area 6 firing areas (the cinder cone, the area south of TA-33-16, and the slopes above) and the west slope of the cinder cone down to the west drainage channel (SWMU 33-009) will be surveyed to locate points for a radiation survey. A 15-ft grid is needed on the east-facing slope west of the east drainage channel. The grids shown in Fig. 4-13, can be randomized using either or both of the methods discussed in Section 4.1.2, as long as the surveyed areas cover approximately the areas shown there for a total of about 50 survey points on each grid.

4.3.1.4 Channel Mapping

After TA-33-16 outfall and pavement drainage points have been mapped (Section 4.3.1.1), sampling locations within three feet of each will be located. A sediment catchment is to be selected if possible within this constraint, otherwise a soil sampling position is to be marked in the channel below the outfall or drainage. Additional sampling locations will be surveyed and flagged at approximately 50-ft intervals along the first-order channels to the points where they merge with the second-order tributaries to Chaquehui Canyon west of the site. Two to four sediment catchments will be located in this drainage at the base of SWMU 33-009. Additional sediment catchments will be surveyed at approximately 200-ft intervals along the west tributary, and also along the east drainage that heads near TA-33-1, to the bottom of Chaquehui Canyon, a distance of approximately one-fourth mile.

4.3.2 Field Surveys

4.3.2.1 Geophysical Survey

Electromagnetic and magnetic measurements will be made at each node of the five-foot grid in Fig. 4-12. These will be examined for anomalies that might indicate the presence of buried projectiles.

4.3.2.2 Radiation Survey

Low-energy gamma radiation measurements for the detection of uranium, plutonium, and americium will be reported at the nodes of the 50- and 15-ft grids described in Section 4.3.1.3 (Fig. 4-13). The radiation survey will also be carried down the two tributaries to Chaquehui Canyon, with observations at the flagged locations approximately every 100 ft, for approximately one-fourth mile. Measurements will be examined for anomalies that would be used to guide the sampling described in the following sections.

4.3.3 Surface Sampling

4.3.3.1 Samples from Identified SWMUs

Two to ten additional surface samples will be collected within each area that may have been contaminated by identified SWMUs:

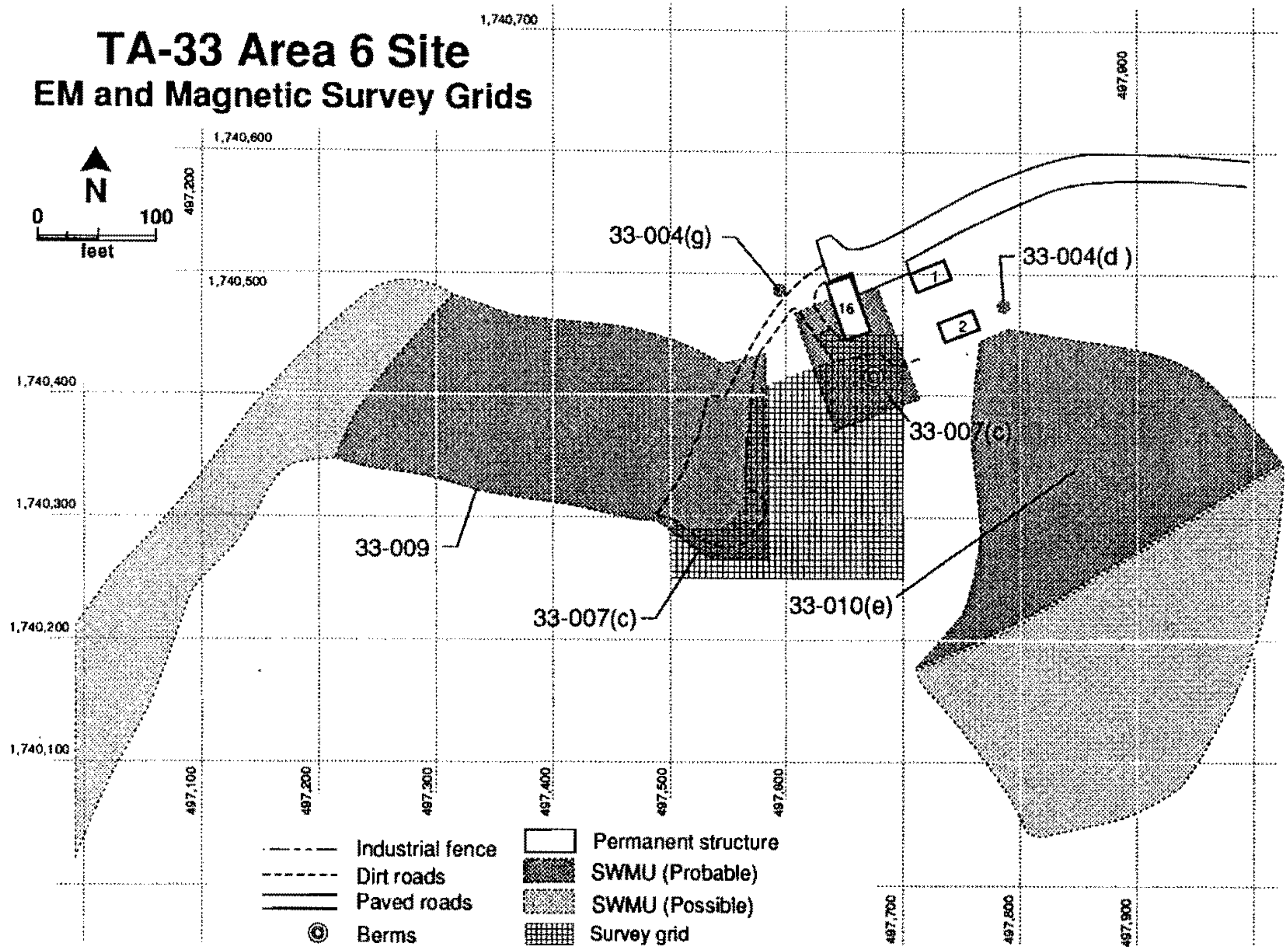

Fig. 4-12. Electromagnetic and magnetic surveys at Area 6 Site.

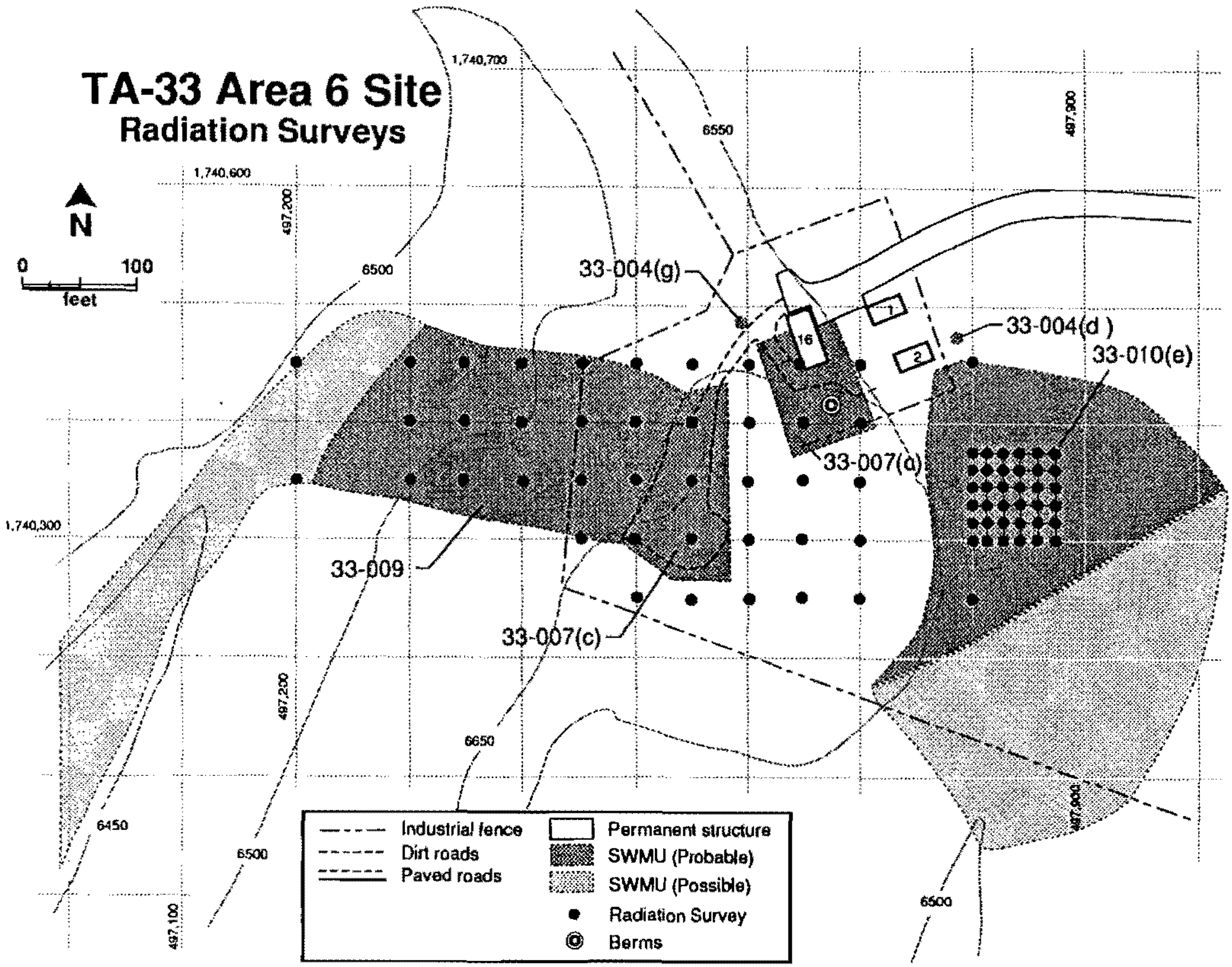

Fig. 4-13. Radiation surveys at Area 6 Site.

33-004(d) Three surface samples will be collected from the top six inches of the holes drilled near the septic tank (TA-33-121) and in its buried outfall area (Section 4.3.4). These surface samples are not necessarily intended to characterize the septic system but are an economical means of collecting surface samples.

33-007(c) Every other point of the 50-ft radiation grid covering the firing areas will be sampled. Additional samples will be collected next to each gun mount in the cinder cone. Two field duplicates will be added to the sample for a total of about 15 specimens.

33-009 Six surface soil samples will be collected at grid points on the west slope of the cinder cone below the Area 6 landfill site: two near the top, two about half way down, and two near the bottom where some debris is still visible. Placement of these samples will be guided by the anomalies observed during the radiation survey, if any. One field duplicate will be included.

33-010(e) Three surface soil samples will be collected in the area of this surface disposal site. Their locations will be based on high radiation readings or on visual evidence, if any, are found.

Additional localized areas will be sampled (at the rate of approximately 2 samples per 100-200 ft^2) if identified by the geophysical or radiation survey. Sample sizes and analyses are summarized in Table 4-B (located at the end of Chapter 4). Sample maxima (or, for the larger samples of 33-007(c) and 33-009, sample means) will be compared with action levels.

4.3.3.2 Outfall and Channel Sediment Samples

One outfall at Area 6 has been identified as a SWMU. In addition, surface runoff from the area around the firing site is channeled to the northwest. Other drainage points may be identified during site mapping (Section 4.3.1.1). Sediment (or soil) will be sampled at the flagged locations near the ends of the pipes and drainage points, and additional samples will be collected from sediment catchment basins in the first-order channels 50 to 100 ft below, if these channels can be located (as described in Section 4.3.1.4).

Two samples will be taken near the top of the east drainage, below the outfall from TA-33-121, and two near the top of the west drainage below the former surface disposal area. Continuing down these second-order channels, one sediment sample will similiarly be collected approximately every 400 ft to Chaquehui Canyon, (as described in Section 4.3.1.4).

Sample sizes and analyses are summarized in Table 4-B. Sample maxima will be compared with action levels.

4.3.4 TA-33-1 Septic System

One fluid sample and one sludge sample will be collected from septic tank TA-33-121, assuming both components are present. The material will not be homogenized.

A hole will be drilled next to the septic tank, and samples will be collected from the depth of the bottom of the tank and at the soil/tuff interface or three feet below the tank, whichever is shallower.

Two holes will be drilled through the outfall area from septic tank TA-33-121 to three feet below the end of the pipe. A specimen from the top six inches of each hole will be included in the surface sample (Section 4.3.3.1). Additional samples, (two from each hole) will be taken from just below the pipe and from the bottom of each hole.

Sample analyses are summarized in Table 4-B. Sample maxima will be compared with action levels.

4.3.5 Area 6 Berm

A 12-in. wide trench will be excavated through the berm directly opposite the south doors of TA-33-16, to a depth of 4 ft. The excavated material will be field screened for radioactivity; if any projectiles are found, a sample of them (up to three) will be submitted for laboratory analysis to determine their composition. The volume of non-native material will be estimated as a fraction of the excavated material.

Three samples, one from the top 6 in. of material, one from the next 12, and a third from a depth of 3.5-4 ft into the berm, will be collected from each side of the trench. Sample analyses are summarized in Table 4-B. Sample maxima will be compared with action levels.

4.4 South Site Phase I Field Sampling Plans

4.4.1 Site Mapping

Detailed site mapping is needed to locate SWMUs accurately in the field, as well as to lay out grids for geophysical and radiation surveys and locations for surface and subsurface sampling.

4.4.1.1 Field Identification of SWMUs

The boundaries of the disposal area, SWMU 33-010(h) and the debris pile at SWMU 33-010(c) will be surveyed and flagged. Two holes will be drilled to the fill/tuff interface at each site and also at the landfill inside berm TA-33-43, SWMU 33-008(a), to estimate the depth and volume of fill at each site. The material obtained from these initial holes will be field screened for radioactivity and explosives.

4.4.1.2 Grids for Geophysical Surveys

A geophysical survey at South Site will be conducted on the north side of the northern firing area. This area is contained within:

Corner	East	North
Southwest	499,400	1,736,500

Northwest	499,400	1,736,750
Northeast	499,800	1,736,750
Southeast	499,800	1,736,500

A five-foot grid will be laid out in this area, as shown in Fig. 4-14.

4.4.1.3 Grids for Radiation Survey and Surface Sampling

A radiation survey will be carried out on a grid in the area bounded on the north at 1,736,800N and by the fence around the east, south, and west perimeter of the site, and extending out onto the benches south and east of the site bounded by (approximately):

Corner	East	North
Southwest	499,100	1,735,600
Northwest	499,100	1,736,800
Northeast	500,300	1,736,800
Southeast	500,300	1,735,600

The grid will have a 100-ft spacing over most of the mesa top, a 200-ft spacing on the benches, and a 50-ft spacing near the shot pad as shown in Fig. 4-15. (These grid points can be randomized using either or both of the methods discussed in Section 4.1.2, as long as it covers the area shown. A north extension, from 499,600E, 1,736,900N, will be flagged every 100 ft for 500 ft.

Additional small-scale grids (20 ft spacing) will be surveyed over the two gun firing areas and the blivit storage site.

4.4.2 Field Surveys

4.4.2.1 Geophysical Surveys

Electromagnetic and magnetic measurements will be made at each node of the five-foot grid in Fig. 4-14. These will be examined for anomalies that might indicate the presence of buried projectiles.

4.4.2.2 Radiation Survey

Low-energy gamma radiation measurements for the detection of uranium, plutonium, and americium will be reported at the nodes of the grids described in Section 4.4.1.3 (Fig. 4-15) and at 100-ft intervals along the north extension. Radiation measurements will also be made at 100-ft intervals along the central channel, at the centers of the flagged sediment catchments. These will be examined for anomalies to guide surface sampling and for trends with distance from the shot pad.

TA-33 South Site
EM and Magnetic Survey Grids

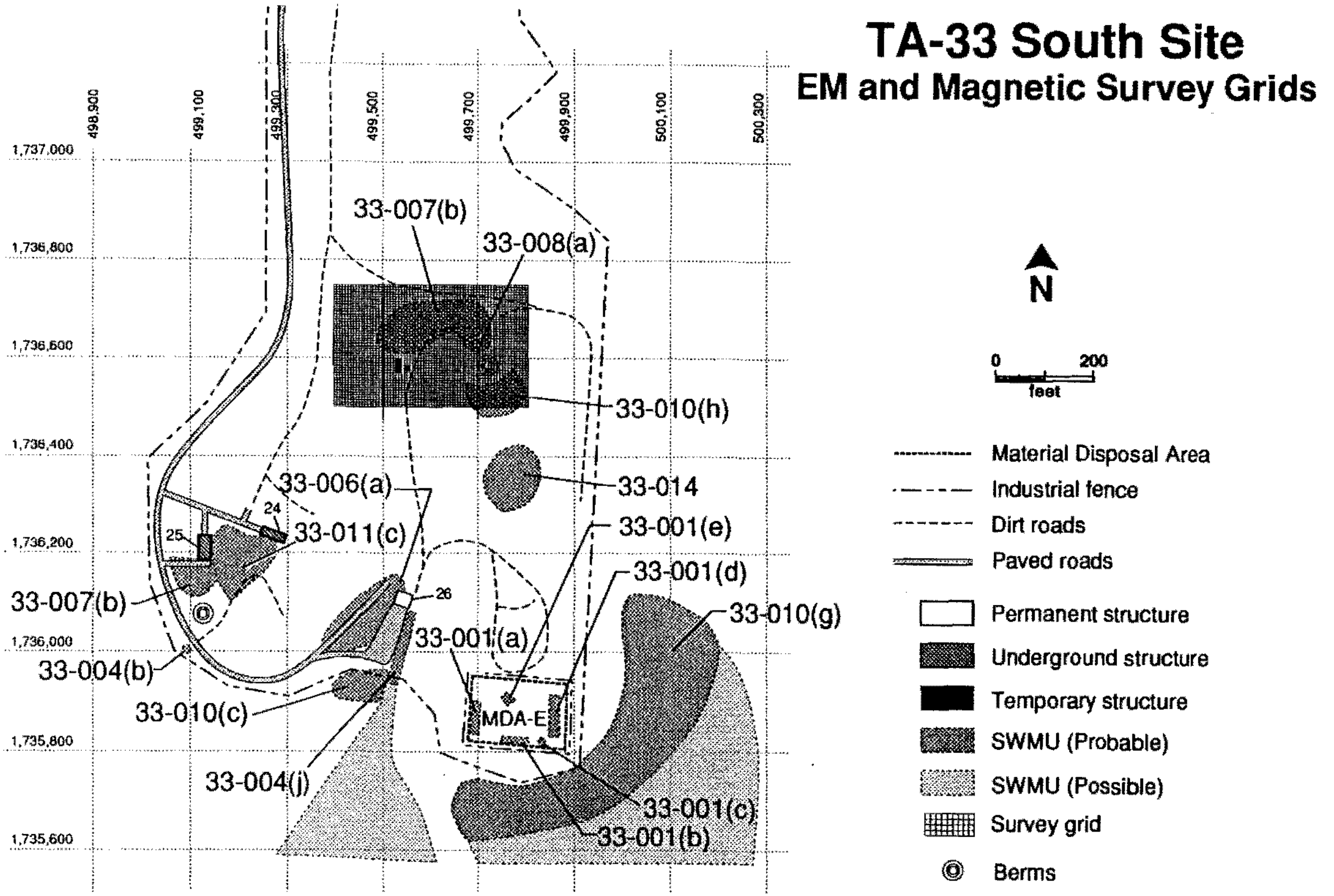

Fig. 4-14. Electromagnetic and magnetic surveys at South Site.

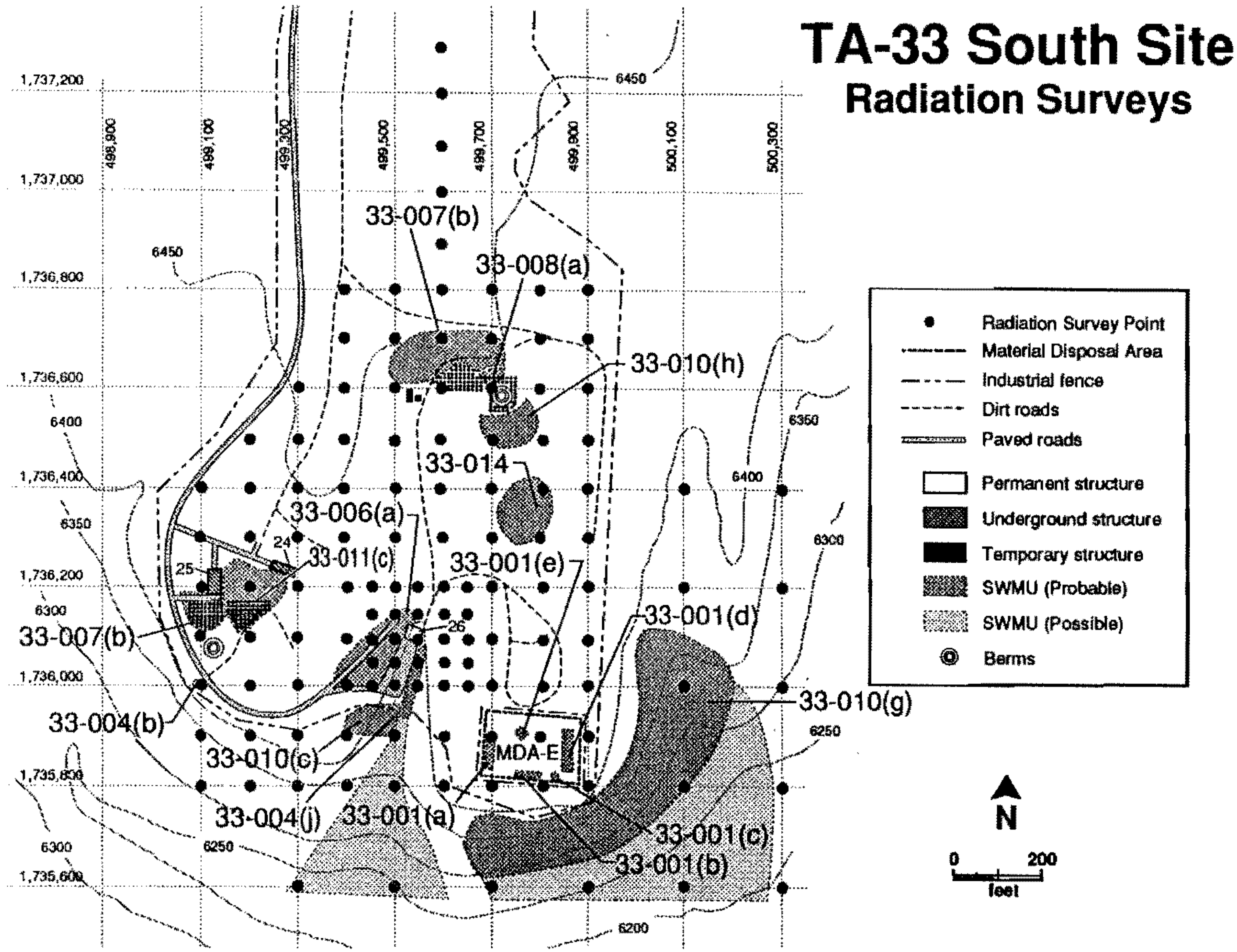

Fig. 4-15. Radiation surveys at South Site.

4.4.3 Surface Sampling

4.4.3.1 Samples from Identified SWMUs

Surface soil samples will be collected within areas that contain potential surface SWMUs:

33-004(b) One surface sample will be taken in the top six inches of the hole drilled near septic tank TA-33-33.

33-007(b) Surface samples will be collected next to each gun mount in the northern firing area (TA-33-85 and other gun mounts in the area), and two from the south side of TA-33-25. Up to four additional samples may be collected based on radiation survey anomalies, if any.

33-010(g) Two surface soil samples will be collected from the bench immediately south and east of MDA-E, and two along the rim of the mesa east of the burning pit and northeast of MDA-E. These may be sited on the basis of the radiation survey results, or next to debris.

33-011(c) Two surface samples will be located in the blivit area. Their locations will be based on anomalies detected in the radiation survey, if any.

33-014 Four surface samples will be collected at the burning pit. These may be soil or tuff samples, and two should be sited on the basis of visual evidence of burning (blackened areas).

Additional localized areas may be sampled (at the rate of approximately two samples per 100-200 ft^2) if identified by the geophysical or radiation survey. Sample sizes, field duplicates, and sample analyses are summarized in Table 4-C (included at the end of Chapter 4). Sample maxima will be compared with action levels.

4.4.3.2 Outfall and Channel Sediment Samples

Sediments in the central channel will be sampled every 200 ft between the northern firing area and the outfall from TA-33-26, and every 50 ft below this point for another 200 ft. Two sediment samples will be collected at the outfall itself, and two more along the base of the canyon-side disposal area, SWMU 33-010(c).

Three soil or sediment samples will be collected below the outfall from TA-33-24; two near the end of the pipe and the third 50 to 100 ft away in the channel below. Sample sizes, field duplicates, and sample analyses are summarized in Table 4-C. Sample maxima will be compared with action levels.

4.4.3.3 Shot Pad

Surface samples will be collected at every other point of the 50-ft radiation-survey grid around the shot pad (SWMU 33-006[a]), of the 100-ft grid covering the mesa top, of the 200-ft grid on the benches, and two samples will be collected along the grid extension to the north of the site, for a total of about 32 samples. Sample sizes, field duplicates, neighbors, and sample analyses are summarized in Table 4-C. Observations will be summarized by overall means, trend estimates, and/or local means. Neighbors and field duplicates will be used in estimating the variability and spatial predictability of contaminant distributions.

4.4.4 MDA-E

Because MDA-E is close to the edge of a mesa, a geomorphological study is necessary to assess the long-term stability of the site. Estimations of the probability of a landslide affecting a particular site at a given distance from the canyon rim require data on the size and frequency of landslides and the relations of these slides to variations in the underlying bedrock. These data will be acquired in a two-phase study that includes: 1) reconnaissance mapping of landslides in White Rock Canyon to determine general relations between landslide size and bedrock characteristics and, 2) detailed investigations of specific landslides within Operable Unit 1122 to more thoroughly characterize failure conditions and to constrain landslide frequency.

The reconnaissance mapping will include both aerial photo analysis and supplemental field mapping within White Rock Canyon. A large area is needed for the reconnaissance study to obtain a large enough sample of landslides to quantify the relationship between landslide size and bedrock variability. This reconnaissance work will determine if the large landslide within the TA-70 portion of Operable Unit 1222 results from any unique geologic conditions.

During the detailed investigations, detailed field mapping and photo analysis will be focused on the landslides within Operable Unit 1122 to evaluate the style of failure, e.g., slow, discontinuous slumping in contrast to rapid, debris flow or rock avalanching. A variety of surface dating techniques will be used to determine the ages, and thus the frequency, of landslides within the area.

4.4.5 TA-33-24 Septic System

One fluid sample and one sludge sample will be collected from septic tank TA-33-33, assuming both components are present. The material will not be homogenized. A hole will be drilled next to the septic tank and samples will be collected from the top six inches, the depth at the bottom of the tank, and at the soil/tuff interface or three feet below the tank, whichever is shallower. Sample analyses are summarized in Table 4-C. Sample maxima will be compared with action levels.

4.4.6 Berms and Target Areas

Twelve-inch wide trenches will be excavated through berm TA-33-63 directly opposite the south doors of TA-33-25, through berm TA-33-43 in the middle of the north side of its south curve, and through the remains of the catcher box on the north side of the northern firing area. (The excavation in berm TA-33-43 may be combined with that of the landfill [Section 4.4.7] it encloses, but the material from the landfill should be kept separate from the berm material.) Each trench will be excavated to a depth of four feet. The excavated material will be field screened for radioactivity and if any projectiles are found, a sample of them (up to six total) will be submitted for laboratory analysis to determine their composition. The total amount of projectile material remaining in the berms will be estimated based on the amount recovered from the excavations.

Three samples, one from the top 12 in. of material, one from the next 12, and a third from a depth of 3.5-4 ft into the berm, will be collected from one side of each trench. Sample analyses are summarized in Table 4-C. Sample maxima will be compared with action levels.

4.4.7 Landfill and Debris Piles

A 12-in. wide trench will be excavated through the landfill inside berm TA-33-43 to the tuff/fill interface. The excavated material will be categorized into natural fill material (soil, tuff, pumice) and various types of debris (shrapnel, other metal debris, lumber, cinders, ash, etc.). The volume of material recovered in each category will be estimated. Two samples of material from each category will be submitted for laboratory analysis.

A 12-in. wide trench will be excavated through the loose fill and debris on the slope near the shot pad (SWMU 33-010[c]), to a depth of 4 ft or until undisturbed soil or tuff is encountered, whichever is shallower. The excavated material will be categorized into natural fill material (soil, tuff, pumice) and other types of debris (shrapnel, metal pieces, bits of wire). The volume of material recovered in each category will be estimated. Three samples of material from each category will be submitted for laboratory analysis.

A 12-in. wide trench will be excavated through the mounded area at SWMU 33-010(h) to a depth of 4 ft or until undisturbed soil or tuff is encountered, whichever is shallower. The excavated material will be categorized into natural fill material (soil, tuff, or pumice) and various types of debris (shrapnel, other metal debris, lumber, cinders, ash, etc.), and the volume of material recovered in each category will be estimated. Two samples of material from each category will be submitted for laboratory analysis. Samples and analyses are summarized in Table 4-C. Sample maxima will be compared with action levels.

4.5 East Site Phase I Field Sampling Plans

4.5.1 Site Mapping

Detailed site mapping is needed to locate SWMUs accurately in the field, as well as to lay out grids for geophysical and radiation surveys and locations for surface and subsurface sampling.

4.5.1.1 Field Identification of SWMUs

The boundaries of the landfill in the center of the site will be surveyed and flagged. Two holes will be drilled to the tuff/fill interface through the landfill (SWMU 33-008[b]) to estimate the depth and volume of fill. The material obtained from these initial holes will be field screened for radioactivity and explosives.

The outfall from TA-33-87 in the center of the site must be located and flagged and its coordinates recorded.

4.5.1.2 Grid for Geophysical Surveys

Geophysical surveys at East Site will be conducted over the double berm at the end of the site, within:

Corner	East	North
Southwest	505,800	1,736,325
Northwest	505,800	1,736,575
Northeast	506,200	1,736,575
Southeast	506,200	1,736,325

and over the berm west of gun mount TA-33-116, within:

Corner	East	North
Southwest	505,550	1,736,200
Northwest	505,550	1,736,400
Northeast	505,600	1,736,400
Southeast	505,600	1,736,200.

Five-foot grids will be laid out in these areas as shown in Fig. 4-16. The first grid will terminate at the north side of the road.

4.5.1.3 Grids for Radiation Survey

A 50-ft grid will be surveyed over the central firing area, SWMU 33-007(a), an area within the rectangle:

Corner	East	North
Southwest	505,600	1,736,200
Northwest	505,600	1,736,500
Northeast	506,200	1,736,500
Southeast	506,200	1,736,200.

Another grid will be surveyed over the northwest end of MDA-D, an area within:

Corner	East	North
Southwest	505,600	1,736,500
Northwest	505,600	1,736,700
Northeast	505,800	1,736,700
Southeast	505,800	1,736,500.

Grid points as shown in Fig 4-17 may be randomized using either or both of the

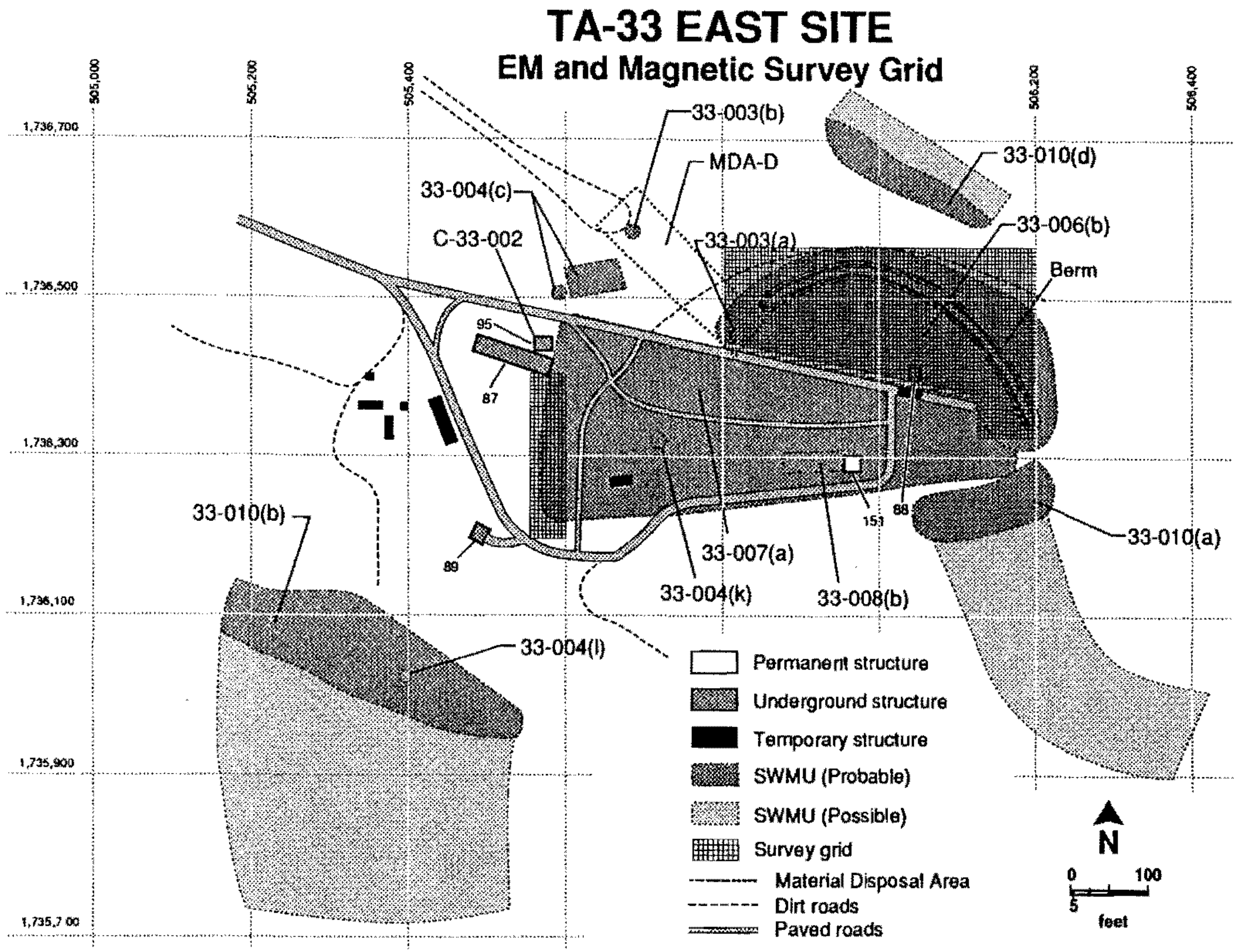

Fig. 4-16. Electromagnetic and magnetic surveys at East Site.

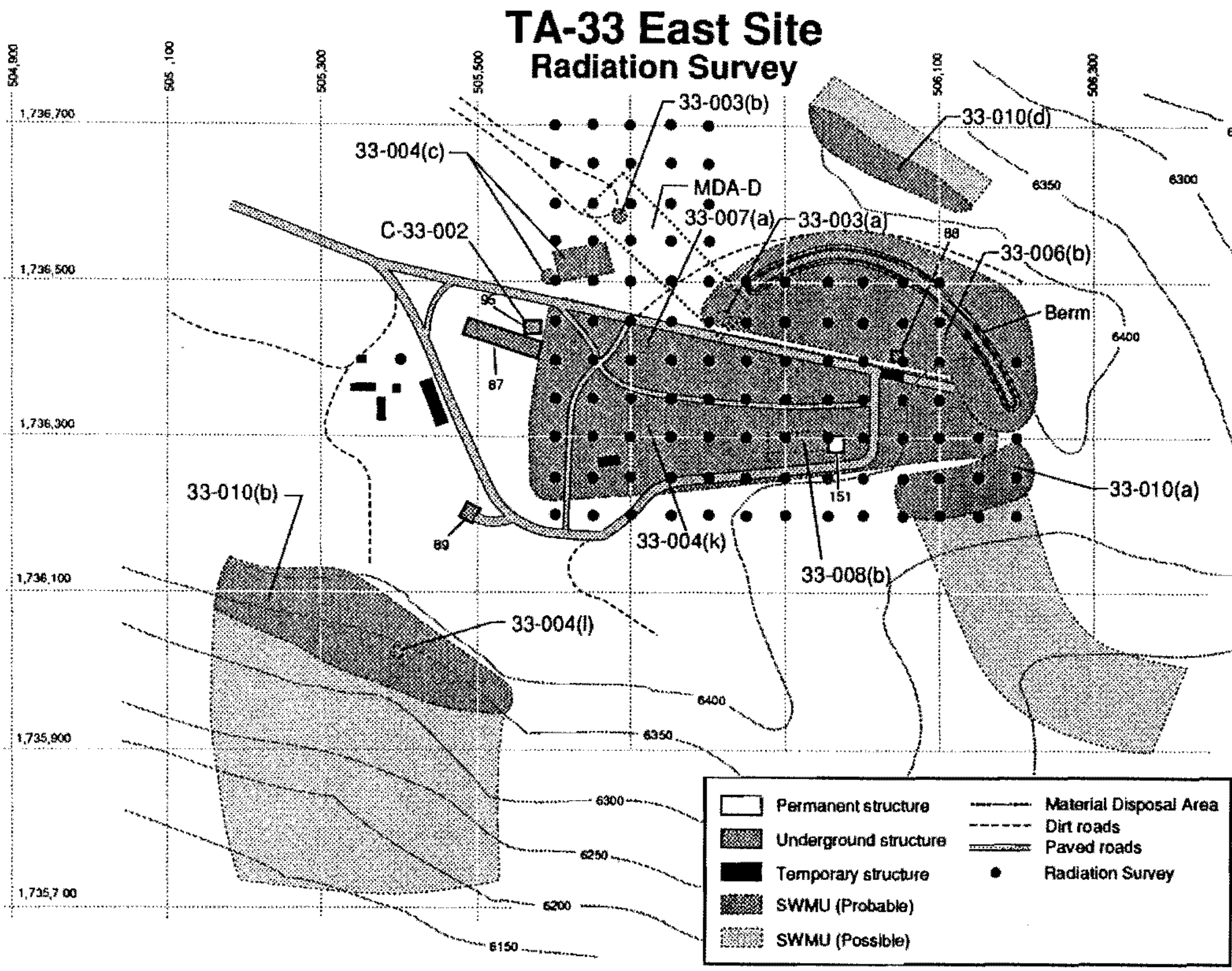

Fig. 4-17. Radiation survey at East Site.

methods described in Section 4.1.2.

4.5.1.4 Channel Mapping

Sampling locations are to be surveyed and flagged at approximately 50-ft intervals along the central channel from the outfall from TA-33-87 to about 506,200E, below SWMU 33-010(a). Sediment catchments are to be selected if possible, otherwise soil sampling locations are to be marked.

Another small drainage starts *northeast* of MDA-D and passes through the canyon-side disposal area 33-010(d) north of the berm. Three sampling locations should be designated in and below the canyon-side disposal area along this channel.

4.5.2 Field Surveys

4.5.2.1 Geophysical Surveys

Electromagnetic readings will be reported at each node of the five-foot grids in Fig. 4-16. These will be examined for anomalies that might indicate the presence of projectiles

4.5.2.2 Radiation Survey

Low-energy gamma radiation measurements for the detection of uranium, plutonium, and americium will be reported at the nodes shown in Fig. 4-17 of the 50-ft grids described in Section 4.5.1.3. Radiation measurements will also be made at 50-ft intervals along the central channel, at the centers of the flagged sediment catchments. Measurements will be examined for anomalies that would be used to guide subsequent surface sampling.

4.5.3 Surface Sampling

4.5.3.1 Samples from Identified SWMUs

Surface soil samples will be collected within areas that contain potential surface SWMUs:

33-003(b) Every other point of the 50-ft grid over the northwest end of MDA-D will be sampled.

33-004(c) Three surface samples will be collected from the top six inches of the holes drilled near septic tank TA-33-96 and in its drain field (Section 4.5.4).

33-006(b) Two surface sample will be collected next to each of the shot pads south of TA-33-97 and TA-33-98.

33-007(a) Every other point of the 50-ft grid over the firing areas described in

Section 4.5.1.3 will be sampled. Additional surface soil samples will be collected next to each gun mount (TA-33-116, TA-33-135, and possibly others) in the central firing area.

33-010(a) Four surface soil samples will be collected from the slope in and below this canyon-side disposal area. Two of the samples should be selected next to pieces of metallic debris, if any.

33-010(b) Three surface soil or tuff samples will be collected from the cliff or bench below the south rim of the site where debris lies on the surface. Two of these samples should be selected from beneath metallic debris.

33-010(d) Three surface soil samples will be collected near the rim of Ancho Canyon. Two of these samples should be selected from beneath metallic debris.

Additional localized areas may be sampled (at the rate of approximately two samples per 100-200 ft^2) if identified by the geophysical or radiation survey. Sample sizes, field duplicates, and sample analyses are summarized in Table 4-D (located at the end of Chapter 4). Sample maxima will be compared with action levels.

4.5.3.2 Outfall and Drainage Sediment Samples

Sediments in the central channel will be sampled every 150 ft, beginning with two samples within 3 ft of the outfall from TA-33-87 (SWMU 33-004[k]) and continuing eastward to 506,200E, through the firing site (SWMU 33-007[a]) to below the eastern canyon-side disposal area (SWMU 33-010[a]).

Three samples will be collected from the channel northeast of MDA-D, two where it passes through the canyon-side disposal area SWMU 33-010(d), and one 50 to 100 ft below on the slope of Ancho Canyon. Sample sizes, field duplicates, and sample analyses are summarized in Table 4-D. Sample maxima will be compared with action levels.

4.5.4 TA-33-87 Septic System (SWMU 33-004[c])

One fluid sample and one sludge sample will be collected from septic tank TA-33-96, assuming both components are present. The material will not be homogenized. A hole will be drilled next to the septic tank, and samples will be collected from the top six inches, from the depth of the bottom of the tank, and at the soil/tuff interface or three feet below the tank, whichever is shallower. Two holes will be drilled through the drain field, to three feet below the tiles, or to the soil/tuff interface, whichever is shallower. A specimen from the top six inches of each hole will be included in the surface sample. Additional samples will be taken from just below the tiles and from the bottom of the hole. Sample sizes, field duplicates, and sample analyses are summarized in Table 4-D. Sample maxima will be reported.

4.5.5 Berms and Target Areas

Two trenches will be excavated in the double berm north of the shot pads, one in the middle of the south side of each curved section. An additional trench will be excavated in the berm west of TA-33-116. Each trench will be excavated to a depth of four feet. The excavated material will be field screened for radioactivity, and if any projectiles are found, a sample of them (up to six total) will be submitted for laboratory analysis to determine their composition. The total amount of projectile material remaining in the berm will be estimated based on the amount recovered from the excavation.

Three samples, one from the top 12 in. of material, one from the next 12, and a third from a depth of 3.5-4 ft into the berm, will be collected from each trench. Sample sizes, field duplicates, and sample analyses are summarized in Table 4-D. Sample maxima will be compared with action levels.

4.5.6 Landfill

A 12-in wide trench will be excavated through the landfill in the center of the site to the tuff/fill interface. The excavated material will be categorized into natural fill material (soil, tuff, pumice) and various types of debris (shrapnel, other metal debris, lumber, cinders, ash, etc.), and the volume of material recovered in each category will be estimated. Two samples of material from each category will be submitted for laboratory analysis. Sample analyses are summarized in Table 4-D. Sample maxima will be compared with action levels.

4.6 NRAO Site Phase I Field Sampling Plans

4.6.1 Site Mapping

Detailed site mapping is needed to lay out grids for a radiation survey and locations for surface and subsurface sampling.

4.6.1.1 Field Identification of SWMUs

The boundary of the area formerly used for storage will be surveyed and flagged. The drain field for the septic system will be located.

4.6.1.2 Grid for Radiation Survey

A radiation survey will be carried out on a 50-ft grid over the area of the former surface storage site, which is within:

Corner	East	North
Southwest	501,200	1,737,400
Northwest	501,200	1,737,700
Northeast	501,500	1,737,700

Southeast	501,500	1,737,400

(See Fig. 4-18.) Grid points may be randomized using either or both of the methods described in Section 4.1.2.

4.6.2 Radiation Survey

Low-energy gamma radiation measurements for the detection of uranium, plutonium, and americium will be reported at the nodes of the 50-ft grid over the former storage area, SWMU 33-011(b). Measurements will be examined for anomalies that would be used to guide subsequent surface sampling.

4.6.3 Surface Sampling

4.6.3.1 Samples from Identified SWMUs

Every other point in the 50-ft grid over the storage site (SWMU 33-011[b]) will be sampled (Fig. 4-18). If anomalies are observed during the radiation survey described in Section 4.6.2, samples at nearby grid points may be moved to cover those areas more densely. Three surface samples will be collected from the top six inches of the holes drilled near septic tank TA-33-179 and in its drain field. Sample sizes, field duplicates, and sample analyses are summarized in Table 4-E (included at the end of Chapter 4). Sample maxima will be compared with other action levels.

4.6.4 TA-33-179 Septic System (SWMU 33-004[m])

One fluid sample and one sludge sample will be collected from septic tank TA-33-179, assuming both components are present. The material will not be homogenized. A hole will be drilled next to the septic tank, and samples will be collected from the top six inches, from the depth at the bottom of the tank, and at the soil/tuff interface or three feet below the tank, whichever is shallower. Two holes will be drilled through the drain field, to three feet below the tiles or to the soil/tuff interface, whichever is shallower. Samples will be taken from the top six inches of each hole, from just below the tiles, and from the bottom of the hole. Sample analyses are summarized in Table 4-E. Sample maxima will be compared with action levels and levels allowed under NPDES.

TA-33 NRAO Site
Radiation Survey

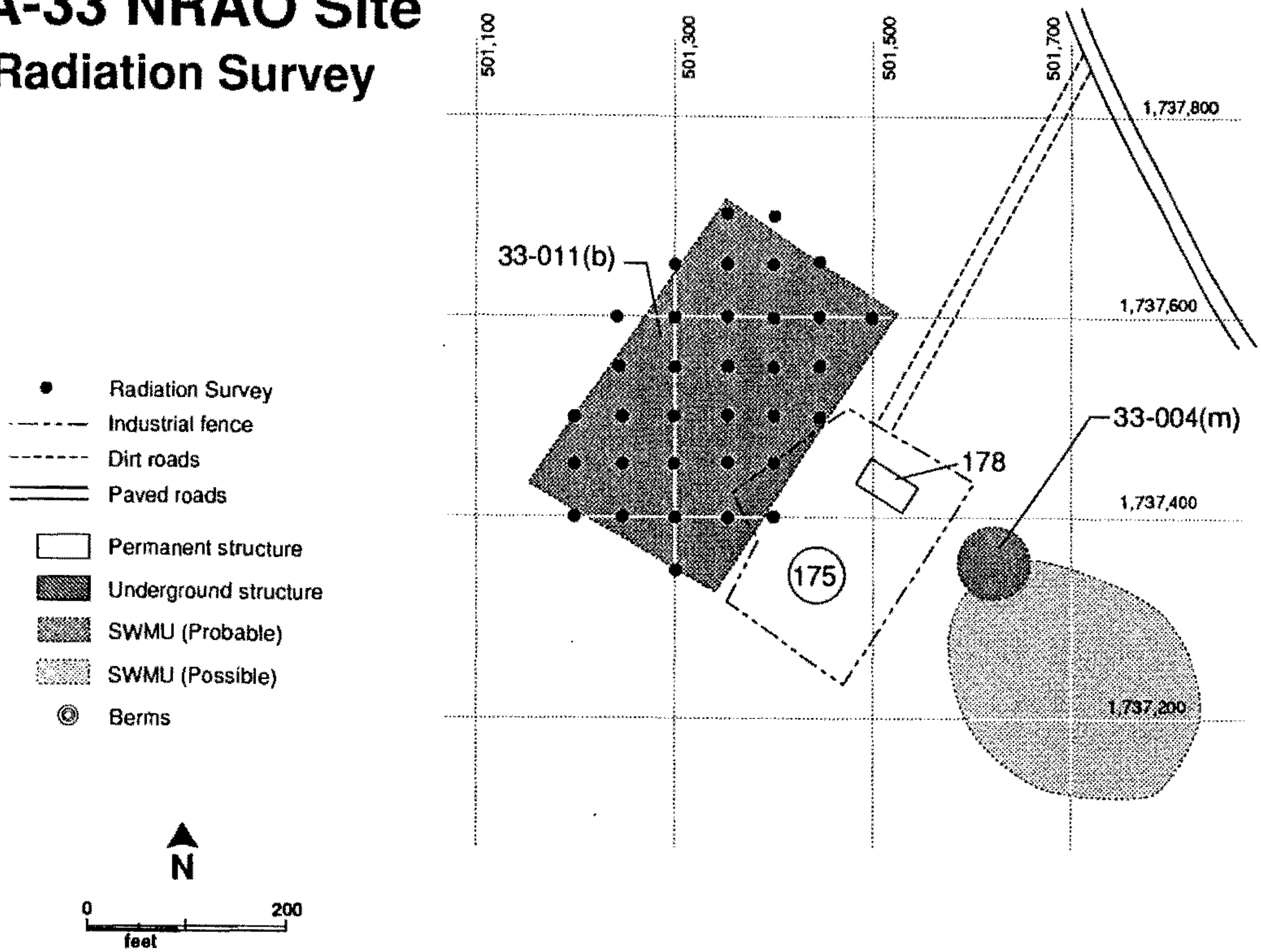

Fig. 4-18. Radiation survey at the NRAO Site.

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Table 4-A

Summary of Main Site Surveys, Sampling and Analysis

SWMU or AOC	SWMU Type	Phase 1 Approach	Field Surveys: Land Survey	Field Surveys: Geophysics	Field Surveys: Radiation	Samples: Sampled Media	Samples: Structure	Samples: Structure dup	Samples: Surface	Samples: Surface dup	Samples: Subsurface	Samples: Subsurface dup	Samples: Neighbors	Field Screening: Gross Alpha	Field Screening: Gross Gamma	Field Screening: Organic Vapor	Field Screening: Combustible gas/oxygen	Field Screening: Explosives	Field Screening: Lithologic Logging	Field Lab.: Gross Alpha	Field Lab.: Tritium	Field Lab.: Soil Moisture	Laboratory Analyses*: Gamma spectroscopy	Laboratory Analyses*: Tritium	Laboratory Analyses*: Total Uranium	Laboratory Analyses*: Isotopic Uranium	Laboratory Analyses*: Isotopic Plutonium	Laboratory Analyses*: VOA (SW8240)	Laboratory Analyses*: Semivolatiles (SW 8270)	Laboratory Analyses*: Metals (SW 6010)	Laboratory Analyses*: PCB (SW 8080)	Laboratory Analyses*: Explosives	Laboratory Analyses*: Cyanide	Laboratory Analyses*: Herbicides	Laboratory Analyses*: Pesticides
33-002(a)	septic system	VCA				fluid/sludge	2	1						x	x	x	x				x		x	x	x		x	x	x	x					
		VCA				soil/tuff			1		2			x	x	x	x				x		x	x	x		x	-	x	x				1	1
	drain field	reconn	x	x	x	soil/tuff			4		4	1		x	x	x	x				x		x	x	x		x	-	x	x					
33-002(b)	sump	VCA				fluid/sludge	2							x	x	x					x		x	x	x		x	x	x	x					
		VCA				soil/tuff					3	1		x	x	x					x		x	x	x		x	x	x	x					
33-002(c)	sump	VCA				fluid/sludge	2							x	x	x					x		x	x	x		x	x	x	x					
		VCA				soil/tuff					3	1		x	x	x					x		x	x	x		x	x	x	x					
33-002(d)	outfall	reconn	x		x	sediments			4					x	x	x					x		x	x	x		x		x	x				1	1
		reconn				water			3					x	x	x					x		x	x	x		x		x	x					
33-002(e)	outfall	reconn	x		x	sediments			3					x	x	x					x		x	x					x						
33-002	subsurface	extent		x	x	tuff**					60	6		x	x				x		x	x	•	x	•		•	•	•	•					
33-004(a)	septic system	VCA				fluid/sludge	3							x	x	x	x				x		x	x	x			x	x	x					
		VCA				soil/tuff			1		2			x	x	x	x				x		x	x	x			-	x	x					
	seepage pits	reconn				fluid/gravel	4							x	x	x	x				x		x	x	x			x	x	x					
	drain field	reconn	x	x	x	soil/tuff			4	1	4			x	x	x	x				x		x	x	x			-	x	x				2	2
33-004(h)	outfall	reconn	x		x	sediments			3	1				x	x								x		x					x				1	1
33-004(i)	outfalls	reconn	x		x	sediments			6					x	x	x							x		x				x	x				1	1
33-005(a)	excavated septic tank	extent	x			soil/tuff			1		5			x	x	x	x						x		x		x	-	x	x					
	outfall	reconn	x		x	sediments			3					x	x	x							x		x		x		x	x					
33-005(b)	outfall	reconn	x		x	sediments			3					x	x	x							x		x		x		x	x					
33-005(c)	excavated drain field	extent	x		x	soil/tuff			4		20	2		x	x	x	x						x		x		x	-	x	x				2	2

Table 4-A (concluded)

Summary of Main Site Surveys, Sampling and Analysis

			Field Surveys			Samples								Field Screening						Field Lab.			Laboratory Analyses*												
SWMU or AOC	SWMU Type	Phase 1 Approach	Land Survey	Geophysics	Radiation	Sampled Media	Structure	dup	Surface	dup	Subsurface	dup	Neighbors	Gross Alpha	Gross Gamma	Organic Vapor	Combustible gas/oxygen	Explosives	Lithologic Logging	Gross Alpha	Tritium	Soil Moisture	Gamma spectroscopy	Tritium	Total Uranium	Isotopic Uranium	Isotopic Plutonium	VOA (SW8240)	Semivolatiles (SW 8270)	Metals (SW 6010)	PCB (SW 8080)	Explosives	Cyanide	Herbicides	Pesticides
33-010(f)	surface disposal	reconn	x		x	soil			2					x	x	x							x	x						x				1	1
33-011(a)	drum storage	reconn	x			soil			3					x	x	x													x		x			1	1
33-011(d)	general storage	reconn	x		x	soil			3					x	x	x					x		x		x					x					
		reconn				paving			2					x	x	x					x		x		x					x					
33-011(e)	drum storage	reconn	x		x	soil			2	1				x	x								x		x									1	1
33-012(a)	drum storage	reconn	x		x	soil/paving			4					x	x	x							x						x	x	x			1	1
33-013	drum storage	reconn	x		x	soil/paving			3					x	x	x					x		x	x					x	x				1	1
33-015	incinerator	reconn				soil			2					x	x	x					x		x							x					
33-016	sump	reconn				fluid/sludge	2							x	x	x		x										x	x			x			
		reconn				soil/tuff			1		2			x	x	x		x										-	x			x			
	outfall	reconn	x			sediments			3	1				x	x	x		x											x			x			
33-017	vehicle maintenance	reconn	x			soil			2	1				x	x	x					x		x						x	x				1	1
	operational release	extent		x	x	soil			48	3			6	x	x	x					x		x	x	x		x		x	x				14	14
	drainage	extent	x		x	sediments			14	2	1			x	x	x					x		x	x	x		x		x	x					

* x = all samples, n = n samples only, - = subsurface samples only, • = 25%

** 33% of these samples, plus all other samples with positive field screening for radiation or moisture, will be submitted for laboratory analysis, Sec. 4.2.6.

Table 4-B

Summary of Area 6 Surveys, Sampling and Analysis

			Field Surveys			Samples							Field Screening						Field Lab.			Laboratory Analyses*												
SWMU or AOC	SWMU Type	Phase 1 Approach	Land Survey	Geophysics	Radiation	Sampled Media*	Structure	dup	Surface	dup	Subsurface	dup	Gross Alpha	Gross Gamma	Organic Vapor	Combustible gas/oxygen	Explosives	Lithologic Logging	Gross Alpha	Tritium	Soil Moisture	Gamma spectroscopy	Tritium	Total Uranium	Isotopic Uranium	Isotopic Plutonium	VOA (SW8240)	Semivolatiles (SW 8270)	Metals (SW 6010)	PCB (SW 8080)	Explosives	Cyanide	Herbicides	Pesticides
33-004(d)	septic system	VCA				fluid/sludge	2						x	x	x	x						x		x			x	x	x			x		
		VCA				soil/tuff			1		2		x	x	x	x						x		x			-	x	x			x		
	buried outfall	reconn	x			soil/tuff			2		4	1	x	x	x	x						x		x			-	x	x			x		
	drainage	reconn	x		x	sediments			6	1			x	x	x	x						x		x				x	x			x		
33-004(g)	outfall	reconn	x			sediments			4				x	x		x	x					x		x				x	x		x			
33-007(c)	firing site	reconn			x	soil			13	2			x	x	x		x					x		x					x		x		3	1
	berm	reconn		x		projectiles					3		x	x								x			x				x					
		reconn				soil					6		x	x			x					x		x					x		x			
33-009	surface disposal	reconn			x	soil			6	1			x	x								x		x				x	x	x			2	1
	drainage	reconn	x		x	sediments			6	1			x	x			x					x		x				x	x	x	x			
33-010(e)	surface disposal	reconn			x	soil			3				x	x	x							x		x					x				1	

* x = all samples, n = n samples only, - = subsurface samples only

Table 4-C

Summary of South Site Surveys, Sampling and Analysis

SWMU or AOC	SWMU Type	Phase 1 Approach	Field Surveys: Land Survey	Field Surveys: Geophysics	Field Surveys: Radiation	Samples: Sampled Media	Samples: Structure	Samples: Structure dup	Samples: Surface	Samples: Surface dup	Samples: Subsurface	Samples: Subsurface dup	Samples: Neighbors	Field Screening: Gross Alpha	Field Screening: Gross Gamma	Field Screening: Organic Vapor	Field Screening: Combustible gas/oxygen	Field Screening: Explosives	Field Screening: Lithologic Logging	Field Lab.: Gross Alpha	Field Lab.: Tritium	Field Lab.: Soil Moisture	Laboratory Analyses*: Gamma spectroscopy	Laboratory Analyses*: Tritium	Laboratory Analyses*: Total Uranium	Laboratory Analyses*: Isotopic Uranium	Laboratory Analyses*: Isotopic Plutonium	Laboratory Analyses*: VOA (SW8240)	Laboratory Analyses*: Semivolatiles (SW 8270)	Laboratory Analyses*: Metals (SW 6010)	Laboratory Analyses*: PCB (SW 8080)	Laboratory Analyses*: Explosives	Laboratory Analyses*: Cyanide	Laboratory Analyses*: Herbicides	Laboratory Analyses*: Pesticides
33-004(b)	septic system	VCA				fluid/sludge	2							x	x	x	x						x					x	x	x			x	1	1
		VCA				soil/tuff			1		2			x	x	x	x						x					-	x	x			x		
	outfall	reconn				sediments			3					x	x	x	x						x						x	x			x		
33-004(j)	outfall	reconn				sediments			2					x	x								x		x					x					
33-006(a)	shot pad	extent			x	soil			32	2			4	x	x			x					x	x	x					x		x		6	
	drainage	extent			x	sediments			10	1				x	x			x					x	x	x					x		x		2	2
33-007(b)	firing areas	reconn			x	soil			10	1				x	x	x		x					x	x	x				x	x		x			
	berms	reconn		x		projectiles					6			x	x								x			x				x					
		reconn				soil					12	1		x	x			x					x		x					x		x			
33-008(a)	landfill	reconn	x			debris			8					x	x	x		x					x						x	x		x			
		reconn				soil/tuff			2					x	x	x		x					x						x	x		x			
33-010(c)	canyon-side disposal	reconn	x			debris			8					x	x	x		x					x		x					x		x			
		reconn				soil/tuff			2					x	x	x		x					x		x					x		x			
33-010(g)	canyon-side disposal	reconn			x	soil			4					x	x	x		x					x		x					x		x		1	
33-010(h)	disposal area	reconn	x		x	debris			8					x	x	x		x					x		x				x	x		x			
		reconn				soil/tuff			2					x	x	x		x					x		x				x	x		x			
33-011(c)	blivit storage	reconn			x	soil			2	1				x	x								x	x											
33-014	burn site	reconn				soil/tuff			4					x	x			x					x		x					x		x		1	

* x = all samples, n = n samples only, - = subsurface samples only

Table 4-D

Summary of East Site Surveys, Sampling and Analysis

SWMU or AOC	SWMU Type	Phase 1 Approach	Field Surveys: Land Survey	Field Surveys: Geophysics	Field Surveys: Radiation	Samples: Sampled Media	Samples: Structure	dup	Samples: Surface	dup	Samples: Subsurface	dup	Field Screening: Gross Alpha	Field Screening: Gross Gamma	Field Screening: Organic Vapor	Field Screening: Combustible gas/oxygen	Field Screening: Explosives	Field Screening: Lithologic Logging	Field Lab.: Gross Alpha	Field Lab.: Tritium	Field Lab.: Soil Moisture	Laboratory Analyses*: Gamma spectroscopy	Tritium	Total Uranium	Isotopic Uranium	Isotopic Plutonium	VOA (SW8240)	Semivolatiles (SW 8270)	Metals (SW 6010)	PCB (SW 8080)	Explosives	Cyanide	Herbicides	Pesticides
33-003(b)	shot chamber	reconn			x	soil			9	1			x	x			x					x							x		x			
33-004(c)	septic system	VCA				fluid/sludge	2						x	x	x	x						x					x	x	x			x		
		VCA				soil/tuff			1		2		x	x	x	x						x					-	x	x			x		
	drain field	reconn				soil/tuff			2		4	1	x	x	x							x						x	x			x	1	1
33-004(k)	outfall	reconn	x			sediments			2				x	x	x													x	x			x		
	drainage	reconn				sediments			3	1			x	x														x	x			x	2	1
33-006(b)	shot pads	reconn				soil			4				x	x	x		x			x		x	x	x				x	x		x			
	berm	reconn		x		projectiles					4		x	x								x			x				x					
		reconn				soil					6		x	x	x		x			x		x	x	x				x	x		x			
33-007(a)	firing site	reconn			x	soil			23	2			x	x	x		x			x		x	x	x				x	x		x		4	
	berm	reconn		x		projectiles					2		x	x								x			x				x					
		reconn				soil					3		x	x	x		x			x		x	x	x				x	x		x			
33-008(b)	landfill	reconn	x			debris			8				x	x	x		x					x						x	x		x			
		reconn				soil			2				x	x	x		x					x						x	x		x			
33-010(a)	canyon-side disposal	reconn				soil			4	1			x	x								x		x					x					
33-010(b)	canyon-side disposal	reconn				soil			3				x	x								x		x					x					
33-010(d)	canyon-side disposal	reconn				soil			3				x	x								x		x					x					
	drainage	reconn	x			sediments			3				x	x								x		x					x					

* x = all samples, n = n samples only, - = subsurface samples only

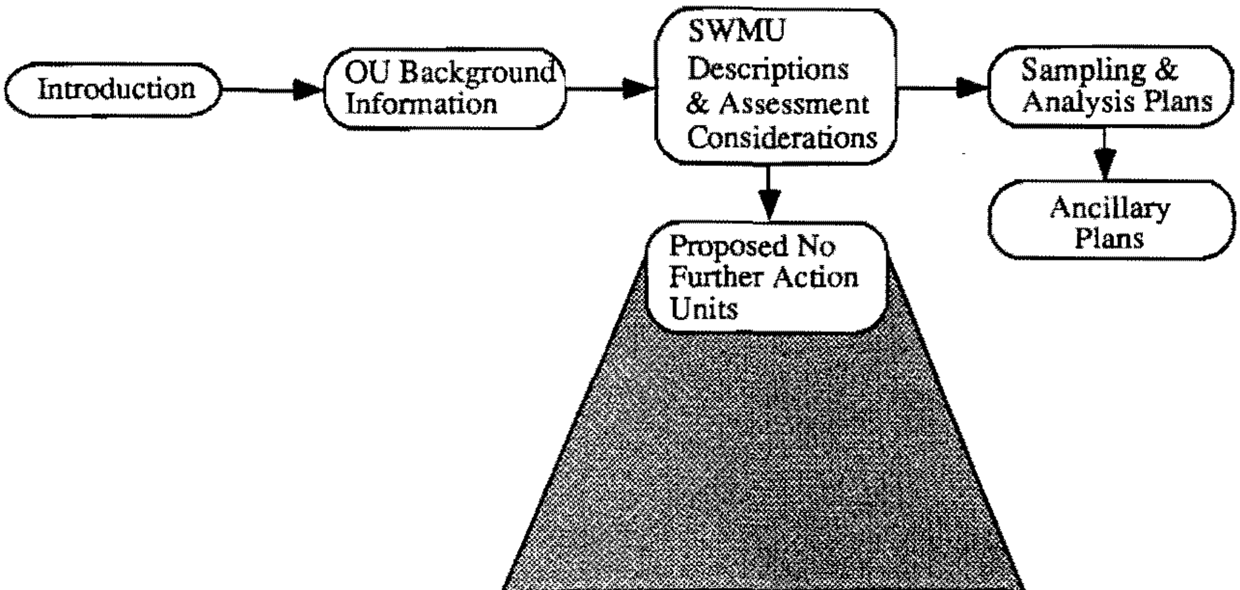
Table 4-E

Summary of NRAO Site Surveys, Sampling and Analysis

SWMU or AOC	SWMU Type	Phase 1 Approach	Field Surveys: Land Survey	Field Surveys: Geophysics	Field Surveys: Radiation	Samples: Sampled Media	Samples: Structure	Samples: Structure dup	Samples: Surface	Samples: Surface dup	Samples: Subsurface	Samples: Subsurface dup	Field Screening: Gross Alpha	Field Screening: Gross Gamma	Field Screening: Organic Vapor	Field Screening: Combustible gas/oxygen	Field Screening: Explosives	Field Screening: Lithologic Logging	Field Lab.: Gross Alpha	Field Lab.: Tritium	Field Lab.: Soil Moisture	Laboratory Analyses*: Gamma spectroscopy	Laboratory Analyses*: Tritium	Laboratory Analyses*: Total Uranium	Laboratory Analyses*: Isotopic Uranium	Laboratory Analyses*: Isotopic Plutonium	Laboratory Analyses*: VOA (SW8240)	Laboratory Analyses*: Semivolatiles (SW 8270)	Laboratory Analyses*: Metals (SW 6010)	Laboratory Analyses*: PCB (SW 8080)	Laboratory Analyses*: Explosives	Laboratory Analyses*: Cyanide	Laboratory Analyses*: Herbicides	Laboratory Analyses*: Pesticides
33-004(m)	septic system	reconn				fluid/sludge	2								x	x											x	x						
		reconn				soil/tuff			1		2				x	x											-	x						
	drain field	reconn	x			soil/tuff			2		4	1			x	x												x						1
33-011(b)	general storage	reconn	x		x	soil			6	1			x	x								x		x					x				1	

* x = all samples, n = n samples only, - = subsurface samples only

CHAPTER 5



PROPOSED

NO FURTHER ACTION UNITS

- Proposed No Further Action Units (5.0)
- SWMU 33-004(e) (5.1)
- SWMU 33-004(f) (5.2)
- SWMU 33-004(l) (5.3)
- SWMU 33-012(b-d) (5.4)

5.0 PROPOSED NO FURTHER ACTION UNITS

No further action units are SWMUs that are being proposed for removal from Table A of the HSWA Module through a permit modification. This chapter describes the SWMUs being proposed for removal from the permit and provides the available information that justifies their removal.

5.1 SWMU 33-004(e) TA-33-169 Septic Tank

In the 1980s an L-shaped transportable building (TA-33-169) was located just south of water tank TA-33-28, and across the west road from TA-33-114 at Main Site. TA-33-169 was managed as office space. The drain exited TA-33-169 at the northwest corner to septic tank TA-33-161, approximately 20 ft west of the building. Overflow went to a seepage pit, TA-33-188, approximately 20 ft west of the tank. No known hazardous material was used in the building (LANL 1990, 0145).

TA-33-169 and the septic tank were removed in 1989. The location is now cleared and cleaned. The seepage pit is covered.

5.1.1 Justification for No Further Action

A seepage pit is all that remains of this septic system. Discharges to the septic system were only sanitary wastes from an office building where no known hazardous materials were used. No corrective action is required.

5.2 SWMU 33-004(f) TA-33-23 Septic Tank, SWMU 33-004(n) SepticTank

This septic tank is located near TA-33-23 along the west road south of Main Site. The "Solid Waste Management Units Report" (LANL 1990, 0145) states that SWMU 33-004(f) is: "The tank north of the building, TA-33-23, was constructed in 1987. It consists of 1000-gallon fiberglass septic tank that serves a residential trailer, TA-33-181. The tank is pumped and and has no discharges to the environment. This system has EID Permit Number LA-124."

The "Solid Waste Management Units Report" (LANL 1990, 0145) states SWMU 33-004(n) "TA-33-206 (33-004[n]) was installed in 1987 and has a capacity of 1,000 gallons. It serves a trailer and discharges to a holding tank."

It is assumed by Operable Unit 1122 project team members that these SWMUs are the same septic tank.

The residential trailer, now removed, once housed a 24-hour attendant for Group EES-1, Geology and Geochemistry. The septic tank is pumped and has no discharges to the environment.

5.2.1 Justification for No Further Action

Discharges to this septic tank were sanitary wastes from a residential trailer. No hazardous materials are present. No corrective action is required.

5.3 SWMU 33-004(l) TA-33-89 Outfall

A perforated, corrugated metal pipe exits TA-33-89 and runs south to an outfall on the rim of White Rock Canyon within SWMU 33-010(b).

TA-33-89 was completed in June 1955. Implosion testing activity never occurred at East Site, so the unit was never used. There is no record of radioactive or hazardous materials being used or stored in this building (LANL 1990, 0145). Nor, was shot debris scattered over this site. TA-33-89 is not used at this time.

5.3.1 Justification for No Further Action

There is no record of any potential hazardous materials being released to TA-33-89 or the outfall. No corrective action is required.

5.4 SWMUs 33-012(b-d) Active Waste Satellite Storage Areas

These three SWMUs, located at Main Site, were visited by Operable Unit 1122 project team members June 7, 1991, and July 3, 1991. SWMU 33-012(b) is described in the SWMU Report as a storage area for photoprocessing chemicals at Main Site in TA-33-114, Room 116. During the site visit it was noted that photoprocessing chemicals were being collected and stored in plastic containers in the darkroom, Room 126, rather than Room 116 (LANL 1990, 0145). SWMU 33-012(c) is described in the SWMU Report as a satellite waste storage area for organics in TA-33-114, Room 117. This satellite storage area is a laboratory collection point for organic wastes. It is located in Room 116 rather than in Room 117 (LANL 1990, 0145). SWMU 33-012(d) consists of a 55-gal. steel drum located on the loading dock of TA-33-19. This satellite storage area is a collection point for waste organic liquids. These storage areas and their locations agree with the November 1991 LANL container storage data base.

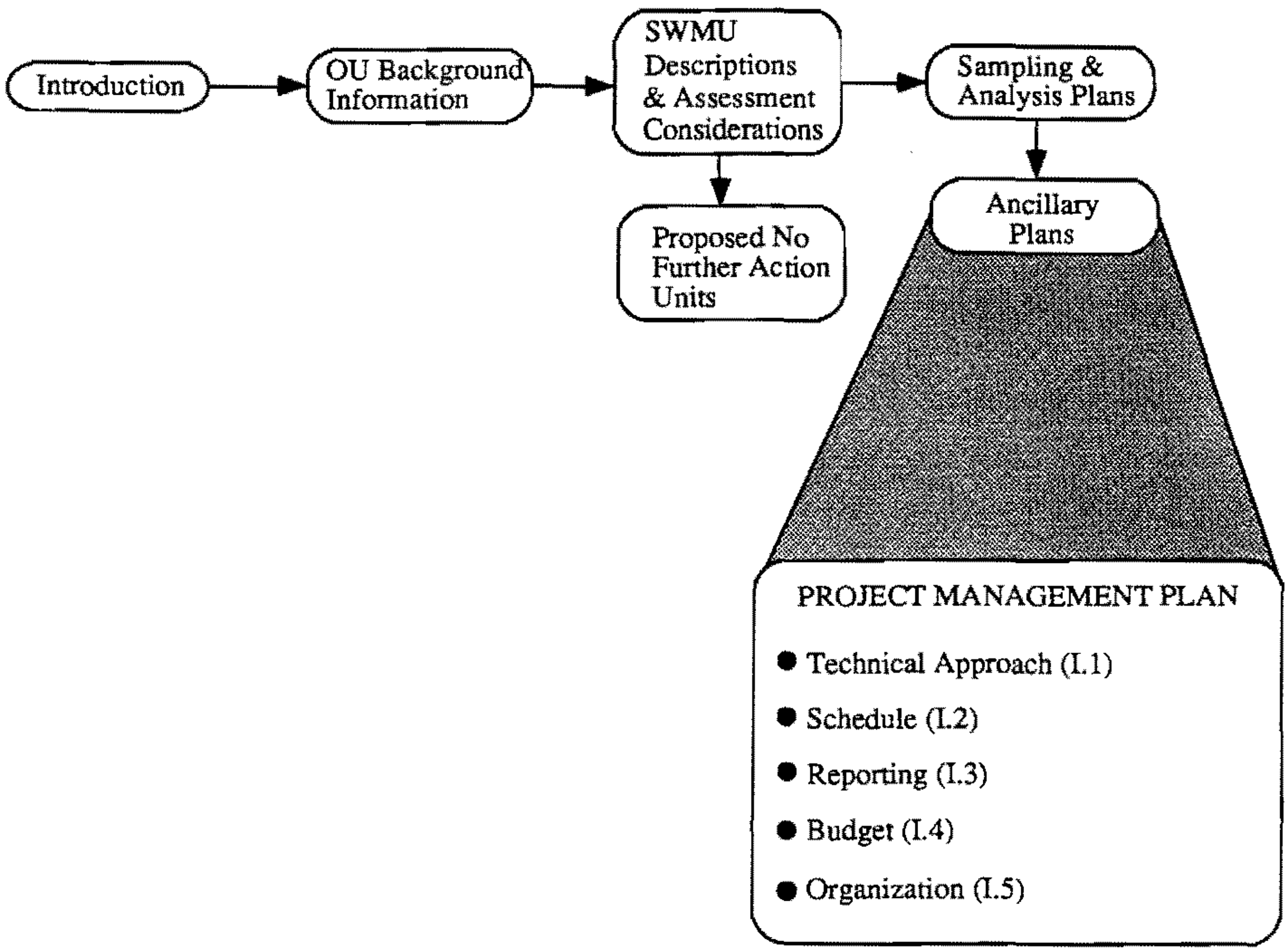
5.4.1 Justification for No Further Action

During site visits, these SWMUs were found to be operating as waste satellite storage areas in accordance with current Laboratory waste management practices. There was no evidence of any releases from these units. Informational searches have not produced any documented releases to the environment from either inside or outside the buildings.

REFERENCES

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)**

ANNEX I


Introduction
OU Background Information
SWMU Descriptions & Assessment Considerations
Sampling & Analysis Plans
Proposed No Further Action Units
Ancillary Plans
PROJECT MANAGEMENT PLAN
Technical Approach (I.1)
Schedule (I.2)
Reporting (I.3)
Budget (I.4)
Organization (I.5)

1.0 PROJECT MANAGEMENT PLAN

This annex presents the technical approach, organizational structure, schedule, budget, and reporting milestones for implementation of the Operable Unit 1122 RFI work plan. This plan is an extension of the ER Program project management plan in Annex I of the IWP (LANL 1991, 0553). The Operable Unit 1122 RFI work plan does not contain any deviations from the IWP. This annex addresses the project management requirements of the 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 1122 RFI work plan is described in Chapter 3, Section 3.1, Assessment Approach. The approach used is based on the ER Program's overall technical approach to the RCRA Facility Investigation (RFI)/ Corrective Measures Study (CMS) process as described in Chapter 3 of the IWP (LANL 1991, 0553). 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, CERCLA, NEPA, AEA, and other applicable regulations.

The general philosophy is to develop and iteratively define the nature and extent of contamination at OU 1122 through a planned phased investigation and data interpretation. An objective is to support voluntary corrective action or a corrective measures study 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 SWMU
- Determine the vertical and lateral extent of the contamination at each SWMU
- Identify contaminant migration pathways
- Acquire sufficient information to allow quantitative migration pathway and risk assessment, as necessary
- Provide necessary data for the assessment of potential remedial alternatives

- Provide the basis for planning detailed corrective measures studies
- Use of RCRA Subpart S regulation's conditional remedy concept to adopt an approach of stabilization in-place for material disposal areas (MDAs) as appropriate
- Assume that eventual transfer of the DOE property will be to the National Park Service (Bandelier National Monument)

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 drain lines and outfalls, and detection of buried projectiles in berms at firing areas; 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 SWMUs are indicative of releases from individual SWMUs or only represent the presence of the OU-wide contamination.

Generic investigations include surface sampling at individual SWMUs, channel sediment sampling, sampling at subsurface structures such as septic tanks and sumps, near-surface sampling at buried outfalls and leach fields, and sampling of landfills and berms. Sites with unique problems, such as Material Disposal Areas (MDA-K and MDA-E) and septic system seepage pits at Main Site, are addressed separately. Sampling logic and proposed flow of investigations and decisions for these generic and specific investigations are illustrated with sampling logic and flow diagrams in Chapter 4.

Scheduling priorities are based on the 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 SWMU-specific data.
- Investigations at the MDAs are the most likely to require extensive subsequent investigations and should be scheduled early to allow time for additional work.
- Subsurface investigations will require the next level of effort and are scheduled parallel with the MDAs.
- Characterization of surface contamination SWMUs can be secondary to the other priorities.

1.2 Schedule

The schedule for the entire RFI/CMS process at OU 1122 is provided in Table I-1.

TABLE I-1

PROJECTED SCHEDULE FOR CORRECTIVE ACTION PROCESS OPERABLE UNIT 1122

Milestone	Date
Submit EPA/NMED Work Plan	15 May 92
Start RFI	1 July 93
Start RFI Report	1 July 93
Complete Draft Phase 1 RFI Phase Report	22 Mar 95
Complete RFI Field Work	6 Sept 96
Complete Draft RFI Report	8 June 98
Start CMS Plan	9 June 98
Complete RFI	6 Oct 98
Complete CMS Plan	5 Jan 99
Start CMS Work	29 April 99
Start CMS Report	29 April 99
Complete CMS Work	21 April 00
Complete Draft CMS Report	24 July 00
Complete Assessment	7 Nov 00

Implementation of RFI activities is contingent upon regulatory review and approval of this RFI Work Plan and upon available funding. The assumptions used to generate this schedule include the following:

- Review and approval of the OU 1122 RFI work plan and supporting project plans, by regulatory agencies is scheduled to be completed by September 28,1992.
- The schedule assumes that an adequate number of support personnel (e.g., health and safety technicians, trained drilling contractors) will be available to conduct necessary tasks.
- Adequate analytical capacity is available.
- EPA approval of RFI phase report/work plan modifications (including EPA comments, Laboratory revision, and final EPA approval) is assumed to take two and one-half months, of which one month is allowed for EPA review and comment and one and one-half months for revisions.
- SWMUs expected to require Phase II investigations have been scheduled earlier in the RFI to allow time for data assessment and subsequent investigations.
- The work scheduled in the first two investigation years is constrained by planned DOE budgets for fiscal years 1992 and 1993.

- Where possible, field work has not been scheduled between November 15 and March 15 each year, to allow for inclement weather.

1.3 Reporting

Results of RFI field work will be presented in three principal documents: quarterly technical progress reports, RFI phase reports/work plan modifications, and the RFI report. 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-2

REPORTS PLANNED FOR OU 1122 RFI

Report Type	EPA	DOE	Date Due
Monthly Reports	X	X	25th of the following month
Quarterly Reports	X		15 Feb, 15 May, 15 August
Annual Reports	X	X	15 November
Phase Reports			
Draft RFI Work Plan	X	X	15 May 92
Draft Phase 1 Report	X	X	22 March 95
Draft RFI Report	X	X	8 June 98
Draft CMS Plan	X	X	5 January 99
Draft CMS Report	X	X	24 July 00

1.3.1 Quarterly Technical Progress Reports

As the OU 1122 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 SWMUs or on individual SWMUs. 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).

The standard outline for a RFI phase report/work plan modification, is given in Table I-3. This outline may be changed as needed for a given RFI phase report/work plan modification.

TABLE I-3

OUTLINE OF RFI PHASE REPORT/WORK PLAN MODIFICATION

1. Executive Summary
2. Introduction
3. SWMU Descriptions
4. Summary of Investigation
5. Methods and Procedures
5. Data Assessment
5.1 Data Quality Summary
5.2 Source Term
5.3 Nature and Extent of Contamination
5.4 Contaminant Migration
6. Subsequent Investigation Sampling Plans
7. Permit Modification

1.3.3 RFI Report

The RFI report will summarize all field work conducted during the five-year duration of 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 Sec. 3.5.3 (LANL 1991, 0553), the RFI Report will describe the procedures, methods, and results of field investigations and will include information on the type and extent of contamination, sources and migration pathways, and actual and potential receptors. The report will also contain adequate information to support justification for no further action and corrective action decisions for SWMUs.

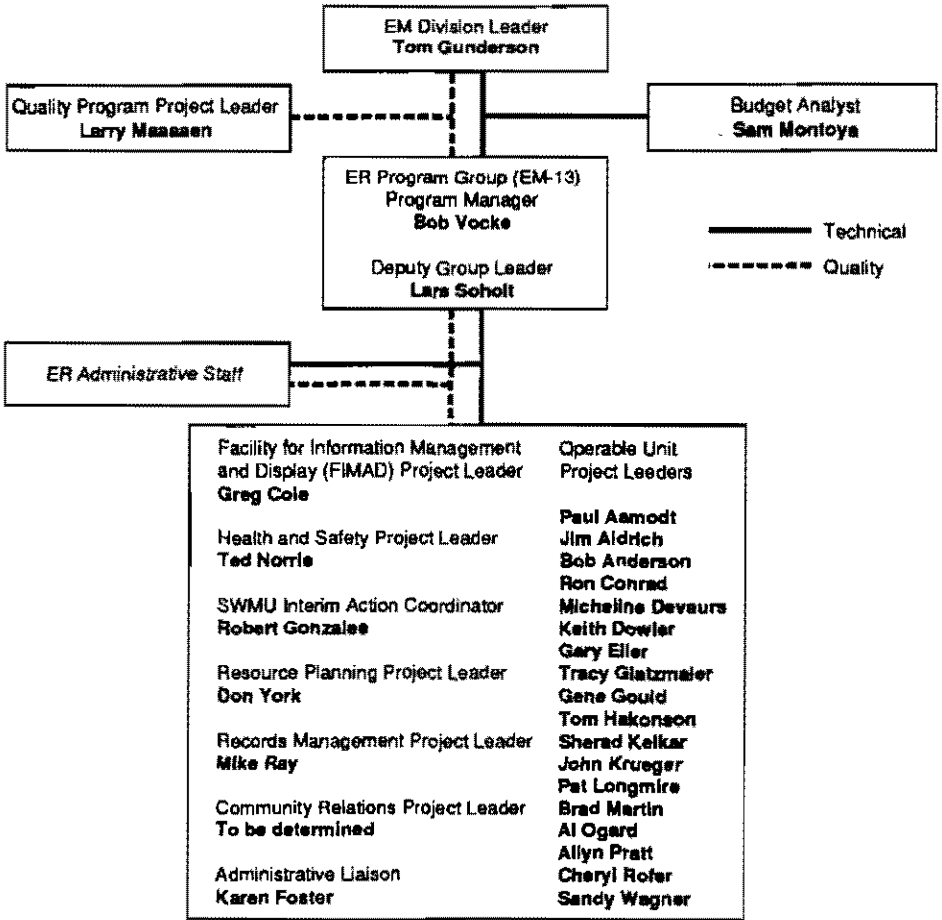
1.4 Budget

The schedule presented above is based on fixed budgets for the first two years of the RFI. The fixed budgets in fiscal years 1992 and 1993 (FY92 and FY93) are based on expected 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 FY94. Funding requests for FY94 and beyond will reflect the cost and schedule that most efficiently complete the RFI plans. Table I-4 (included at the end of Annex I)presents a cost estimate for the OU 1122 RFI. Schedules and costs will be updated through DOE change control procedures as appropriate with revisions submitted to the 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 1991, 0553). ER Program personnel are identified to the Technical Team Leader and OU Project Leader level in Fig. 1-3 of the IWP, which is reproduced here as Fig. I-1. Section 3.3, Annex I of the IWP, identifies line authority and personnel responsibilities for each position identified in the figure.

This section details the management organization for the OU 1122 RFI, as shown in Fig. I-2. Persons currently assigned to the positions shown in the figure are identified in Table I-5. A list of contributors to the OU 1122 RFI Work Plan is in Appendix C.



Technical Teams	Groups/Divisions **(Proposed Lead Group)**	Technical Team Leader	QA Representative	ER Program Office Tech. Team Coord.
Air Quality	**EM-8**, EES-5	Craig Eberhart	Lars Soholt	Lars Soholt
Applied Analytical Chemistry Instrumentation and Methods Development	**EM**, A, CLS, EES, ENG, INC, M, N, NMT, AET	Harry Ettinger	Harry Ettinger	Sandy Wagner
Community Relations	**PA-3**, -1	TBD	TBD	TBD
Corrective Meas. Implem. and Remediation	**ENG**, EM-7	Bill Foley	Lars Soholt	Lars Soholt
Decision Analysis and Cost Benefit	**A**-1, -4	Elizabeth Kelly	Kathy Campbell	Micheline Devaurs
Document Preparation	IS-9, 11, 12	Betsy Barnett	Karen Foster	Lars Soholt
Drilling/Borehole Geophys. Logging/Curation	**EES**, EM	Sue Goff	Paul Aamodt	Paul Aamodt
Engineering	**ENG**, MEE	Bill Foley	Paul Aamodt	Paul Aamodt
Environmental Assessment	EM-8, EES-2	Doris Garvey	Doris Garvey	Paul Aamodt
FIMAD	**EES**	Greg Cole	Greg Cole	Greg Cole
Framework Studies	**EES**, EM, INC	Jamie Gardner	Jamie Gardner	Micheline Devaurs
Geochemistry	**INC**, CLS, EES	Clarence Duffy	Terry Morgan	Sandy Wagner
Health and Safety	**EM-13**, HS-1, 2, 3, EM-8	Susan Alexander	Susan Alexander	Lars Soholt
Hydrology	**EES**, EM-8	Bruce Gallaher	Bruce Gallaher	Micheline Devaurs
Mixed-Waste Storage and Disposal Facility	**MEE**, ENG, EM-7	Dean Nelson	Don York	Paul Aamodt
Planning/Scheduling/Cost Estimating/Rptg.	EM-13, MEE-4, contractors	Don York	Don York	Bob Vocke
Quality Assurance	**EM-13**, MEE-9	Karen Foster	Karen Foster	Lars Soholt
Records Management	EM-13	Mike Ray	Mike Ray	Mike Ray
Regulatory Compliance	EM-8	Dave McInroy	Dave McInroy	John Krueger
Risk Assessment	**EM**, EES, A, UC Los Angeles	Ted Norris	Ted Norris	Lars Soholt
Site Assessment and Remediation Technologies Development	**EM**, A, CLS, EES, ENG, INC, M, N, NMT, AET	Harry Ettinger	Harry Ettinger	Paul Aamodt
SWMU Review and Interim Rem. Actions	**EM-8**, EM-13, HS-3	Philip Fresquez	Mary Salisbury	Robert Gonzales
Statistics and Data Quality Objectives	A-1	Kathy Campbell	Kathy Campbell	Micheline Devaurs

Fig. I-1. ER Program organizational chart.

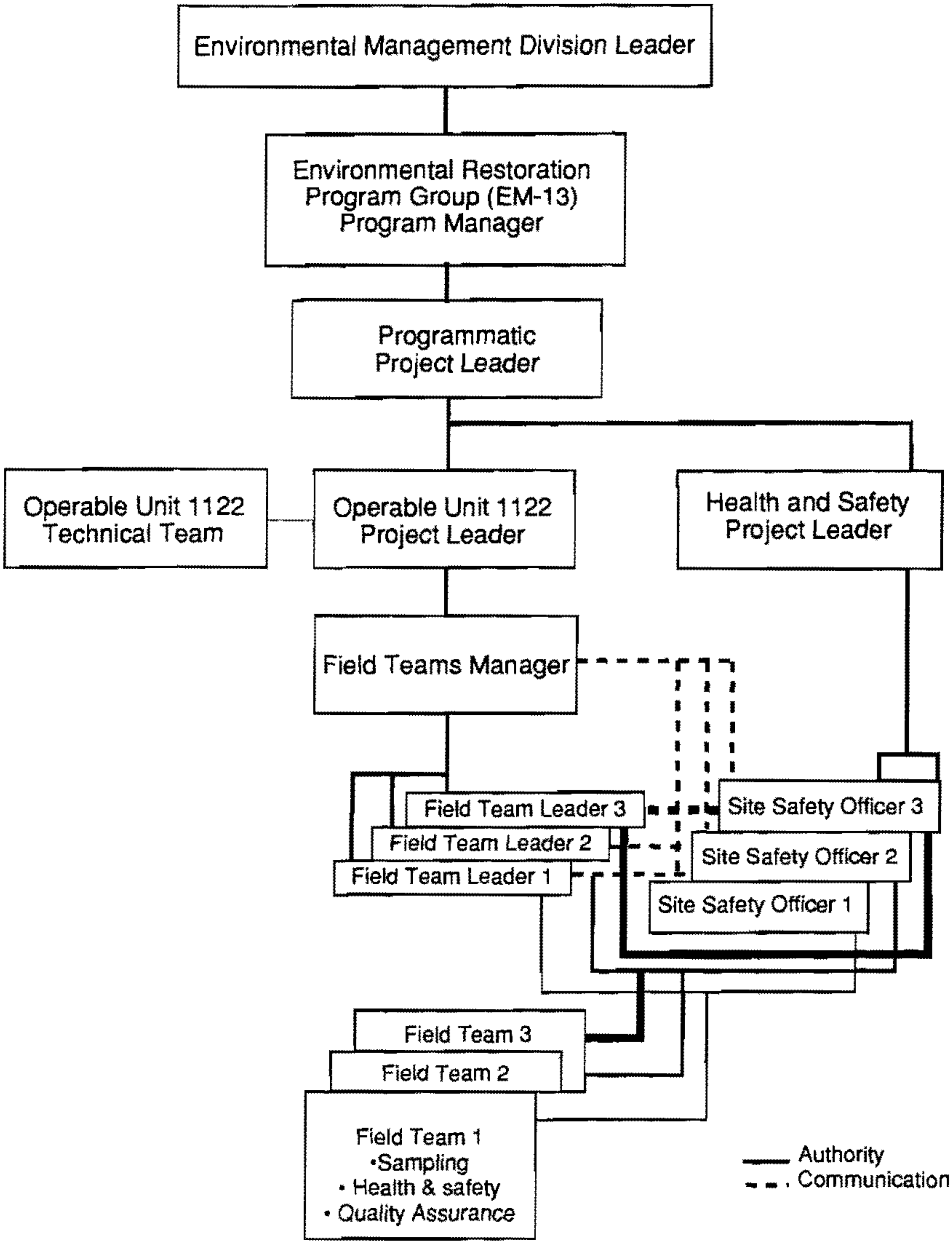


Fig. I-2. Operable unit field work organization showing health and safety responsibility.

TABLE I-5

OU 1122 RFI PERSONNEL*

Operable Unit Project Leader	Keith Dowler, CLS-1
Assistant to OUPL	TBD†
Field Teams Manager	TBD†
Field Team Leaders	TBD†
Field Team Members	TBD†
Technical Team Members	Katherine Campbell (Statistics), A-1 William Laughlin (Geology, Geochemistry), EES-1 Dorothy Hoard (Archiving, analytical chemistry), CLS-1

*Current as of May 1, 1992. All personnel are located at the Laboratory, unless otherwise indicated. Note that additional laboratory and contractor personnel will be added, as needed, to implement the RFI.

†TBD - To Be Determined.

The following are the responsibilities of the the program manager, programmatic project leader, technical team, field team leaders, and field teams identified in Fig. I-2:

Program Manager

- ensures that the Laboratory's ER activities are consistent with the goals and objectives of the EM Division Leader, DOE, EPA, NMED, and others, as appropriate;
- 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 acknowledgement system when necessary,

- ensuring the preparation and controlled distribution of administrative procedures, and
- establishing a standard routing system for routine guidance.

Programmatic Project Leader

- provides technical and administrative programmatic guidance to operable unit project leaders and technical team leaders including:
- regulatory compliance requirements (especially RCRA and CERCLA), RFI/CMS/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 LANL ER Program;
- responsible for defining allocation of resources to Laboratory and contractor personnel to accomplish required technical and management activities, and tracking progress and fiscal spending;
- assists OUPLs and TTLs in obtaining appropriate and sufficient resources to perform their assigned duties;
- performs technical and policy reviews of documents prepared for the ER Program by OUPLs, TTLs, and affiliated staff;
- reviews and recommends management action as appropriate for scopes of work, proposals, or requests for work to be supported by the ER Program;
- reviews progress of OUPLs and TTLs;
- recommends to the management, corrective or enhancement actions as appropriate to expeditiously meet ER Program goals;
- works closely with other programmatic project leaders and group leaders to assure proper integration of program activities and fiscal responsibility, and to ensure compliance with applicable federal and state regulations;
- interacts with federal and state regulatory agencies; and
- provides input to monthly, quarterly, and/or annual progress reports as required.

OU 1122 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 (PM);
- oversees subcontractors, as appropriate;
- coordinates with technical team leaders;
- 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 QA staff for audits;
- complies with the LANL ER Program Health and Safety (H&S), records management, and community relations requirements;
- oversees RFI field work and manages the field teams manager; and
- complies with the Laboratory's technical and QA requirements for the LANL 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 field work, data analysis, report preparation, work plan modifications, and planning of subsequent investigations as necessary.

The primary disciplines currently represented on the technical team are geology, geochemistry, statistics, and chemistry. 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 Chapter 4; and
- manages field team members.

Field Team Leader

The field teams manager will assign field work to field team leaders for implementation in the field. Each field team leader will direct the execution of field sampling activities using crews of field team members appropriate for the activity. Field team leaders may be contractor personnel.

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 field team leader. Field team members may be contractor personnel.

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 VI, Hazardous Waste Management Division, Dallas, Texas. **(EPA 1990, 0306)**

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

Table 1-4

LANL - KEITH DOWLER | FINEST HOUR | ADS 1122: TA-33, 70 ASSESSMENT

REPORT DATE 18FEB92 RUN NO. 75 14:23 | ENVIRONMENTAL RESTORATION | START DATE 1OCT91 FIN DATE 7NOV(

SCHED/BUDGET FEEDBACK RPT FOR COSTPRO ANALYSIS | DATA DATE 1OCT91 PAGE NO. 1

ACTIVITY ID	ORIG DUR	REM DUR	%	ACTIVITY DESCRIPTION / BUDGET	EARNED	SCHEDULED START	SCHEDULED FINISH
180055	250	250	0	1122: Manage ADS During FY-92 (LOE)		1OCT91	30SEP92
				79937.00	.00		
180060	30	30	0	1122: Develop Management Plan for RFI Work Plan		1OCT91	13NOV91
				12125.00	.00		
180070	10	10	0	1122: Write Final QA Plan		1OCT91	15OCT91
				7139.00	.00		
180080	10	10	0	1122: Write Final Health and Safety Plan		1OCT91	15OCT91
				7139.00	.00		
180100	10	10	0	1122: Write Final Records Management Plan		1OCT91	15OCT91
				7139.00	.00		
180105	249	249	0	1122: Manage ADS During FY-93 (LOE)		1OCT92	30SEP93
				237024.58	.00		
180110	250	250	0	1122: Manage ADS During FY-94 (LOE)		1OCT93	30SEP94
				157886.72	.00		
180115	247	247	0	1122: Manage ADS During FY-95 (LOE)		3OCT94	29SEP95
				166566.72	.00		
180120	249	249	0	1122: Manage ADS During FY-96 (LOE)		2OCT95	30SEP96
				175732.80	.00		
180125	249	249	0	1122: Manage ADS During FY-97 (LOE)		1OCT96	30SEP97
				185394.88	.00		
180130	249	249	0	1122: Manage ADS During FY-98 (LOE)		1OCT97	30SEP98
				185394.88	.00		

LANL - KEITH DOWLER | FINEST HOUR | ADS 1122: TA-33, 70 ASSESSMENT

REPORT DATE 18FEB92 RUN NO. 75 | ENVIRONMENTAL RESTORATION | START DATE 1OCT91 FIN DATE 7NOV
14:23
SCHED/BUDGET FEEDBACK RPT FOR COSTPRO ANALYSIS | DATA DATE 1OCT91 PAGE NO. 2

ACTIVITY ID	ORIG DUR	REM DUR	%	ACTIVITY DESCRIPTION / BUDGET	EARNED	SCHEDULED START	SCHEDULED FINISH
180135	249	249	0	1122: Manage ADS During FY-99 (LOE)		1OCT98	30SEP99
				229255.28	.00		
180155	50	50	0	1122: Develop Internal Draft RFI Work Plan		14NOV91	30JAN92
				229520.00	.00		
180160	19	19	0	1122: LANL/VE Review Internal Draft RFI WP		31JAN92	27FEB92
				34143.00	.00		
180165	20	20	0	1122: Write DOE Draft RFI Work Plan		28FEB92	26MAR92
				16055.00	.00		
180170	21	21	0	1122: DOE Review DOE Draft Work Plan		27MAR92	24APR92
				2870.00	.00		
180175	15	15	0	1122: Incorp DOE Comments/Write EPA/NMED Dft WP		27APR92	15MAY92
				16119.00	.00		
180180	44	44	0	1122: Conduct NMED Review of RFI Work Plan		18MAY92	20JUL92
				2870.00	.00		
180185	44	44	0	1122: Conduct EPA Review of RFI Work Plan		18MAY92	20JUL92
				5936.00	.00		
180190	20	20	0	1122: Mobilize for RFI		1JUL93	29JUL93
				8295.00	.00		
180195	245	245	0	1122: Conduct RFI Bench/Pilot Studies (LOE)		1JUL93	23JUN94
				.00	.00		
180200	327	327	0	1122: Conduct RFI PH1 Field Work		1JUL93	20OCT94
				882162.81	.00		

LANL - KEITH DOWLER FINEST HOUR ADS 1122: TA-33, 70 ASSESSMENT

REPORT DATE 18FEB92 RUN NO. 75 ENVIRONMENTAL RESTORATION START DATE 1OCT91 FIN DATE 7NOV
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SCHED/BUDGET FEEDBACK RPT FOR COSTPRO ANALYSIS DATA DATE 1OCT91 PAGE NO. 3

ACTIVITY ID	ORIG DUR	REM DUR	%	ACTIVITY DESCRIPTION	BUDGET	EARNED	SCHEDULED START	SCHEDULED FINISH
180205	357	357	0	1122: Conduct RFI PH1 Sample Analysis	9568708.00	.00	1JUL93	6DEC94
180210	367	367	0	1122: Conduct RFI PH1 Data Assessment	166267.37	.00	1JUL93	20DEC94
180215	60	60	0	1122: Write RFI PH1 Tech Memo/WP Modification	107578.63	.00	21DEC94	22MAR95
180220	20	20	0	1122: Demobilize RFI PH1 Field Work	8295.00	.00	21OCT94	18NOV94
180225	22	22	0	1122: EPA/NMED Rev PH1 Tech Memo/WP Modification	13518.37	.00	23MAR95	21APR95
180230	22	22	0	1122: DOE Review PH1 Tech Memo/WP Modification	13518.37	.00	23MAR95	21APR95
180235	20	20	0	1122: Write PH2 Contract; Mobilize for RFI	36480.48	.00	23MAR95	19APR95
180240	327	327	0	1122: Conduct RFI PH2 Field Work	1091218.84	.00	20APR95	8AUG96
180245	357	357	0	1122: Conduct RFI PH2 Sample Analysis	11477773.00	.00	20APR95	20SEP96
180250	20	20	0	1122: Demobilize RFI PH2 Field Work	8295.00	.00	9AUG96	6SEP96
180255	367	367	0	1122: Conduct RFI PH2 Data Assessment	266496.12	.00	20APR95	4OCT96

LANL - KEITH DOWLER | FINEST HOUR | ADS 1122: TA-33, 70 ASSESSMENT

REPORT DATE 18FEB92 RUN NO. 75
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SCHED/BUDGET FEEDBACK RPT FOR COSTPRO ANALYSIS | DATA DATE 1OCT91 PAGE NO. 4

ACTIVITY ID	ORIG DUR	REM DUR	%	ACTIVITY DESCRIPTION / BUDGET	EARNED	SCHEDULED START	SCHEDULED FINISH
180315	100	100	0	1122: Conduct RFI Report Facility Investigation		23SEP96	20FEB97
				172120.85	.00		
180320	110	110	0	1122: Conduct RFI Report Investigation Analysis		23SEP96	6MAR97
				714587.78	.00		
180325	100	100	0	1122: Develop NEPA Documentation for RFI Report		1JUL93	22NOV93
				104027.92	.00		
180335	132	132	0	1122: Prepare Internal Draft of RFI Report		7MAR97	11SEP97
				940036.65	.00		
180340	40	40	0	1122: LANL/VE Review Internal Draft of RFI Rpt		12SEP97	7NOV97
				29119.31	.00		
180345	40	40	0	1122:Incorp.LANL Rev.Comments Intern RFI Dft Rpt		11NOV97	13JAN98
				27856.85	.00		
180350	20	20	0	1122: Publish DOE Draft of RFI Report		14JAN98	10FEB98
				1299.06	.00		
180355	22	22	0	1122: Conduct Review of DOE Draft of RFI Report		11FEB98	13MAR98
				12121.62	.00		
180360	40	40	0	1122:Incorp DOE Rev Comments into DOE Dft RFIRpt		16MAR98	8MAY98
				12121.62	.00		
180365	20	20	0	1122: Publish EPA/NMED Draft of RFI Report		11MAY98	8JUN98
				1299.06	.00		
180370	44	44	0	1122: Conduct EPA Review of RFI Report		9JUN98	10AUG98
				12611.66	.00		

LANL - KEITH DOWLER FINEST HOUR ADS 1122: TA-33, 70 ASSESSMENT

REPORT DATE 18FEB92 RUN NO. 75 ENVIRONMENTAL RESTORATION START DATE 1OCT91 FIN DATE 7NO
14:23
SCHED/BUDGET FEEDBACK RPT FOR COSTPRO ANALYSIS DATA DATE 1OCT91 PAGE NO. 5

ACTIVITY ID	ORIG DUR	REM DUR	%	ACTIVITY DESCRIPTION	BUDGET	EARNED	SCHEDULED START	SCHEDULED FINISH
180375	44	44	0	1122: Conduct NMED Review of RFI Rpt	12611.66	.00	9JUN98	10AUG98
180380	245	245	0	1122: Conduct Bench/Pilot Studies for CMS Pl LOE	.00	.00	9JUN98	2JUN99
180385	35	35	0	1122: Establish Current Situation for CMS Plan	6303.24	.00	9JUN98	28JUL98
180390	35	35	0	1122: Establish CA Objectives for CMS Plan	9833.18	.00	9JUN98	28JUL98
180395	35	35	0	1122: Develop Screening Technologies for CMS Pl.	8592.92	.00	9JUN98	28JUL98
180400	245	245	0	1122: Develop NEPA Documentation for CMS Plan	5844.54	.00	9JUN98	2JUN99
180405	15	15	0	1122: Develop Alternatives for CMS Plan	8592.92	.00	29JUL98	18AUG98
180410	15	15	0	1122: Develop Internal Draft of CMS Plan	20817.75	.00	19AUG98	9SEP98
180415	10	10	0	1122: LANL/VE Review Internal Draft of CMS Plan	588.11	.00	10SEP98	23SEP98
180420	10	10	0	1122:Incorp LANL REV Commts Intern Dft CMS Pl	588.11	.00	24SEP98	7OCT98
180425	5	5	0	1122: Publish DOE Draft of CMS Plan	1299.06	.00	8OCT98	15OCT98

ACTIVITY ID	ORIG DUR	REM DUR	%	ACTIVITY DESCRIPTION	BUDGET	EARNED	SCHEDULED START	SCHEDULED FINISH
180430	22	22	0	1122: Conduct Review of DOE Draft of CMS Plan	186.89	.00	16OCT98	17NOV98
180435	20	20	0	1122:Incorp. DOE Rev.Commts into DOE Dft CMS Pl	186.89	.00	18NOV98	17DEC98
180440	10	10	0	1122: Publish EPA/NMED Draft of CMS Plan	1299.06	.00	18DEC98	5JAN99
180445	44	44	0	1122: Conduct EPA Review of CMS Plan	186.89	.00	6JAN99	10MAR99
180450	44	44	0	1122: Conduct NMED Review of CMS Plan	186.89	.00	6JAN99	10MAR99
180455	245	245	0	1122: Conduct CMS Bench/Pilot Studies (LOE)	1339099.00	.00	29APR99	21APR00
180460	30	30	0	1122: Conduct Technical Evaluation for CMS Rpt	46966.18	.00	29APR99	10JUN99
180465	30	30	0	1122: Conduct Environ Evaluation for CMS Report	46106.65	.00	29APR99	10JUN99
180470	30	30	0	1122: Conduct Human Health Eval for CMS Rpt	42822.00	.00	29APR99	10JUN99
180475	30	30	0	1122: Conduct Community Relations Eval. CMS Rpt	40525.44	.00	29APR99	10JUN99
180480	30	30	0	1122: Conduct Cost Evaluation for CMS Report	42335.44	.00	29APR99	10JUN99

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REPORT DATE 18FEB92 RUN NO. 75 ENVIRONMENTAL RESTORATION START DATE 1OCT91 FIN DATE 7NO
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SCHED/BUDGET FEEDBACK RPT FOR COSTPRO ANALYSIS DATA DATE 1OCT91 PAGE NO. 7

ACTIVITY ID	ORIG DUR	REM DUR	%	ACTIVITY DESCRIPTION	BUDGET	EARNED	SCHEDULED START	SCHEDULED FINISH
180485	30	30	0	1122: Develop NEPA Documentation for CMS Report	83986.74	.00	29APR99	10JUN99
180490	10	10	0	1122: Prepare Internal Draft of CMS Report	31695.18	.00	11JUN99	24JUN99
180495	10	10	0	1122: LANL/VE Review Internal Draft of CMS Rpt	1420.61	.00	25JUN99	9JUL99
180500	35	35	0	1122:Incorp.LANL Rev Commt Intern Dft CMS Rpt	1420.61	.00	6MAR00	21APR00
180505	10	10	0	1122: Publish DOE Draft of CMS Report	1299.06	.00	24APR00	5MAY00
180510	22	22	0	1122: Conduct Review of DOE Draft of CMS Report	887.39	.00	8MAY00	7JUN00
180515	22	22	0	1122: Incorp. DOE Rev Commt into DOE Dft CMS Rpt	887.39	.00	8JUN00	10JUL00
180520	10	10	0	1122: Publish EPA/NMED Draft of CMS Report	1299.06	.00	11JUL00	24JUL00
180525	44	44	0	1122: Conduct EPA Review of CMS Report	887.39	.00	25JUL00	25SEP00
180530	44	44	0	1122: Conduct NMED Review of CMS Rpt	887.39	.00	25JUL00	25SEP00
180535	245	245	0	1122: Assmt - Conduct VCA (LOE)	.00	.00	1JUL93	23JUN94

LANL - KEITH DOWLER FINEST HOUR ADS 1122: TA-33, 70 ASSESSMENT

REPORT DATE 18FEB92 RUN NO. 75 ENVIRONMENTAL RESTORATION START DATE 1OCT91 FIN DATE 7NOV
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SCHED/BUDGET FEEDBACK RPT FOR COSTPRO ANALYSIS DATA DATE 1OCT91 PAGE NO. 8

ACTIVITY ID	ORIG DUR	REM DUR	%	ACTIVITY DESCRIPTION / BUDGET	EARNED	SCHEDULED START	SCHEDULED FINISH
180540	45	45	0	1122: Write Ph1 Contracts for RFI		21JUL92	22SEP92
				24332.00	.00		
180545	20	20	0	1122: Incorporate EPA/NMED Comments for RFI WP		21JUL92	17AUG92
				2512.00	.00		
180550	10	10	0	1122: Publish Final RFI Work Plan		18AUG92	31AUG92
				994.00	.00		
180570	20	20	0	1122: Incorporate EPA/NMED Comments on RFI Rpt		11AUG98	8SEP98
				6175.14	.00		
180575	20	20	0	1122: Publish Final RFI Report		9SEP98	6OCT98
				1299.06	.00		
180580	20	20	0	1122: Incorporate EPA/NMED Comments on CMS Plan		11MAR99	7APR99
				.00	.00		
180585	10	10	0	1122: Publish Final CMS Plan		8APR99	21APR99
				1299.06	.00		
180590	5	5	0	1122: EPA Approves CMS Plan		22APR99	28APR99
				1431.06	.00		
180595	20	20	0	1122: Incorporate EPA/NMED Comments on CMS Rpt		26SEP00	24OCT00
				.00	.00		
180600	10	10	0	1122: Publish Final CMS Report		25OCT00	7NOV00
				1299.06	.00		
180605	245	245	0	1122:Conduct Voluntary C. Actions for RFI WP LOE		1OCT91	23SEP92
				.00	.00		

NL - KEITH DOWLER　　FINEST HOUR　　ADS 1122: TA-33, 70 ASSESSMENT

PORT DATE 18FEB92 RUN NO. 75 ENVIRONMENTAL RESTORATION　　START DATE 1OCT91 FIN DATE 7NOV(
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HED/BUDGET FEEDBACK RPT FOR COSTPRO ANALYSIS　　DATA DATE 1OCT91 PAGE NO. 9

ACTIVITY ID	ORIG DUR	REM DUR	%	ACTIVITY DESCRIPTION	BUDGET	EARNED	SCHEDULED START	SCHEDULED FINISH
180610	245	245	0	1122: Cond Bench/Pilot Studies for RFI WP (LOE)	.00	.00	1OCT91	23SEP92
180615	30	30	0	1122: Develop NEPA Documentation for RFI WP	43092.00	.00	29JUN92*	10AUG92
180700	158	158	0	1122: Detailed Field Planning	200000.00	.00	1OCT92*	21MAY93
630000	189	189	0	1122: Conduct VCA (LOE)	96807.00	.00	2JAN97*	30SEP97
630005	245	245	0	1122: Conduct VCA (LOE)	130690.00	.00	1OCT97	24SEP98
18M000	0	0	0	1122: DOE DRAFT OF RFI WORK PLAN COMPLETE	.00	.00		26MAR92
18M005	0	0	0	1122: EPA/NMED WORK PLAN SUBMITTED	.00	.00		15MAY92
18M010	0	0	0	1122: START RFI	.00	.00	1JUL93*	
18M015	0	0	0	1122: RFI FIELD WORK COMPLETED	.00	.00		6SEP96
18M020	0	0	0	1122: START DEVELOPING RFI REPORT	.00	.00	1JUL93	
18M025	0	0	0	1122: EPA/NMED DRAFT OF RFI REPORT COMPLETED	.00	.00		8JUN98

LANL - KEITH DOWLER | FINEST HOUR | ADS 1122: TA-33, 70 ASSESSMENT

REPORT DATE 18FEB92 RUN NO. 75 14:23 | ENVIRONMENTAL RESTORATION | START DATE 1OCT91 FIN DATE 7NOV

SCHED/BUDGET FEEDBACK RPT FOR COSTPRO ANALYSIS | | DATA DATE 1OCT91 PAGE NO. 10

ACTIVITY ID	ORIG DUR	REM DUR	%	ACTIVITY DESCRIPTION	BUDGET	EARNED	SCHEDULED START	SCHEDULED FINISH
18N030	0	0	0	1122: RFI COMPLETED	.00	.00		6OCT98
18N035	0	0	0	1122: START DEVELOPMENT OF CMS PLAN	.00	.00	9JUN98	
18N040	0	0	0	1122: EPA/NMED DRAFT OF CMS PLAN COMPLETED	.00	.00		5JAN99
18N045	0	0	0	1122: START CMS WORK	.00	.00	29APR99	
18N050	0	0	0	1122: CMS WORK COMPLETED	.00	.00		21APR00
18N055	0	0	0	1122: START DEVELOPMENT OF CMS REPORT	.00	.00	29APR99	
18N060	0	0	0	1122: EPA/NMED DRAFT OF CMS REPORT COMPLETED	.00	.00		24JUL00
18N065	0	0	0	1122: ASSESSMENT COMPLETED	.00	.00		7NOV00
18N070	0	0	0	1122: EPA NOTIFICATION OF CMS REQUIREMENTS	.00	.00		6OCT98
18N075	0	0	0	1122: EPA APPROVED CMS PLAN	.00	.00		28APR99
18N080	0	0	0	1122: RFI WORK PLAN COMPLETED	.00	.00		23SEP92

LANL - KEITH DOWLER   FINEST HOUR   ADS 1122: TA-33, 70 ASSESSMENT

REPORT DATE 18FEB92 RUN NO. 75 14:23   ENVIRONMENTAL RESTORATION   START DATE 1OCT91 FIN DATE 7

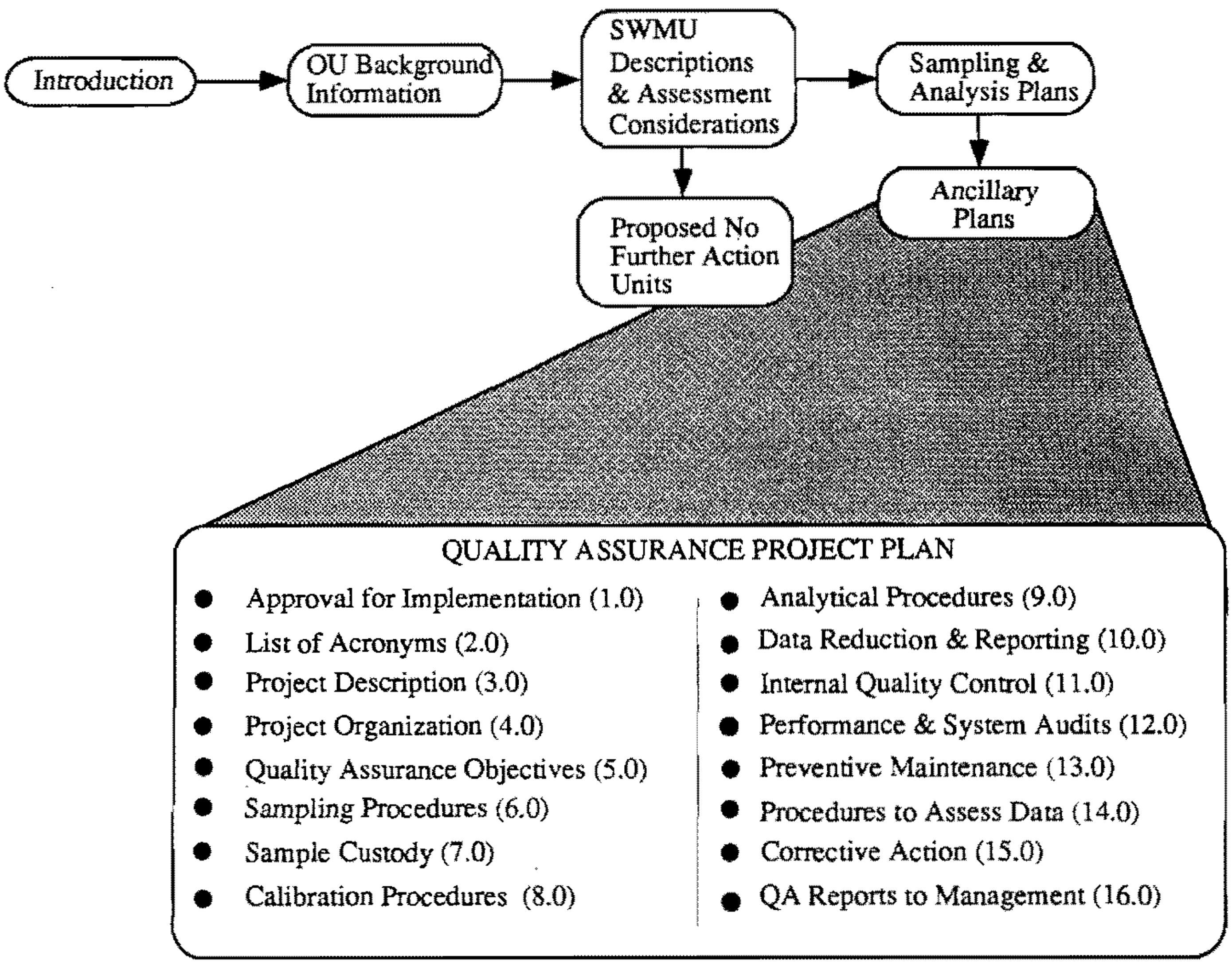
SCHED/BUDGET FEEDBACK RPT FOR COSTPRO ANALYSIS   DATA DATE 1OCT91 PAGE NO. 1

ACTIVITY ID	ORIG DUR	REM DUR	%	ACTIVITY DESCRIPTION / BUDGET	EARNED	SCHEDULED START	SCHEDULED FINISH
18W085	0	0	0	1122: EPA/NMED DRAFT OF PH1 TECH/MEMO COMPLETED			22MAR95
				.00	.00		
REPORT TOTAL				29703631.25	.00		

$ X 1000

EST TO COMPLETION	$29,704
ESCALATION	$406
PRIOR YEARS	$1,334
TOTAL AT COMPLETION	$31,444

ANNEX II


Introduction
OU Background Information
SWMU Descriptions & Assessment Considerations
Sampling & Analysis Plans
Ancillary Plans
Proposed No Further Action Units
QUALITY ASSURANCE PROJECT PLAN
Approval for Implementation (1.0)
List of Acronyms (2.0)
Project Description (3.0)
Project Organization (4.0)
Quality Assurance Objectives (5.0)
Sampling Procedures (6.0)
Sample Custody (7.0)
Calibration Procedures (8.0)
Analytical Procedures (9.0)
Data Reduction & Reporting (10.0)
Internal Quality Control (11.0)
Performance & System Audits (12.0)
Preventive Maintenance (13.0)
Procedures to Assess Data (14.0)
Corrective Action (15.0)
QA Reports to Management (16.0)

1.0 APPROVAL FOR IMPLEMENTATION

1. NAME: Robert Vocke
   TITLE: ER Program Manager, Los Alamos National Laboratory

   SIGNATURE: ______________________________

   DATE: ________________

2. NAME: Karen Warthen
   TITLE: Quality Assurance Project Leader, ER Program, Los Alamos National Laboratory

   SIGNATURE: ______________________________

   DATE: ________________

3. NAME: Larry Maassen
   TITLE: ER Programmatic Project Leader, Los Alamos National Laboratory

   SIGNATURE: ______________________________

   DATE: ________________

4. NAME: Craig Leasure
   TITLE: Group Leader, Environmental Chemistry Group (EM-9)

   SIGNATURE: ______________________________

   DATE: ________________

5. NAME: Margaret Gautier
   TITLE: Quality Assurance Data Management Section Leader, Environmental Chemistry Group (EM–9)

   SIGNATURE: ______________________________

   DATE: ________________

6. NAME: Keith Dowler
   TITLE: Project Leader, Los Alamos National Laboratory

   SIGNATURE: ______________________________

   DATE: ________________

7. NAME: Charles Ritchey
   TITLE: Acting Chief of Office of Quality Assurance, Region VI Environmental Protection Agency

   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.

2.0 LIST OF ACRONYMS

ANSI	American National Standards Institute
AOC	Area of concern
AP	Administrative procedure
ASA	American Society of Agronomy, Inc.
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
COE	US Army Corp of Engineers
DOE	US Department of Energy
DQO	Data quality objective
EPA	US Environmental Protection Agency
ER	Environmental Restoration Division
FIMAD	Facility for Information Management, Analysis and Display
H&S	Health and safety
HS	Health and Safety Division
ICPMS	Inductively coupled plasma mass spectroscopy
IWP	Installation Work Plan
LANL	Los Alamos National Laboratory
OU	Operable unit
PCB	Polychlorinated biphenyl
PL	Project leader
PM	Program manager
QA	Quality assurance
QAP	Quality Assurance Plan
QAPjP	Quality Assurance Project Plan
QA/QC	Quality assurance/quality control
QC	Quality control
QP	Quality procedure
QPP	Quality Program Plan
QPPL	Quality program project leader
RCRA	Resource Conservation and Recovery Act
RFI	RCRA facility investigation
RMP	Records Management Plan
SMF	Sample management facility
SOP	Standard operating procedure
SSSA	Soil Science Society of America, Inc.
SW	Solid waste
SWMU	Solid waste management unit
USATHAMA	US Army Toxic and Hazardous Materials Agency

3.0 PROJECT DESCRIPTION

3.1 Introduction

This Operable Unit (OU) Resource Conservation and Recovery Act (RCRA) Facility Investigation Quality Assurance Project Plan is tiered to the Los Alamos National Laboratory (LANL) Environmental Restoration Program Generic Quality Assurance Project Plan (QAPjP) (LANL 1991, 0412). Information specific to the Operable Unit 1122 Quality Assurance Project Plan is presented in detail in this annex. Information covered by the LANL Environmental Restoration Program generic QAPjP, or presented elsewhere, has been referenced to that document by chapter. To facilitate cross-referencing the generic QAPjP and this Quality Assurance Project Plan for Operable Unit 1122, the section titles and numbers in this plan correspond directly to the section titles and numbers in the generic QAPjP

The Operable Unit 1122 Quality Assurance Project Plan integrates the US Environmental Protection Agency (EPA) 16-point QAMS-005/80 guidance (EPA 1980, 0552), as well as the American Society of Mechanical Engineers (ASME) NQA-1-1989 edition of "Quality Assurance Program Requirements for Nuclear Facilities" (ANSI/ASME 1989, 0018), as specified in DOE Order 5700.6C (DOE 1991, 0703). This integration is described in Section 3, Quality Assurance Program, of the LANL Environmental Restoration Quality Program Plan (QPP), published as Annex II of the Laboratory's Installation Work Plan (IWP) (LANL 1991, 0553).

A description of the Operable Unit 1122 RCRA Facility Investigation (RFI) and tasks is presented in Chapter 1 of this work plan.

3.2 Facility Description

A facility description of Los Alamos National Laboratory is presented in Section 2.0 of the LANL IWP (LANL 1991, 0553). Additional historical information on Operable Unit 1122 is presented in Chapter 2 and Chapter 3 of this work plan.

3.3 Environmental Restoration Program

The Environmental Restoration Program is described in Section 3.0 of the LANL IWP (LANL 1991, 0553).

3.4 Project Description

3.4.1 Project Objectives

Information regarding project objectives is presented in Chapter 1, Section 1.0 of this work plan.

3.4.2 Project Schedule

Project activity dates are presented in Table I-1, Annex I of this work plan.

3.4.3 Project Scope

Project scope is described in Chapter 1, Section 1.0 of this work plan.

3.4.4 Background Information

This information is presented in sections of Chapter 2 and Chapter 3 of this work plan.

3.4.5 Data Usage

Information regarding data usage and data users is presented in Chapter 3, Sections 3.2.5, 3.3.5, 3.4.5, 3.5.5, and 3.6.5 of this work plan. Data collected during the RFI will be used to determine whether or not a source of contamination is present and if present, to define the extent of contamination at Solid Waste Management Units (SWMUs) or SWMU aggregates, and areas of concern (AOCs) detailed in field sampling plans in Chapter 4 of this work plan. The investigation should provide sufficient data for baseline risk assessment and corrective measures studies.

Data collected during the RFI will be entered into the Facility for Information Management, Analysis and Display (FIMAD) following the Environmental Restoration Records Management Procedure, Annex IV of this work plan, and the Records Management Plan (RMP). Data will be analyzed, as appropriate, using statistical techniques, kriging, 2- and 3-dimensional modeling, or other appropriate methods (see IWP Annex IV and IWP updates for additional detail as FIMAD develops) (LANL 1991, 0553).

4.0 PROJECT ORGANIZATION AND RESPONSIBILITY

The overall organizational structure of the Environmental Restoration Program is presented in Section 2.0 of the LANL ER Program QPP (IWP, Annex II, LANL 1991, 0553). Environmental Restoration program personnel are identified to the level of the technical team leader and operable unit project leader and personnel responsibilities and line authority are detailed. In addition, the Quality Assurance (QA) organizational structure is presented.

Management organization information for Operable Unit 1122 is provided in Annex I of this work plan, the Project Management Plan. Records of qualifications and completion of training of all personnel working on RFI field work will be kept as Environmental Restoration Records (see Annex IV, Section 5.0, of the IWP) (LANL 1991, 0553). Additional information on the general responsibilities of personnel is in Annex I of this work plan.

The following details QA responsibilities.

Operable Unit 1122 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 technical team leaders;
- conducts technical reviews of the milestones and final reports;
- interfaces with the Environmental Restoration Quality Program Project Leader (QPPL) to resolve quality concerns and to coordinate audits with the QA staff;
- complies with the LANL Environmental Restoration Program health and safety, records management, and community relations procedures;
- oversees RFI field work and directs the field teams manager; and
- complies with the LANL's technical and QA requirements for the Environmental Restoration Program.

Operable 1122 Field Teams Manager:

- oversees day-to-day field operations, including planning, scheduling, and implementation of RFI field activities in this work plan; and
- manages field team members

Field Team Member(s):

- Field team members will include (depending upon the sampling activity being conducted): sampling personnel, a site safety officer, and staff members with technical knowledge of geology, hydrology, statistics, or other applicable disciplines.

5.0 QUALITY ASSURANCE OBJECTIVES FOR MEASUREMENT DATA IN TERMS OF PRECISION, ACCURACY, REPRESENTATIVENESS, COMPLETENESS, AND COMPARABILITY

The precision, accuracy, and completeness objectives for LANL ER Program projects are based upon historical precision and accuracy data where available and upon the completeness needed to accomplish project goals. Where historical information is not available, the published precision and accuracy for the method are the bases for the stated objectives.

The analytical methods that will be used for analysis at Los Alamos are detailed in the LANL documents LA-10300-M, Volumes 1 and 2, Health and Environmental Chemistry: Analytical Techniques, Data Management, and Quality Assurance. These methods are based on EPA methods when available, or generally recognized and accepted institutions such as the American Public Health Association or American Society for Testing and Materials (ASTM).

The overall quality assurance objective is to develop and implement procedures that will ensure quality in field sampling, field testing, chain-of-custody, laboratory analysis, and data reporting. Specific procedures for sampling, chain-of-custody, audits, preventive maintenance, and corrective actions are described in other sections of this quality assurance project plan. This section defines the goals for accuracy, precision, completeness, representativeness, and comparability. Quality assurance goals for field measurements are also discussed.

5.1 Level of Quality Control

5.1.1 Field Sampling

A discussion of quality-control samples for the Environmental Restoration Program is presented in Subsection 5.1 and 6.1, and depicted on Table V.1 of the generic QAPjP (LANL 1991, 0412). Refer to Chapter 4, Phase 1 Sampling Plans, for detail on the appropriate sample requirements and Environmental Restoration program Standard Operating Procedure (SOP) Number 01.05, Field Quality Control Samples (LANL 1992, 0688).

Soil samples for geotechnical analyses will be collected during this RCRA Facility Investigation. These analyses will use conventional laboratory procedures specified by the American Society for Testing and Materials. Many of these procedures are detailed by SOPs. In contrast to samples submitted for chemical analyses, field quality control samples are not routinely associated with geotechnical samples.

5.1.2 Field Measurements

The field measurements quality control level of effort will follow the recommendations presented in Table V.1, Section 5.1.2 of the generic QAPjP (LANL 1991, 0412).

5.1.3 Analytical Laboratory

The analytical laboratory quality control level of effort will follow the recommendations specified in the EPA methods or the frequency presented in Table V.2, Section 5.1.3 of the generic QAPjP (LANL 1991, 0412).

5.2 Precision, Accuracy, and Sensitivity of Analyses

The analytical laboratory quality control acceptance criteria for precision, accuracy, and sensitivity of analyses will use the methods and detection limits specified for the EPA and US Department of Energy (DOE) presented in Section 5.2 of the generic QAPjP (LANL 1991, 0412). Generally, the following will be used (or excluded from use):

- Table V.3 for volatile organic compounds
- Table V.4 for semivolatiles
- Tables V.5 and V.6 for polychlorinated biphenyls (PCBs) and pesticides
- Table V.7 for inorganics
- Table V.8 for radionuclides
- Table V.9 for miscellaneous analytes
- Table V.10 for high explosives

Any specific analyte identified in the tables listed above may be included in the investigations at OU 1122.

The analytical laboratory quality control acceptance criteria for precision, accuracy, and sensitivity of analyses which are to be used are not specific to this RCRA facility investigation. The table numbers cited in the sections below correspond to the table numbers in the generic QAPjP (LANL 1991, 0412) and include the analytes specific to OU 1122.

5.3 Quality Assurance Objectives for Precision

The quality assurance objectives for precision of laboratory analyses will follow the EPA guidance specified in Section 5.3 and Table V.11 of the generic QAPjP (LANL 1991, 0412).

5.4 Quality Assurance Objectives for Accuracy

The quality assurance objectives for accuracy of laboratory analyses of samples will follow the EPA guidance specified in Section 5.4 and Tables V.11 and V.12 of the generic QAPjP (LANL 1991, 0412).

5.5 Representativeness, Completeness, and Comparability

The field sampling plans in Chapter 4 of this work plan were developed to meet the sample representativeness criteria described in Section 14.3 of the generic QAPjP (LANL 1991, 0412).

Completeness of analytical data will be calculated according to the formula presented in Section 14.4 of the generic QAPjP (LANL 1991, 0412). The quality assurance objective for analytical data completeness is 90% for the Environmental Restoration Program and this work plan.

Data comparability will be achieved by the use of standard sampling and analytical techniques. Sampling will be performed according to Environmental Restoration Program SOPs (LANL 1992, 0688). Sample analyses will be performed according to analytical methods referenced in the generic QAPjP (LANL 1991, 0412) or this Quality Assurance Project Plan. Data results will be reported in units consistent with existing site data and applicable regulatory levels.

5.6 Field Measurements

Field laboratory measurements, specified in Chapter 4, will be performed according to Quality assurance/quality control (QA/QC) procedures in Environmental Restoration Program SOPs (LANL 1992, 0688). Adherence to these SOPs will ensure the accuracy, precision, and completeness of the field measurement data.

5.7 Data Quality Objectives

All Data Quality Objective (DQO) elements are covered in sections of this work plan and the generic QAPjP (LANL 1991, 0412).

DQOs and the development process for this RCRA Facility Investigation are described in Chapter 3, Sections 3.2.6, 3.3.6, 3.4.6, 3.5.6, and 3.6.6 of this work plan. Chapter 3, Sections 3.2.5, 3.3.5, 3.4.5, 3.5.5, and 3.6.5 also present specific objectives for each investigation unit. Chapter 4 (Phase I Sampling Plans) also contains a list of data needs, location figures, and sampling and analytical requirement tables specific to each SWMU, SWMU aggregate, or area of concern.

Data analysis, interpretation, statistical representativeness, and applicability to the conceptual model are discussed in Chapter 3, Sections 3.2.5, 3.3.5, 3.4.5, 3.5.5, and 3.6.5 of this work plan.

Budget and schedule information relative to anticipated field and laboratory activities is presented in Annex I of this work plan.

6.0 SAMPLING PROCEDURES

Procedures for collecting soil and aqueous samples will be selected, as appropriate, from the Environmental Restoration Program SOPs (LANL 1992, 0688). A general description of all types of field investigations is presented in Chapter 4, Section 4.1, of this work plan.

Information on required sample containers, volume, preservation, and holding times is presented in Environmental Restoration Program SOP Number 01.02, Sample Containers and Preservation (LANL 1992, 0688) and in Section 6 of the generic QAPjP (LANL 1991, 0412).

The collection management and handling of media samples is detailed in Environmental Restoration Program SOPs: Number 01.04, Sample Control and Field Documentation, and Number 01.03, Handling, Packaging, and Shipping of Samples (LANL 1992, 0688). Refer to Section 6.0 and Subsection 7.5 of the generic QAPjP for additional information on proper sample management and coordination (LANL 1991, 0412).

6.1 Quality Control Samples

Environmental Restoration Program quality control samples are discussed in Section 6.1 of the generic QAPjP (LANL 1991, 0412) and in Environmental Restoration Program SOP Number 01.05, Field Quality Control Samples (LANL 1992, 0688). The frequency and type of field quality-control samples will follow the generic QAPjP for chemical analyses of samples.

Soil samples for geotechnical analyses will be collected in this RCRA Facility Investigation. 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 collecting and submitting a sufficient volume of a sample to the laboratory. A large sample volume provides for reanalysis of a sample in the event results from the initial aliquot did not meet specific method requirements.

6.2 Sample Preservation During Shipment

Information on sample preservation during shipment is presented in Environmental Restoration Program SOP Number 01.02, Sample Containers and Preservation (LANL 1992, 0688) and in Section 6.2 of the generic QAPjP (LANL 1991, 0412).

6.3 Equipment Decontamination

Equipment decontamination is described in Section 6.3 of the generic QAPjP (LANL 1991, 0412). LANL Environmental Restoration Program SOP Number 01.06, Management of RFI-Generated Waste (LANL 1992, 0688), provides information for proper handling and disposal of wash water and other materials generated during equipment decontamination.

6.4 Sample Designation

Each sample will be assigned a unique alphanumeric identifier to provide chain-of-custody control during the transfer of samples from the time of collection through analysis and reporting. This information is detailed in Environmental Restoration

Program SOP Number 01.04, Sample Control and Field Documentation (LANL 1992, 0688).

7.0 SAMPLE CUSTODY

7.1 Overview

Field and laboratory sample chain-of-custody procedures, described in Section 7.0 of the generic QAPjP (LANL 1991, 0412), will be followed for sampling activities conducted in OU 1122. The Environmental Restoration Program SOP Sample Control and Field Documentation (LANL 1992, 0688), also provides the guidance for chain-of-custody procedures, including examples of chain-of-custody records and tags.

7.2 Field Documentation

A sample numbering system developed for the Environmental Restoration Program uniquely identifies each boring location, monitor well, and sample collected. The Environmental Restoration Program numbering system, including standard sample identifiers, identifiers for quality control samples, and the code system is detailed in Environmental Restoration Program SOP, Sample Control and Field Documentation (LANL 1992, 0688).

Section 7.2 of the generic QAPjP (LANL 1991, 0412) provides sample documentation guidance for field personnel involved with sample collection activities. The Environmental Restoration Program numbering system will be followed for all sampling activities. All field data collection forms will be reviewed by the OU 1122 Field Teams Manager, or a technical reviewer designee, before being submitted to the Environmental Restoration Records Processing Facility. Incorrect entries will be crossed out with a single line and signed and dated by the person originating the entry and the field teams manager or technical reviewer designee.

7.3 Sample Management Facility

Section 7.3 of the generic QAPjP (LANL 1991, 0412) defines Environmental Restoration Program activities that will be coordinated by the Environmental Restoration Program Sample Management Facility.

7.4 Laboratory Documentation

Laboratory custody procedures associated with sample receipt, storage, preparation, analysis, and general security are described in Section 7.4 of the generic QAPjP (LANL 1991, 0412). These procedures will be followed by all laboratories participating in chemical analysis of samples generated during the RCRA facility investigations.

Laboratories providing radiological and geotechnical analyses samples will also follow chain-of-custody and record-keeping procedures described in Section 7.4 of the generic QAPjP (LANL 1991, 0412). Storage for these samples will be according to requirements described in the analysis procedure or in the laboratory QA plan. Tracking these samples will be according to requirements described in the laboratory's QA Plan.

Acquisition of appropriate QA manuals for all participating laboratories, including the LANL Environmental Chemistry Group (EM-9), is the responsibility of the LANL Sample Management Facility.

7.5 Sample Handling, Packaging, and Shipping

Sample handling, packaging, and shipping procedures are described in Section 7.5 of the generic QAPjP (LANL 1991, 0412) and in Environmental Restoration Program SOP Number 01.03, Handling, Packaging, and Shipping of Samples (LANL 1992, 0688).

7.6 Final Evidence File Documentation

Final evidence file documentation is described in Section 7.6 of the generic QAPjP (LANL 1991, 0412) and in the Records Management Plan, Annex IV of the IWP (LANL 1991, 0553).

RCRA Facility Investigation activities will follow these Environmental Restoration program-wide procedures. If needed, SOPs will be developed, reviewed, and approved.

8.0 CALIBRATION PROCEDURES AND FREQUENCY

8.1 Overview

Section 8 of the generic QAPjP (LANL 1991, 0412) contains information on the calibration procedures and frequency of calibration for field and laboratory equipment. As appropriate, Environmental Restoration Program SOPs (LANL 1992, 0688) and the manufacturer's equipment manual are also referenced.

8.2 Field Equipment

A list of analytical and health and safety screening procedures that may be used in the field during environmental investigations is presented in Appendix M of the LANL IWP (1991, 0553). Specific information regarding calibration procedures and frequency of calibration for field equipment is presented in the applicable Environmental Restoration Program Section 10.0 SOPs, Field Screening Techniques (LANL 1992, 0688) and the manufacturer's equipment manual.

Instruments will be calibrated according to manufacturer's specifications before and after each field use, or as otherwise described in the Environmental Restoration Program Section 10.0 SOPs. If necessary, instruments will be calibrated each day during field use.

Records will be maintained for each field instrument used as part of environmental investigations at LANL to ensure the instrument provides accurate and precise measurements. Records will be maintained on instrument maintenance and calibration. Instrument records will be tracked by the unique number assigned to each instrument that corresponds to its record file.

8.3 Laboratory Equipment

Section 8.3 of the generic QAPjP (LANL 1991, 0412) contains general information on calibration procedures and frequency of calibration for laboratory instruments. Specific calibration procedures for various analytical instruments are described in detail in the QA manuals of participating laboratories. Acquisition of QA manuals for all participating laboratories, including LANL EM-9, is the responsibility of the LANL Sample Management Facility.

The Environmental Restoration Program SOPs (LANL 1992, 0688) have been provided to EPA Region VI under separate submittal and are not attached to this work plan.

9.0 ANALYTICAL PROCEDURES

9.1 Overview

Field and laboratory analytical measurements for samples will be performed according to Environmental Restoration Program SOPs (LANL 1992, 0688).

9.2 Field Testing and Screening

Field testing and screening of samples will follow Environmental Restoration Program SOP Number 06.02, Field Analytical Measurements of Groundwater Samples (LANL 1992, 0688).

9.3 Laboratory Methods

The analytical methods used for aqueous and soil/sediment samples are those presented in Section 9.3 of the generic QAPjP (LANL 1991, 0412). All of the analytical methods presented there are applicable to this RCRA Facility Investigation. Where those analytes appear in Tables IX.1 and IX.2 of Section 9 in the generic QAPjP, they do not apply in this RCRA field investigation.

10.0 DATA REDUCTION, VALIDATION, AND REPORTING

10.1 Data Reduction

Field and laboratory data reduction will follow the protocols described in Section 10.1 of the generic QAPjP (LANL 1991, 0412).

10.2 Data Validation

Field and laboratory data validation will follow the protocols described in Section 10.2 of the generic QAPjP (LANL 1991, 0412), except no reagent blanks are planned.

10.3 Data Reporting

Field and laboratory data reporting will be done as described in Section 10.3 of the generic QAPjP (LANL 1991, 0412).

11.0 INTERNAL QUALITY CONTROL CHECKS

11.1 Field Sampling Quality Control Checks

Environmental Restoration Program field quality control samples are discussed in Section 6.1 of the generic QAPjP (LANL 1991, 0412). In general, the frequency and type of field quality-control samples identified in the generic QAPjP will be followed for chemical analyses of samples.

11.2 Laboratory Analytical Activities

The types and frequency of internal quality control samples that apply to laboratory activities will follow activities described in Section 11.2 of the generic QAPjP (LANL 1991, 0412).

12.0 PERFORMANCE AND SYSTEM AUDITS

Performance and system audits for field and laboratory operations will be conducted during RCRA Facility Investigations. These audits will be performed as identified and referenced in Section 12.0 of the generic QAPjP (LANL 1991, 0412).

13.0 PREVENTIVE MAINTENANCE

13.1 Field Equipment

Preventive maintenance requirements for field equipment will follow specifications described in Section 13.1 of the generic QAPjP (LANL 1991, 0412). Additional information is detailed in Environmental Restoration Program Section 10 SOPs, Field Screening Techniques (LANL 1992, 0688) and in the equipment owner's manual, which define required equipment checks for each type of field equipment. Environmental Restoration Program SOPs have been provided to EPA Region VI under separate submittal and are not attached to this work plan.

13.2 Laboratory Equipment

Preventive maintenance requirements for laboratory equipment will follow specifications described in Section 13.2 of the generic QAPjP (LANL 1991, 0412). Elements of the LANL EM-9 Environmental Chemistry Laboratory preventive maintenance program are discussed in Chapters 12.0 and 14.0 of the Health and Environmental Chemistry Laboratory Quality Assurance Program Plan (Gladney and Gautier 1991, 0410).

14.0 SPECIFIC ROUTINE PROCEDURES USED TO ASSESS DATA PRECISION, ACCURACY, REPRESENTATIVENESS, AND COMPLETENESS

14.1 Precision

Analytical precision for data will be calculated according to the formula in Section 14.1 of the generic QAPjP (LANL 1991, 0412).

14.2 Accuracy

Analytical accuracy of data will be calculated according to the formula presented in Section 14.2 of the generic QAPjP (LANL 1991, 0412).

14.3 Sample Representativeness

Field sampling plans in Chapter 4 of this work plan were developed to meet the sample representativeness criteria described in Section 14.3 of the generic QAPjP (LANL 1991, 0412).

14.4 Completeness

Completeness of analytical data will be calculated according to the formula presented in Section 14.4 of the generic QAPjP (LANL 1991, 0412).

The quality assurance objective for analytical data completeness for the Environmental Restoration Program is 90%, which will also be the objective for this RCRA Facility Investigation.

15.0 CORRECTIVE ACTION

15.1 Overview

The procedures, reporting requirements, and authority for initiating corrective action will follow those defined in Section 15.0 of the generic QAPjP (LANL 1991, 0412) and in LANL Environmental Restoration-QP-01.3Q, "Deficiency Reporting."

15.2 Field Corrective Action

Field corrective actions will follow the process defined in Section 15.2 of the generic QAPjP (LANL 1991, 0412).

15.3 Laboratory Corrective Action

Laboratory corrective actions will follow the process defined in Section 15.3 of the generic QAPjP (LANL 1991, 0412).

16.0 QUALITY ASSURANCE REPORTS TO MANAGEMENT

16.1 Field Quality Assurance Reports to Management

The OU 1122 Field Teams Manager, or a designee, will provide a monthly field progress status report to the Operable Unit Project Leader. This report will consist of the information identified in Section 16.1 of the generic QAPjP (LANL 1991, 0412).

16.2 Laboratory Quality Assurance Reports to Management

The laboratory QA reports identified in Section 16.2 of the generic QAPjP (LANL 1991, 0412) will be prepared during this RCRA Facility Investigation.

16.3 Internal Management Quality Assurance Reports

The internal management QA reports identified in Section 16.3 of the generic QAPjP (LANL 1991, 0412) will be prepared during this RCRA Facility Investigation.

Attachment A Data Quality Objective - Example Scenario

Data Quality Objectives and the development process for this RCRA Facility Investigation are described in Chapter 3. Chapter 3 also presents specific objectives for each investigation unit. Each sampling plan, Chapter 4 of this work plan, contains a list of data needs, location figures, and sampling and analytical requirement tables specific to each SWMU, SWMU aggregate, or area of concern.

Data analysis, interpretation, statistical representativeness, and applicability to the conceptual model are discussed in Chapter 3.

Attachment B: Quality Assurance/Quality Control Definitions

Quality Assurance/Quality Control definitions presented in Appendix B of the generic QAPjP (LANL 1991, 0412) are applicable to activities described in this work plan's Quality Assurance Project Plan.

REFERENCES

ANSI/ASME (American National Standards Institute/American Society of Mechanical Engineers), 1989. "Quality Assurance Requirements for Nuclear Facilities," NQA-1-1989, 345 East 47th Street, New York, New York. **(ANSI/ASME 1989, 0018)**

DOE (US Department of Energy), August 21, 1991. "Quality Assurance," DOE Order 5700.6C, Washington, DC. **(DOE 1991, 0703)**

EPA (US Environmental Protection Agency), December 29, 1980. "Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans," QAMS-005/80, Office of Monitoring Systems and Quality Assurance, Office of Research and Development, Washington, DC. **(EPA 1980, 0552)**

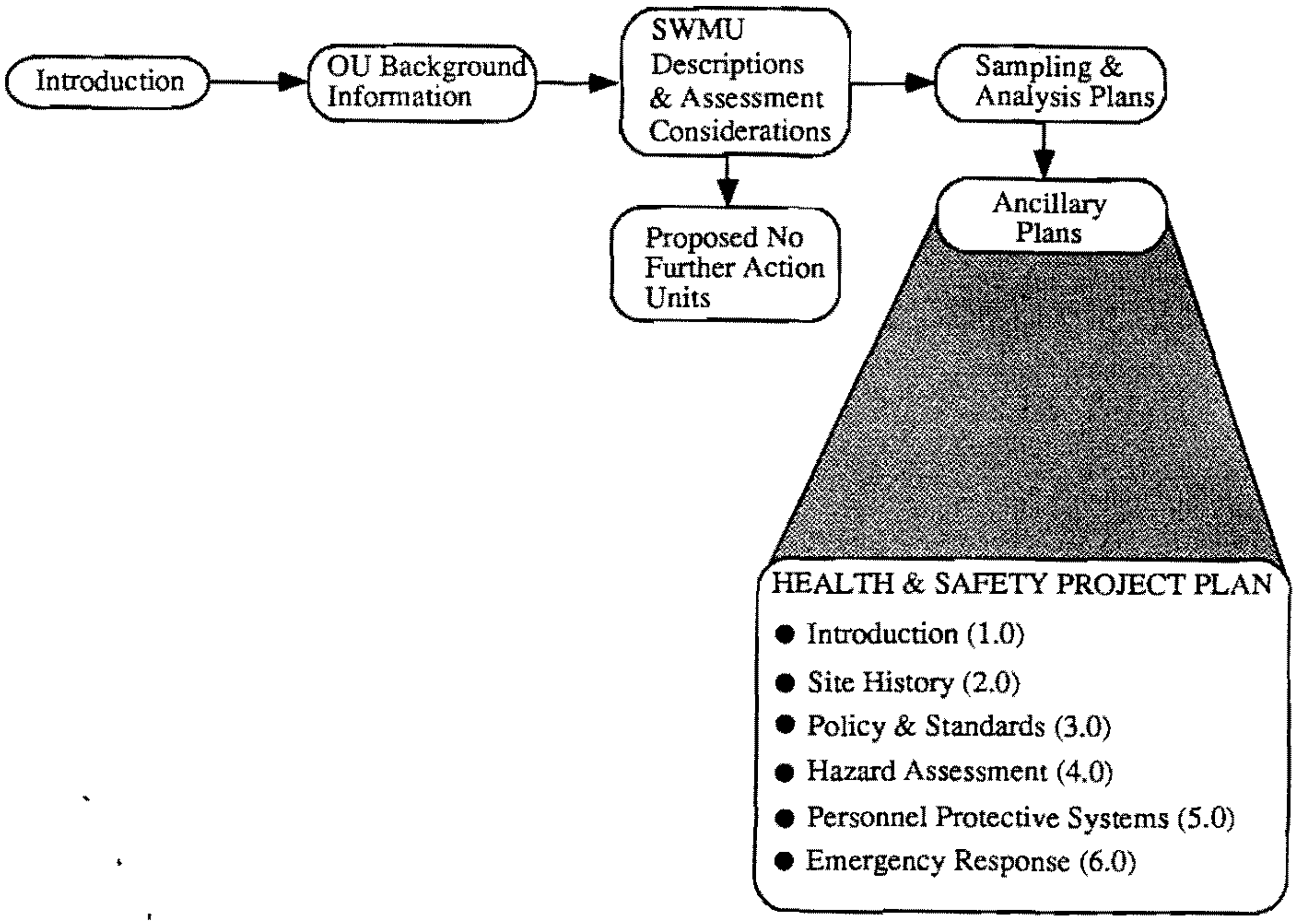
Gladney, E. S., and M. A. Gautier, January 1991. "Health and Environmental Chemistry Quality Assurance Program Plan," Los Alamos National Laboratory, Los Alamos, New Mexico. **(Gladney and Gautier 1991, 0410)**

LANL (Los Alamos National Laboratory), March 1992. "Environmental Restoration Standard Operating Procedures," Vols. I and II, Los Alamos, New Mexico. **(LANL 1992, 0688)**

LANL (Los Alamos National Laboratory), May 1991. "Generic Quality Assurance Project Plan," Rev. 0, *Environmental Restoration* Program, Los Alamos, New Mexico. **(LANL 1991, 0412)**

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

ANNEX III



Introduction
OU Background Information
SWMU Descriptions & Assessment Considerations
Sampling & Analysis Plans
Proposed No Further Action Units
Ancillary Plans
HEALTH & SAFETY PROJECT PLAN
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Site History (2.0)
Policy & Standards (3.0)
Hazard Assessment (4.0)
Personnel Protective Systems (5.0)
Emergency Response (6.0)

1.0 INTRODUCTION

This health and safety plan provides the framework within which personnel protection will be provided during the implementation of the RCRA facility investigation at Operable Unit 1122, TA-33 and TA 70. Task-specific health and safety plans will be prepared prior to initiating any field task. These plans will spell out the specific measures to be taken for personnel protection during implementation of the task. They will also define individual responsibilities for personnel protection during the field investigation. Because personnel involved in field investigations have not been identified, only general responsibilities are described in this operable unit health and safety plan. Overall health and safety policy for the program is provided in Annex III of the Installation Work Plan (LANL 1991, 0553).

As field investigations progress, we may identify more effective measures for personal protection than presented here. Deviation from this health and safety plan will be documented in the task-specific plan along with the reasons for that deviation. As changes are required, this plan will be updated.

This health and safety plan* has been developed for the safe conduct of field investigations at Operable Unit 1122. The plan includes an assessment of potential hazards, justification for personnel protection requirements, and site-specific emergency response procedures. This document is tiered to the Installation Work Plan (IWP), Annex III, Health and Safety Plan (LANL 1991 0553). A copy of the Health and Safety Plan for Operable Unit 1122 must be kept on site at all times.

The purpose of this plan is to establish guidelines for field personnel involved in investigations at Operable Unit 1122. This plan only applies to the field investigations associated with Operable Unit 1122. A new plan must be initiated for any corrective actions. In addition to following the general guidance in the IWP, the following regulations and standards were used to develop the procedures set forth in this plan: Laboratory policies, the Laboratory's Environment, Safety, and Health Manual, DOE Orders, Occupational Safety and Health Administration (OSHA) regulations, National Institute for Occupational Health (NIOSH) standards, American Conference of Governmental Industrial Hygienists (ACGIH) recommendations, Nuclear Regulatory Commission (NRC) regulations, and Environmental Protection Agency (EPA) guidance. These standards and regulations have been established for the protection of workers on hazardous waste and radiation sites. The areas of concern at Operable Unit 1122 are considered to have both hazardous waste and radioactively-contaminated materials. Therefore, adherence to this plan is essential to the health and safety of workers as well as the general public.

The responsibilities of personnel for Operable Unit 1122 health and safety, detailed herein, do not distinguish whether Laboratory or contractor personnel are implementing this plan. If, at a later time, who implements this plan (i.e., contractor or Laboratory personnel) affects how it is implemented, this plan will be modified. EPA will be notified of any such modifications.

* Adapted from "TA-21 Operable Unit RFI Work Plan for ER," Appendix B, Los Alamos National Laboratory Report LA-UR-91-3310, Los Alamos, New Mexico, May 1991, prepared by Micholene Devaurs.

2.0 SITE HISTORY

Technical Area 33 (TA-33), also known as Hot Point (HP) Site, and Technical Area 70 (TA-70) are located at the southeast boundary of the Los Alamos National Laboratory. TA-33 was created in 1947 as a test site for weapons experiments using conventional high explosives, uranium, beryllium, and polonium radiation sources. The experiments were performed in underground chambers, on surface firing pads, and firing sites equipped with large guns that fired projectiles into catcher berms. A high pressure tritium facility was operated at TA-33 from 1955 until late in 1990. Current activities are centered primarily at Main Site with groups occupying portions of the office buildings. Other small buildings and surface areas are also used. An antenna for the Very Large Baseline Array 25-meter radiotelescope was located at TA-33 in 1985. Present activities do not pose additional environmental risks. TA-70 is a buffer zone created in 1989. It has not been used for any Laboratory operations and contains no known wastes.

Primary wastes at TA-33 consist of uranium, beryllium, high explosives residues, tritium, cobalt-60, and ordinary solid wastes such as sewage, timber, wire and cable segments, and tin cans. Other minor wastes associated with Laboratory operations include: plutonium, cadmium, silver, lead, mercury, and solvents. The primary wastes are mostly accumulated into inactive soil-covered waste pits; however, finely divided material and shrapnel were dispersed at most firing sites. Several inactive landfills with metal pieces, timber, wire, and cable segments are present at the firing sites. The tritium and laboratory-associated wastes are located in Main Site near the laboratory buildings.

3.0 POLICY AND STANDARDS

The following information describes policies and standards set forth in this plan. Included are: specific line of responsibility, standards and regulations, requirements for audits, and variances from health and safety policies.

3.1 General Responsibilities

The general responsibilities are contained in Section 5.0 of the Installation Work Plan, Annex III, (LANL 1991, 0553). Visitors, persons who are onsite once or twice are required to attend a site-specific orientation and sign that they have received this orientation (see Attachment A to Annex III). The Site Safety Officer will present a more comprehensive safety briefing to workers. Listed below are specific responsibilities for personnel involved in this field investigation.

3.2 Individual Responsibilities

Within line management of the ER Program activities, there are certain employees and contractors with specific health and safety responsibilities. Figure III-1 is the field work organization chart showing responsibilities of the line organization.

3.2.1 Environmental Management (EM) Division Leader

The EM Division Leader is responsible for ensuring that programmatic health and safety concerns are addressed. The EM Division Leader is also responsible for

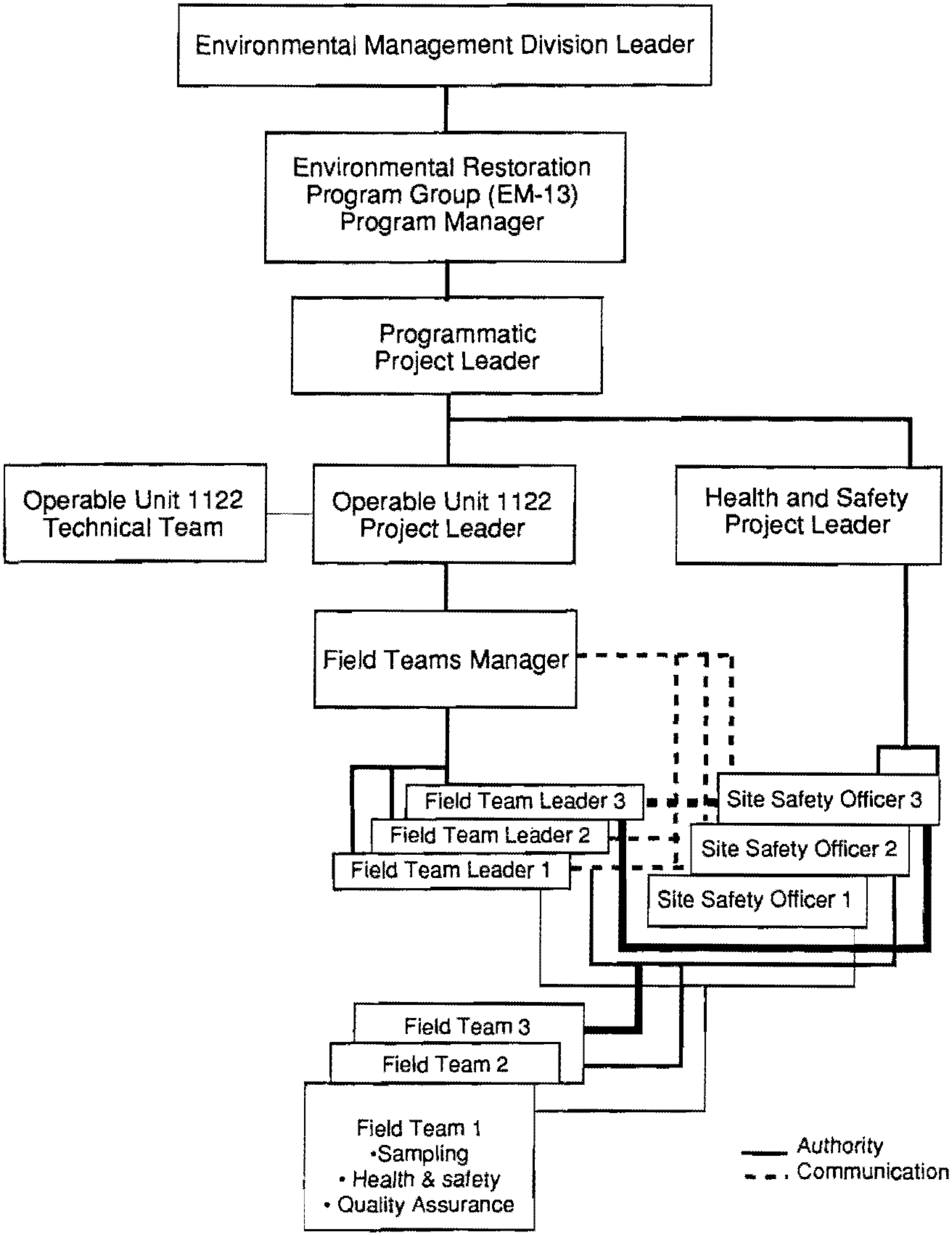


Fig. III-1. Operable Unit 1122 field work organization, showing health and safety responsibility.

promoting a comprehensive health and safety program that will cover special fields such as radiation protection, occupational medicine, industrial safety, industrial hygiene, criticality safety, waste management, and environmental protection and preservation.

3.2.2 Environmental Restoration (ER) Program Manager

The ER Program Manager is responsible for the overall health and safety program for ER Program activities. The Program Manager must ensure that the health and safety programs are established, implemented, and supported.

3.2.3 Health and Safety Project Leader

The Health and Safety Project Leader is responsible for updating and implementing the Health and Safety Plan found in the Installation Work Plan and for reviewing operable unit health and safety plans. The Health and Safety Project Leader is also responsible for interfacing and coordinating with Laboratory personnel to use resources appropriate for the ER Health and Safety Program and to ensure ER Program compliance with all applicable health and safety policies and regulations. In conjunction with the Field Teams Manager, the Health and Safety Project Leader oversees day-to-day health and safety activities in the field.

3.2.4 Operable Unit Project Leader

The Operable Unit Project Leader is responsible for:

- preparation, review, implementation, and revision of operable unit health and safety documents;
- interfacing with the Health and Safety Project Leader to resolve health and safety concerns.

3.2.5 Field Teams Manager

The Field Teams Manager is responsible for:

- compliance with the operable unit health and safety plan and responsibility for the health and safety of the field team members;
- assignment of a site safety officer to ensure compliance with this operable unit's health and safety plan;
- familiarity with emergency response procedures and notification requirements and their implementation;
- acting as a backup to the Site Safety Officer in the event of an emergency; and
- coordination of field activities with Laboratory personnel and contractors, as needed.

3.2.6 Field Team Leader

The Field Team Leader is responsible for:

- reading and complying with this operable unit's health and safety plan; and
- ensuring day-to-day compliance of the health and safety procedures set forth in this plan.

3.2.7 Site Safety Officer

The Site Safety Officer is responsible for:

- reading, complying with, and enforcing this operable unit's health and safety plan;
- performing and documenting initial inspections for all onsite equipment;
- evaluating potential hazards at a site;
- being informed of sample analysis results pertaining to health and safety as the ER site investigation and remediation work progresses;
- concurring with the Field Team Leader about the location of exclusion area boundaries;
- presenting safety briefings to workers;
- determining protective clothing requirements for workers;
- determining personal dosimetry requirements for workers;
- maintaining a current list of telephone numbers for emergency situations;
- having an operating radio transmitter/receiver in case telephone service is not available;
- maintaining an up-to-date copy of the health and safety plan for work at the site;
- maintaining an up-to-date copy of the emergency plan and procedure for the site;
- establishing safety requirements to be followed by visitors;
- providing visitors with a safety briefing;

- maintaining a logbook of workers and visitors within the exclusion area at a site;
- determining whether workers can perform their jobs safely under prevailing weather conditions;
- taking control in the event of an emergency situation;
- ensuring all personnel have been trained in the appropriate safety procedures, have read and understood this operable unit's health and safety plan, and that these requirements are followed during operable unit activities;
- conducting daily health and safety briefings for field team leaders and field team members; and
- having authority and requiring that field work be terminated if unsafe conditions develop or an imminent hazard is perceived.

3.2.8 Field Team Members

The specific responsibilities for Field Team Members may be found in Section 5.0 of the Installation Work Plan, Annex III (LANL 1991, 0553).

3.3 Health and Safety Audits

Health and safety audits will be performed during activities associated with this plan to ensure compliance. The frequency of these audits will be at least quarterly. Audits will be conducted by the Health and Safety Project Leader, or a competent designee and documented in Health and Safety Audit Reports. The LANL EM Division Leader, ER Program Manager, ER Health and Safety Project Leader, and Operable Unit Project Leader will receive copies of this report. Individuals responsible for health and safety deficiencies noted in the audit findings will provide written responses describing corrective actions implemented to resolve deficiencies.

The LANL HS Division may also conduct health and safety audits separately or concurrently with the internal ER audits to ensure compliance with the Environment, Safety, and Health Manual (LANL 1990, 0335).

3.4 Variances from Health and Safety Requirements

Where special conditions exist, a written request for a variance from a specific health and safety requirement may be submitted by the Site Safety Officer to the Field Teams Manager and Health and Safety Project Leader. If the Field Teams Manager and Health and Safety Project Leader agree with the request, the request will be reviewed by the Operable Unit Project Leader or his/her designee. As appropriate, higher levels of management may be consulted. The condition of the request will be evaluated and, if appropriate, a written variance specifying the conditions under which the requirement may be modified will be granted.

4.0 HAZARD ASSESSMENT AND PERSONNEL PROTECTION REQUIREMENTS

The following section is designed to identify potential hazards associated with field activities at TA-33. Because of the number of Solid Waste Management Units (SWMUs) involved, hazards associated with all SWMUs will be listed first. Hazards unique to one or more areas of concern will be identified by SWMU or building number. Areas of specific hazards will be reviewed before work is performed at that particular location.

4.1 Identification of Hazards and Risk Analysis

The Site Safety Officer will monitor field conditions and personnel exposure to physical, chemical, biological, and radiological hazards. If a previously unidentified hazard is discovered, the Site Safety Officer will contact the Field Teams Manager and the Health and Safety Project Leader and address the hazard. A safety analysis on the hazard will be performed which identifies the potential harm, the likelihood of occurrence, and measures to reduce the risk. The analysis will then be written up and added to this plan in the form of an amendment. The amendment must be reviewed and approved by the Health and Safety Project Leader and Operable Unit Project Leader and signed by appropriate field team leaders and field team members, showing they have knowledge of the newly-identified hazard. Field activities will closely follow Laboratory standard operating procedures (SOPs) or by using subcontractor SOPs.

4.1.1 Physical Hazards

Injuries most often occur from exposure to physical hazards. These injuries range from minor cuts and bruises to fatalities caused by serious unexpected events. The severity of these events may be controlled using sound inspection and monitoring practices. Therefore, this section is dedicated to outlining the potential physical hazards, as well as some preventive measures.

4.1.1.1 *Noise*

Many activities for this field investigation have the potential for producing excessive noise levels. Drill rigs and backhoes are a few examples of machinery that can produce noise levels above established standards. Laboratory Administrative Requirement AR 8-2, which describes the Laboratory's hearing conservation policy, will be used to control exposure to below occupational exposure limits (OELs). The Laboratory hearing conservation policy is based on Air Force Regulation 161-35, Hazardous Noise Exposure, as specified in Department of Energy Albuquerque Operations Office Order 5480.4, Environmental Protection, Safety, and Health Protection Standards, and 29 CFR 1910.95, Occupational Noise Exposure (LANL 1990, 0335).

The Site Safety Officer is responsible to have the Laboratory Industrial Hygiene Group (HS-5) perform a noise hazard investigation for any operation where excessive noise is suspected, whether it be steady state or impulse/impact noise.

4.1.1.2 Pinch Points

Pinch points are generally associated with activities utilizing tools or equipment with turning or moving parts such as a drill rig, backhoe, or even small hand tools. The moving parts may even be equipped with guards. If this is the case, periodic inspections must be performed to assure the guards have not been removed. A guard is generally removed by field personnel when the guard slows the operator's progress or makes the tool or equipment difficult to use. When inspections show that a guard has been removed, the tool or equipment should be tagged and not used until the guard has been replaced.

In larger equipment, hydraulic mechanisms and tools are encountered more often. Severity of injury is much greater with hydraulics because of the amount of force created with hydraulically-driven machinery. Initial inspections, identifying areas of concern, and informing field team members of the potential hazards become more important. The most efficient and comprehensive procedure for inspections is that they be performed by a competent person who has experience with that particular piece of machinery. Most equipment can be inspected in less than 30 minutes using a check list. The Site Safety Officer will obtain a check list before the start of field activities.

OSHA requires that most equipment be inspected yearly. This inspection is generally conducted by the manufacturer, representative, or dealer. These inspections are to be documented and kept with the piece of equipment to ensure that the equipment is properly maintained.

4.1.1.3 Slip, Trip, and Fall

Injuries from slip, trip, and fall hazards are the most common around drill rigs, backhoe operations, and uneven terrain. Injuries occur because of poor housekeeping, bad weather conditions, or the uneven terrain caused by soil excavation. Procedures may be developed to reduce the likelihood of slip, trip, and fall injuries. The Site Safety Officer must ensure that good housekeeping practices are followed. This includes the following: keeping tools stored in an accessible but out-of-the-way place; keeping the work area free of soil piles when possible; reminding personnel to be aware of uneven terrain; keeping personnel 5 ft from the mesa edge; and, marking trench and borehole boundaries.

4.1.1.4 Explosion/Fire/Oxygen Deficiency

The potential for flammable, or combustible, and oxygen-deficient atmospheres is anticipated during drilling, trenching, and tank sampling or in any unanticipated activity in which flammable or combustible gases could collect in an enclosed area.

Flammable work will be done according to LANL Administrative Requirement 6-5, Flammable and Combustible Liquids; and Technical Bulletins 601, Flammable Liquids; 602, Flammable Gases; 603, Solvents; and 604, Epoxies. Applicable ER Program SOPs will also be followed.

Explosion potential will be measured in the enclosed space or downhole for drilling using a combustible gas indicator (CGI)/oxygen meter. If the CGI shows concentrations greater than 20 of the LEL (lower explosive limit), all activities in the area will cease. The work area will be evacuated and the appropriate safety measures will be implemented. Continued CGI readings will be made by the Site Safety Officer to determine the appropriate time for return to the area.

Oxygen levels will be measured in enclosed or confined spaces and in areas that are not ventilated frequently. If oxygen levels fall below 19.5%, the area must be evacuated or supplied-air respirators must be furnished to field personnel. Oxygen-rich atmospheres create an increased potential for fire. Therefore, if levels exceed 25%, the area will also be evacuated. If an evacuation becomes necessary, the area will be ventilated, and the Site Safety Officer will continue monitoring oxygen levels. The Site Safety Officer will determine when it is safe for personnel to return and resume work.

CGI/O_2 readings will be performed according to applicable ER Program SOPs.

4.1.1.5 High Explosives

Areas that may contain high explosives will be clearly outlined and described to workers. Explosive hazards may exist at former firing sites, although no occurrence of residual explosives at those areas has been documented.

The following precautions will be taken with respect to explosive hazards while conducting field work:

The location will be monitored before sampling with an appropriate radiation or organic vapor detector.

The ground will be sprayed or saturated with water before sampling to minimize the potential for sparks or particulate dispersion.

A non-sparking sampling device will be pushed into the ground with a minimum amount of turning during surface sampling.

All samples will contain at least 10% moisture before being sealed in containers.

All samples will be screened by trained personnel using the high explosives screening procedures.

Sample containers will be shipped in paint cans padded with vermiculite and placed in a cooler with ice packs.

Samples will be handled only in well-ventilated areas, and their exposure to light and heat will be minimized.

Latex gloves and safety glasses will be worn during sample collection.

The skin will be washed thoroughly with soap and water immediately after accidental contact.

Field personnel will not handle any material in the area unless directed by the sampling plan. This precaution will prevent contact with any high explosive fragments present in the area. Material with blue, pink, red, yellow, green, or orange coloration could be indicative of high-explosive material.

If noticeable surface or buried high explosive residues or fragments are encountered in the immediate vicinity of a drilling location, drilling will be halted. Sample collection will continue only if a blast shield is installed, or if a backhoe is used to obtain samples. This decision will be made by the Site Manager and the Site Safety Officer.

4.1.1.6 Heat Stress

Heat stress occurs when the body's physiological processes fail to maintain a normal body temperature because of excess heat. This failure is enhanced when impervious clothing is worn during hot summer months. Acclimation to heat is the most effective way to prevent heat stress, but drinking plenty of water, avoiding alcohol consumption, and frequent cooling breaks are also effective. When the body cooling system starts failing, a number of symptoms begin to occur. Listed below are the physical reactions that can occur, ranging from mild to fatal.

Heat stress monitoring will be performed according to ER Program SOPs.

4.1.1.6.1 Heat-Related Illness

- Heat rash - caused by exposure to heat and humid air aggravated by changing clothes. Decreases the ability to tolerate heat and becomes a nuisance. If heat rashes occur, it is best to keep the area cool and dry.

- Heat cramps - caused by profuse sweating with inadequate fluid intake and chemical replacement (especially salts and potassium). Signs: muscle spasms and pain in the extremities and abdomen. If heat cramps occur, it is best to drink plenty of fluids (water is best), add slightly more salt to food, and replace potassium by eating bananas.

- Heat exhaustion - caused by an increased heat stress to the body and an inability of various organs to meet the increased demand to cool the body. Signs: shallow breathing; pallor; cool, moist skin; profuse sweating; dizziness; and lassitude. If heat exhaustion occurs, it is best to get the person to a cool, shady area (not in air conditioning) and allow the body to slowly cool and give plenty of fluids. Depending on the severity, one should wait a certain period of time before returning to the hot area.

- Heat stroke - the most severe of the heat-related injuries. This is when the body's cooling system shuts down completely. Signs: red, hot, dry skin; lack of perspiration; nausea; dizziness and confusion; strong rapid pulse; coma. The body must be cooled immediately and sent to the nearest hospital for immediate medical attention to prevent severe injury and/or death.

4.1.1.6.2 Work/Rest Schedule

When working in protective clothing, the following guidelines for calculating work/ rest schedules should be used.

Calculate the adjusted temperature as follows:

T(adjusted) = T(actual) + (13 x sunshine fraction)

100% sunshine =	no cloud cover	= 1.00
75% sunshine =	25% cloud cover	= 0.75
50% sunshine =	50% cloud cover	= 0.50
25% sunshine =	75% cloud cover	= 0.25
0% sunshine =	100% cloud cover	= 0.00

4.1.1.7 Cold Exposure

Persons working outdoors in temperatures at or below freezing can suffer from cold-related injuries. Exposure to extreme cold for a short period of time can cause severe injury to the body surface or can result in profound generalized cooling, causing death. Body areas that have high-surface, area-to-volume ratios, such as fingers, toes, and ears are the most susceptible.

Cold stress monitoring will be performed according to ER Program SOPs.

4.1.1.7.1 Cold-Related Illness

- Frost nip or incipient frostbite - characterized by a sudden whitening of the skin. If this occurs, warm the affected part slowly and get person into warm, dry clothes.

- Superficial frostbite - causes skin to become very waxy or white and superficially firm but flexible underneath. If frostbite occurs, get the victim indoors and place the affected part in warm water (100-105°). Do not rub the affected part. Get the victim to medical attention as soon as possible after the affected part has been warmed.

- Deep frostbite - characterized by cold, pale, solid skin tissue, also may be blistered. Blisters should not be popped, and victim should be warmed in the same manner as above.

- Systemic hypothermia - caused by exposure to freezing or rapidly dropping temperatures. Symptoms are usually exhibited in five stages: 1) shivering; 2) apathy, listlessness, sleepiness, and (sometimes) rapid cooling of the body to less than 95°F; 3) unconsciousness, glassy stare, slow pulse, and slow respirations; 4) freezing of the extremities; and, 5) death. Get the victim to warmth as soon as possible, into warm dry clothing, and transfer to medical attention as soon as possible.

The best cure for cold-related injuries is prevention, which includes dressing in warm, insulated garments. If the potential exists for getting wet, wear wool clothing and take frequent warming breaks.

4.1.1.8 Electric Shock

Personnel working at TA-33 have the potential for exposure to electrical shock during drilling, trenching, and sampling activities. The source of this hazard may be from overhead and underground utilities, use of portable equipment, and digging and/or hand augering into underground utilities. In addition to health and safety SOPs, the following requirements are applicable. Compliance with these requirements will significantly reduce the chance of personnel exposure to electrical shock.

1. Only qualified and licensed personnel will be allowed to operate this equipment.
2. Heavy equipment and energized tools will be inspected by a competent person before use and will meet all applicable local, state, and federal standards.
3. While in use, drill rigs will maintain a 35-ft minimum distance from overhead power lines.
4. In transit, with the boom lowered, the closest approach to a power line will be 16 ft.
5. All areas to be drilled will be cleared through the LANL utilities manager before drilling activities begin.
6. Any cord with the grounding stem removed will be taken out of service and repaired or thrown away.
7. Ground fault interrupters will be used on all portable electrical equipment.

4.1.2 Chemical Hazards

Chemical hazards that may be encountered during field work at TA-33 include inhalation, ingestion, or dermal absorption of heavy metals, PCBs, solvents, hydrocarbons, acids, beryllium, and other chemicals. This section is developed to identify and provide information on chemical contaminants that are known to be present at TA-33. Information is presented for assistance in the identification of known contaminants via field-screening techniques. These same screening tools may identify some of the unknowns. When the unknowns are identified, they will be added to the plan's chemical contaminants of concern, Table III-1. The Site Safety Officer will be responsible for adding chemicals to this table and for notifying field personnel as needed.

TABLE III-1

CHEMICAL CONTAMINANTS OF CONCERN

Contaminant	Exposure Limit	IDLH[1]	Symptoms of Exposure	Route(s) of Exposure	IP(eV)[2]	Monitoring Instrument	Relative Response
Polychlorinated Biphenyls	0.2 ppm 1 mg/m^3	300 mg/m^3	Irritation of eyes; headache; nausea; fatigue; numb limbs; liver damage; chloracne	Inhalation Ingestion Contact	N/A	RAM[3]	Based on concentration
Kerosene	N/A[4]	N/A		Inhalation Ingestion Contact	N/A	PID[5] FID[6]	100% 150%
Benzene	1 ppm	Ca[7]	Nose, eye, respiratory system irritation; giddy; headache; nausea; staggered gait, fatigue; anorexia; lassitude; dermatitis; abdominal pain	Inhalation Absorption Ingestion Contact	9.25	PID FID Draeger tube	100% 100%
Methanol	200 ppm	800 ppm	Eye irritation; headache; drowsy; light headed; nausea; vomiting; visual distortion; eyes burn; failure of vision	Inhalation Ingestion Contact	10.84	PID FID Draeger tube	10% 12%
Nitric acid	2 ppm	100 ppm	Mucous membrane, eye and skin irritation; delayed pulmonary edema; pneuitis; bronchitis; dental erosion	Inhalation Ingestion Contact	N/A	pH paper	
Ethyl benzene	100 ppm	2 000 ppm	Eye, mucous membrane irritation; headache; dermatitis; narcosis coma	Inhalation Ingestion Contact	8.76	PID FID	100% 100%
Toluene	100 ppm	2 000 ppm	Fatigue; weakness; confusion; euphoria; dizziness; headache; dilated pupils; lacrimation; nervous muscle fatigue; insomnia; dermatitis, photophobia	Inhalation Absorption Ingestion Contact	8.82	PID	100%
Xylene	100 ppm	10 000 ppm	Dizziness; excitement; eye, throat, nose irritation staggering gait; vomiting abdominal pain; dermatitis; corneal vacuolization; drowsiness, incoherence; anorexia	Inhalation Absorption Ingestion Contact	8.56	PID FID	113% 114%
Acetone	250 ppm	20 000 ppm	Eye, nose, throat irritation; headache; dizziness; dermatitis	Inhalation Ingestion Contact	9.69	PID FID	63% 60%
1,1,2-Trichloroethane	10 ppm	Ca	Eye, nose irritation; CNS depression; liver and kidney damage	Inhalation Absorption Ingestion Contact	N/A	FID	85%
Trichloroethylene	50 ppm	Ca	Headache; vertigo; visual distortion; tremors; nausea; eye irritation; dermatitis; cardiac arrythmia; somnolence; vomiting	Inhalation Ingestion Contact	9.47	PID FID	89% 70%

[1]IDLH = immediately dangerous to life and health
[2]IP(eV) = Ionization Potential in Electron Volts (eV)
[3]RAM = Real Time Aerosol Monitor
[4]N/A = Not Available
[5]PID = Photoionization Detector
[6]FID = Flame Ionization Detector
[7]Ca = Potential Human Carcinogens

TABLE III-1. (continued)

CHEMICAL CONTAMINANTS OF CONCERN

Contaminant	Exposure Limit	IDLH[1]	Symptoms of Exposure	Route(s) of Exposure	IP(eV)[2]	Monitoring Instrument	Relative Response
Tetrachloro-ethylene	50 ppm	Ca	Eye, nose, throat irritation; nausea; flush face and neck; vertigo; dizziness; incoherence; headache; somnolence; erythema	Inhalation Ingestion Contact	9.32	FID	100%
Cadmium	0.05 mg/m^3	Ca	Pulmonary edema; dyspnea; coughing; tight chest; chills; substernal pain; headache; muscle ache; nausea; diarrhea; anosmia; emphysema; proteinurea	Inhalation Ingestion	N/A	Miniram	
Lead	0.05 mg/m^3	Ca	Lassitude; insomnia; pallor; eye grounds; anorexia; low weight; malnutrition; anemia; constipation; abdominal pain; hypotension; tremors	Inhalation Ingestion Contact	N/A	Miniram	
Chromium	1.0 mg/m^3	500 mg/m^3	Histologic fibrosis of lungs	Inhalation Ingestion	N/A	Miniram	
Beryllium	0.5 ug/m3	Ca	Respiratory systems; fatigue; weakness; weight loss	Inhalation	N/A	Miniram	
Mercury	0.1 mg/m^3	28 mg/m^3	Coughing; dyspnea; bronchial pneumonia; tremors; insomnia, irritability; indecision; fatigue; anorexia; weakness; stomatitis low weight; salivation; eye and skin irritation; proteinurea	Inhalation Absorption Contact	N/A	Miniram	

TABLE III-1. (concluded)

CHEMICAL CONTAMINANTS OF CONCERN

Contaminant	Exposure Limit	IDLH[1]	Symptoms of Exposure	Route(s) of Exposure	IP(eV)[2]	Monitoring Instrument	Relative Response
Hydrofluoric acid	3 ppm	30 ppm	Eye, nose, and throat irritation; pulmonary edema; skin and eye burns	Inhalation Absorption Ingestion Contact	NA	Air sampling	NA

[1]IDLH = Immediately dangerous to life and health
[2]IP(eV) = Ionization Potential in Electron Volts (eV)
[3]RAM = Real Time Aerosol Monitor
[4]N/A = Not Available
[5]PID = Photoionization Detector
[6]FID = Flame Ionization Detector
[7]Ca = Potential Human Carcinogens

The information provided for known contaminants will include the following: threshold limit value (TLV); immediately dangerous to life and health (IDLH) concentrations; exposure symptoms; ionization potential and relative response factor for commonly used instruments (*note: this should be re-evaluated when the particular instrument is selected*); and the best instrument for screening. The TLV (ACGIH) refers to a concentration of a chemical in which nearly all personnel may work for 40 hours/week over a lifetime without suffering any adverse health effects. Permissible exposure limits (PEL) are regulated standards by OSHA and are very similar to TLVs.

The IDLH concentration is a concentration at which nearly all workers may be exposed for 30 minutes without suffering any irreversible health effects or can escape impairing symptoms. The ionization potential is a characteristic of chemicals and is used in photoionization detectors to determine if the instrument can see the compound. The relative response factor reflects the percentage of the compound that an instrument will see. There are relative response factors for both photoionization and flame ionization detectors. The Site Safety Officer will be responsible for having available the Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities as a general reference with chemical-specific information for compounds that are discovered during field sampling (NIOSH et al. 1985, 0414).

4.1.3 Radiological Hazards

Radionuclides that might be present at TA-33 sites include plutonium-238, plutonium-239/240, uranium-238, tritium, and others are suspected. There are three principal pathways by which individuals may be exposed to radioactivity during field investigations:

- inhalation or ingestion of radionuclide particulates or vapors;
- dermal absorption of radionuclide particulates or vapors through wounds; and
- exposure to direct gamma radiation from contaminated materials.

The specific properties of the above radionuclides, including type of emission and half-life, are provided in Table III-2. As concentrations of these radionuclides are determined, and as new radionuclides are discovered, Table III-2 will be updated. The Site Safety Officer will be responsible for adding radionuclides to this table and for notifying field personnel as needed.

Table III-3 describes the suspected chemical and radiological contaminants for each SWMU at TA-33. Figures III-2 to III-7 show the major features of TA-33 and the associated SMWU locations.

4.1.4 Biological Hazards

Biological hazards will likely be encountered in some areas of TA-33. Rattlesnakes may be encountered in all areas at TA-33. Field personnel should wear snake leggings in areas where footing is difficult to see. If a snake bite does occur, summon emergency personnel by calling 9-911. The only first aid treatment that should be administered is that ice or a cold pack should be placed just above the affected area to slow blood flow.

TABLE III-2

Radionuclides of Concern

Radionuclide	Major Radiation	DAC[1] (Ci/mL)	Critical[2] Organ	Radioactive Half-Life	Monitoring Instrument
Plutonium-238	Alpha, gamma	3×10^{-12}	Bone	87.7 yrs	Alpha scintillometer, FIDLER[3]
Plutonium-239	Alpha, gamma	2×10^{-12}	Bone	2.4×10^{4} yrs	Alpha scintillometer, FIDLER
Plutonium-240	Alpha, gamma	2×10^{-12}	Bone	6 537 yrs	Alpha scintillometer, FIDLER
Tritium	Beta	3×10^{-5}	Total body tissue	12.26 yrs	Liquid scintillation
Uranium-235	Alpha, gamma	2×10^{-11}	Lung, GI[4]	7×10^{8} yrs	Alpha scintillometer, FIDLER
Uranium-238	Alpha, gamma	2×10^{-11}	Lung, GI	4.5×10^{9} yrs	Alpha scintillometer, FIDLER
Polonium-210	Alpha, gamma	3×10^{-10}	Total body	138.4 days	Alpha scintillometer

[1]DAC - derived air concentration (DOE draft Order 5480.11)
[2]Critical organ - part of the body that is most susceptible to radiation damage under the specific conditions being considered.
[3]FIDLER - field instrument for the detection of low-energy radiation
[4]GI - gastrointestinal tract

TABLE III-3

SUSPECTED CHEMICAL AND RADIOLOGICAL CONTAMINANTS AT OPERABLE UNIT 1122 (TA-33)

Location	SWMU or AOC Number	Description	Potential Chemical Contaminants	Potential Radiological Contaminants
South Site MDA-E	33-001(a)	Disposal Pit #1	Beryllium	Uranium
South Site MDA-E	33-001(b)	Disposal Pit #2	Beryllium	Uranium
South Site MDA-E	33-001(c)	Disposal Pit #3	Beryllium and kerosene	Uranium
South Site MDA-E	33-001(d)	Disposal Pit #4	Beryllium	Uranium
South Site	33-001(e)	Chamber, TA-33-29	Beryllium and explosives residues	None known
Main Site MDA-K	33-002(a)	Septic Tank, TA-33-93	Solvents	Uranium, plutonium, and tritium
Main Site MDA-K	33-002(b)	Sump, TA-33-134	Ethanol, methanol, trichloroethene, benzene, acetone, beryllium, and mercury	Depleted uranium and tritium
Main Site MDA-K	33-002(c)	Sump, TA-33-133	Trichloroethene, methanol, ethanol, acetone, and propanol	Tritium
Main Site MDA-K	33-002(d)	Cooling water Outfall from TA-33-86	None known	Tritium
Main Site MDA-K	33-002(e)	Roof Drain Outfall from TA-33-86	Semivolatile organic compounds	Tritium
East Site MDA-D	33-003(a)	Chamber, TA-33-4	Beryllium and explosives	None known
East Site MDA-D	33-003(b)	Chamber, TA-33-6	Beryllium and explosives	None known
Main Site	33-004(a)	Septic Tank, TA-33-31	Beryllium, lead, mercury, cadmium, silver, benzene, and trichloroethene	Tritium and depleted uranium

TABLE III-3. (continued)

SUSPECTED CHEMICAL AND RADIOLOGICAL CONTAMINANTS AT OPERABLE UNIT 1122 (TA-33)

Location	SWMU or AOC Number	Description	Potential Chemical Contaminants	Potential Radiological Contaminants
South Site	33-004(b)	Septic Tank, TA-33-33	Photoprocessing chemicals	None known
East Site	33-004(c)	Septic Tank, TA-33-96	Photoprocessing chemicals and volatile organics	None known
Area 6 Site	33-004(d)	Septic Tank, TA-33-121	Photoprocessing chemicals, beryllium, and volatile organics	Uranium
Main Site	33-004(e)	Septic Seepage Pit, TA-33-169	None known	None known
Main Site	33-004(f)	Septic Tank at TA-33-23	None known	None known
Area 6 Site	33-004(g)	Outfall from TA-33-16	Lead, barium, beryllium, zinc, high explosives, and organic compounds	Uranium
Main Site	33-004(h)	Outfall from TA-33-20	Beryllium	Uranium
Main Site	33-004(i)	Outfalls from TA-33-39	Lead, cadmium, beryllium, silver, mercury, and solvents	Uranium
South Site	33-004(j)	Outfall from TA-33-26	Beryllium	Uranium
East Site	33-004(k)	Outfall from TA-33-87	Photoprocessing chemicals	None known
East Site	33-004(l)	Outfall from TA-33-89	None known	None known
NRAO	33-004(m)	NRAO Septic Tank TA-33-179	Solvents	None known
Main Site	33-004(n)	Septic Tank at TA-33-23	None known	None known
Main Site	33-005(a)	Septic System from TA-33-21	None known	None known

TABLE III-3. (continued)

SUSPECTED CHEMICAL AND RADIOLOGICAL CONTAMINANTS AT OPERABLE UNIT 1122 (TA-33)

Location	SWMU or AOC Number	Description	Potential Chemical Contaminants	Potential Radiological Contaminants
Main Site	33-005(b)	Drainage System from TA-33-21	None known	None known
Main Site	33-005(c)	Industrial Waste Drainage from TA-33-21	None known	Plutonium
South Site	33-006(a)	Shot Pad	Beryllium, lead, and high explosives residues	Uranium and tritium
East Site	33-006(b)	Gun Firing Area	Beryllium, lead, cadmium, oil, and high explosives residues	Uranium, tritium, and cobalt-60
East Site	33-007(a)	Gun Firing Area	Beryllium, lead, cadmium, oil, other metals, and high explosives residues	Uranium, tritium, and cobalt-60
South Site	33-007(b)	Gun Firing Area	Beryllium, other metals, oil, and high explosives residues	Uranium, tritium, and cobalt-60
Area 6 Site	33-007(c)	Gun Firing Area	Beryllium, oil, other metals, and high explosives residues	Uranium, tritium, and cobalt-60
South Site	33-008(a)	Nonradioactive Landfill	Beryllium, lead, high explosives residues, and unknown chemicals	None known
East Site	33-008(b)	Nonradioactive Landfill	Beryllium, lead, high explosives residues, and unknown chemicals	None known
Area 6 Site	33-009	Surface Disposal	Polychlorinated biphenyls and beryllium	Depleted uranium

TABLE III-3. (continued)

SUSPECTED CHEMICAL AND RADIOLOGICAL CONTAMINANTS AT OPERABLE UNIT 1122 (TA-33)

Location	SWMU or AOC Number	Description	Potential Chemical Contaminants	Potential Radiological Contaminants
East Site	33-010(a)	Canyon-side Disposal	Beryllium, lead	Uranium
East Site	33-010(b)	Canyon-side Disposal	Beryllium, lead	Uranium
South Site	33-010(c)	Surface Disposal	Beryllium, lead, and high explosives residues	Uranium
East Site	33-010(d)	Surface Disposal	Beryllium, lead	Uranium
Area 6 Site	33-010(e)	Canyon-side Disposal	None known	None known
Main Site	33-010(f)	Surface Disposal	None known	None known
South Site	33-010(g)	Canyon-side Disposal	Beryllium, metals, and high explosives residues	Uranium
South Site	33-010(h)	Surface Disposal	Beryllium, metals, and high explosives residues	Uranium
Main Site	33-011(a)	Drum Storage, TA-33-21	Polychlorinated biphenyls and oils	None known
NRAO	33-011(b)	General Storage Area at NRAO	Beryllium and other metals	Uranium
South Site	33-011(c)	Blivit Storage Area	None known	Tritium
Main Site	33-011(d)	General Storage Area, TA-33-20	Beryllium	Uranium
Main Site	33-011(e)	General Storage Area, TA-33-22	None known	Uranium
Main Site	33-012(a)	Active Satellite Storage Area, TA-33-39	Solvents, oils, metals, and polychlorinated biphenyls	None known
Main Site	33-012(b)	Active Satellite Storage Area, TA-33-114	Photoprocessing chemicals	None known

TABLE III-3, (concluded)

SUSPECTED CHEMICAL AND RADIOLOGICAL CONTAMINANTS AT OPERABLE UNIT 1122 (TA-33)

Location	SWMU or AOC Number	Description	Potential Chemical Contaminants	Potential Radiological Contaminants
Main Site	33-012(c)	Active Satellite Storage Area, TA-33-114	Waste organics	None known
Main Site	33-012(d)	Active Satellite Storage Area, TA-33-19	Solvents, particularly freon	None known
Main Site	33-013	Drum Storage Area, TA-33-86	Oil, metals, and solvents	Tritium
South Site	33-014	Burn Site	High explosives, propellant powders, black powder, and beryllium	Uranium
Main Site	33-015	Incinerator	None known	None known
Main Site	33-016	Sump, TA-33-23	High explosives, propellants, and oil	None known
Main Site	33-017	Operational Releases	Beryllium, lead, cadmium, mercury, silver	Tritium, deuterium, uranium, and plutonium
Main Site	C-33-001	Area of Concern TA-33-124	Polychlorinated biphenyls	None known
East Site	C-33-002	Area of Concern TA-33-95	Polychlorinated biphenyls	None known

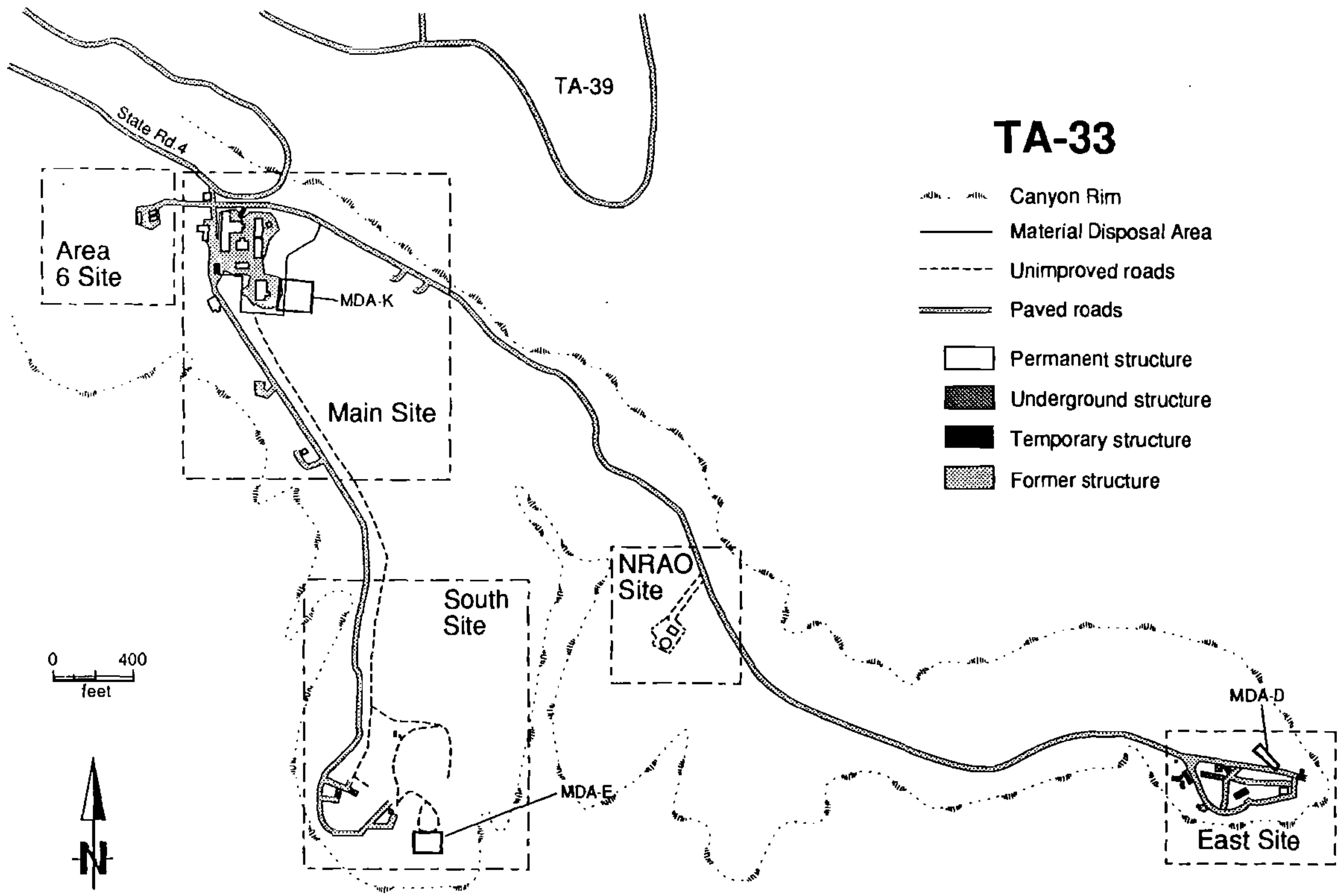


Fig. III-2. Map of TA-33.

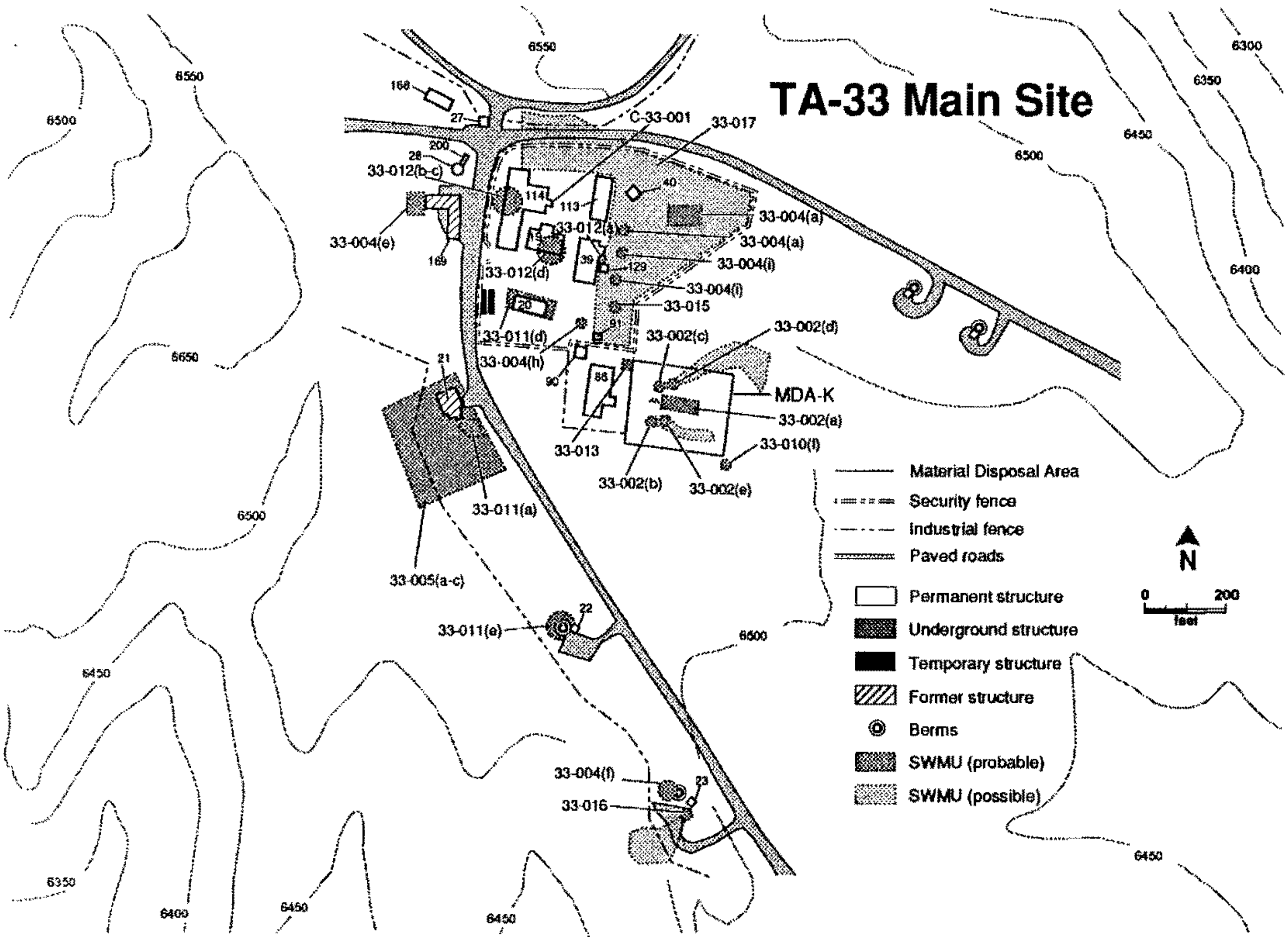


Fig. III-3. Main Site.

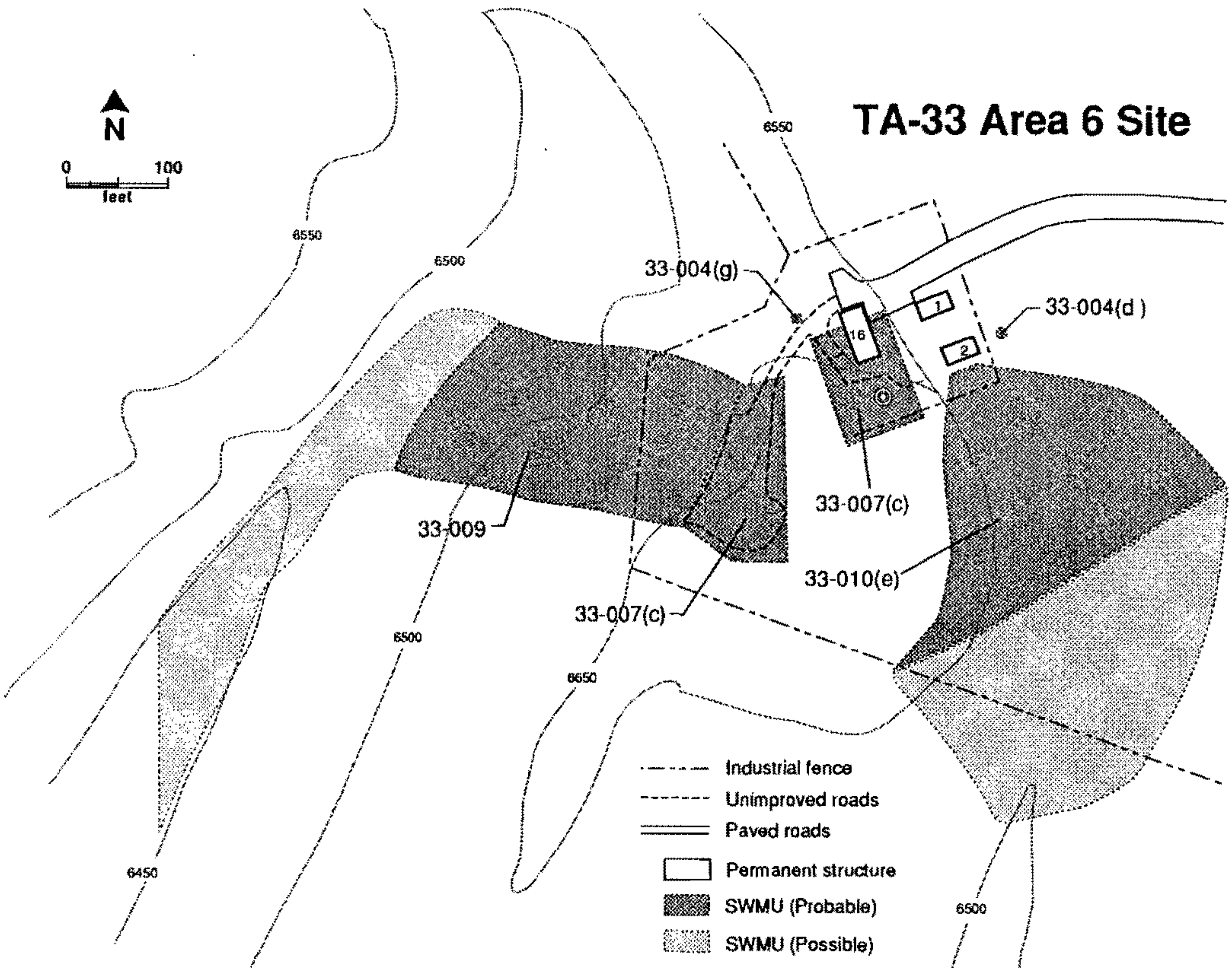


Fig. III-4. Area 6 Site.

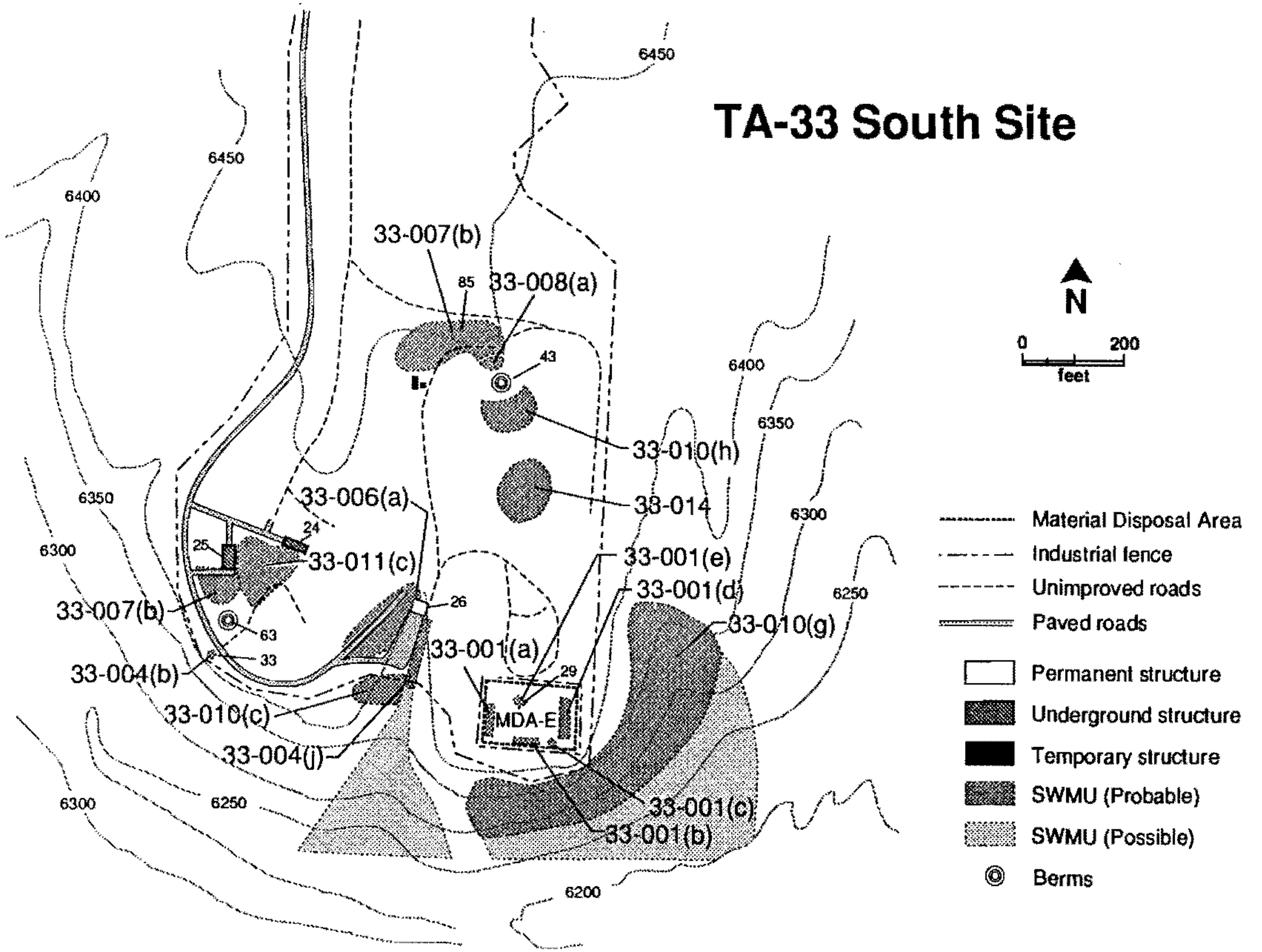


Fig. III-5. South Site.

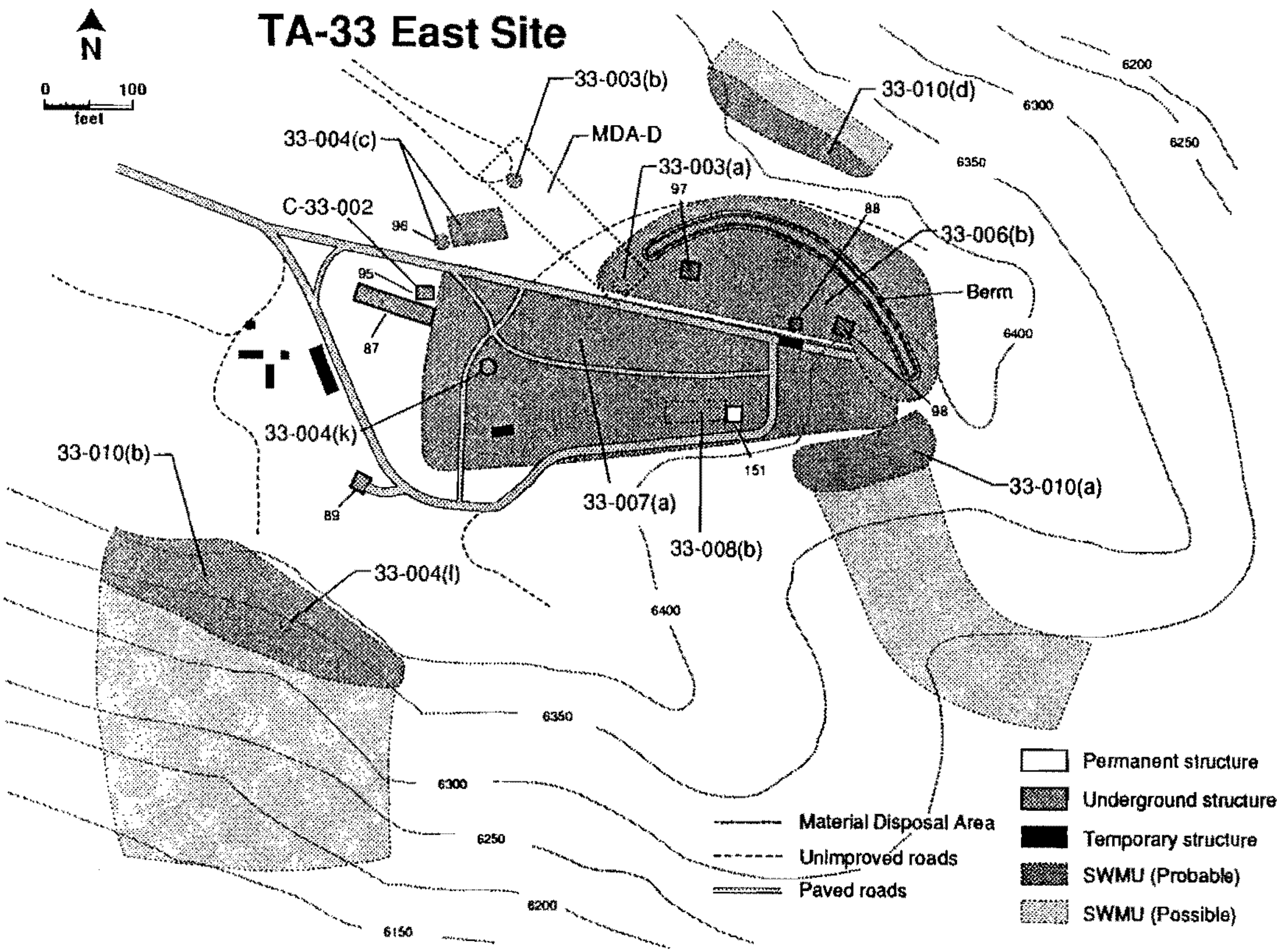


Fig. III-6. East Site.

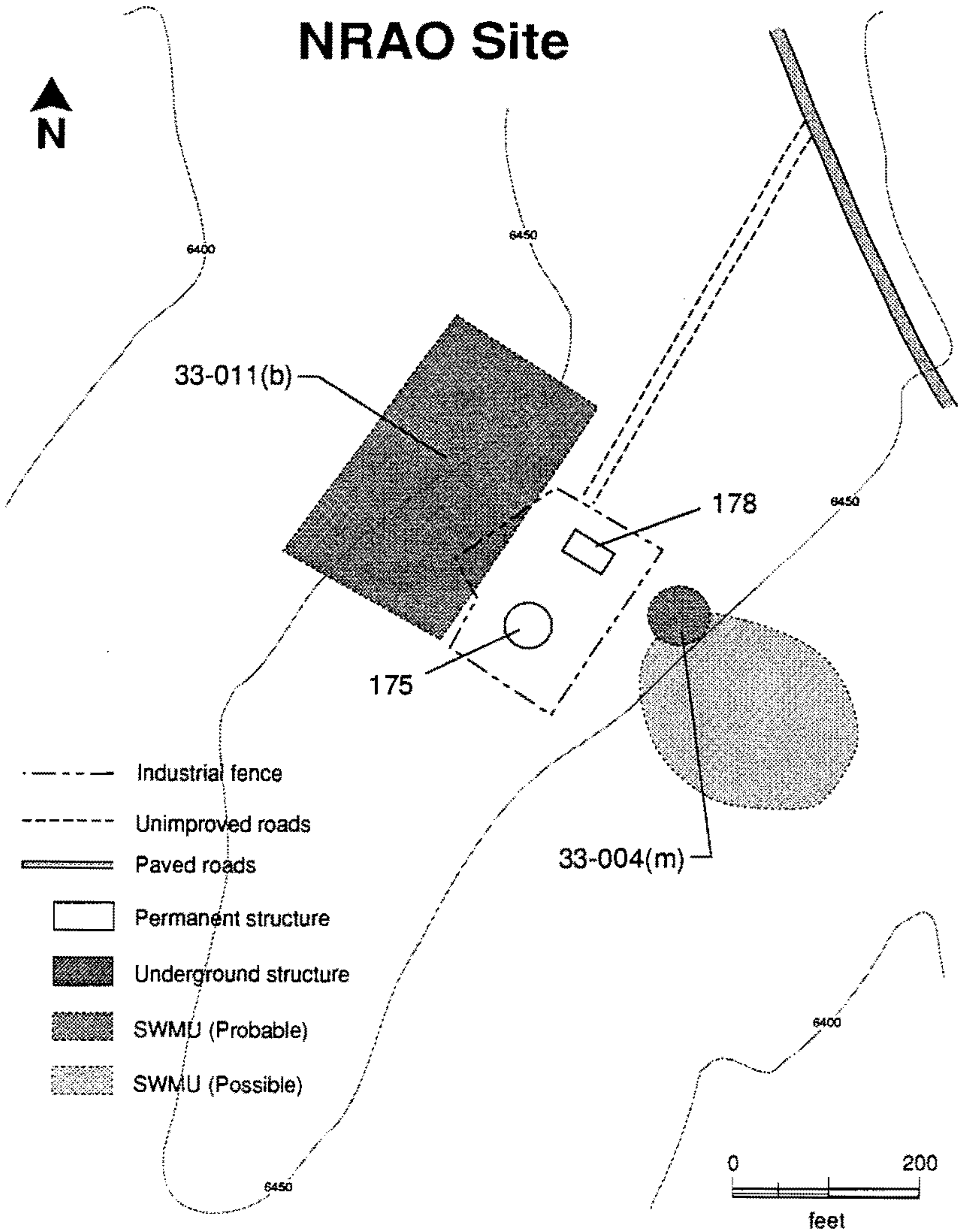


Fig. III-7. NRAO Site.

In addition to snakes, mosquitoes, ticks, spiders, and rodents (including mice and rats), may be encountered. If workers are bitten by insects, first aid creams should be applied by the site safety office to ease the symptoms caused by the bite. If personnel are bitten by a rodent, attempts should be made to obtain the animal, and medical assistance should be sought as soon as possible.

4.2 Task-by-task Risk Analysis

OSHA 1910.120 requires a task-by-task risk analysis. These tasks are related to operations or activities in the field investigation. The preceding section identifies the physical, chemical, radiological, and biological hazards known or suspected to be present at TA-33. This section is designed to take each of the proposed tasks and identify which of the hazards apply and estimate the likelihood of exposure. Sections 4.3, 4.4, and 5.0 of this annex identify methods for eliminating or reducing the potential exposure to the hazards associated with these tasks.

4.2.1 Task: Drilling

Likelihood of Exposure: High

Associated Hazards: In drilling, there is a great possibility for physical injury. The injuries may range from bruised and cut fingers to death. Working around a drill rig allows for entanglement and pinch points in many parts of the rig. These injuries are generally minor but there is the potential for amputation of fingers. Other severe injuries may occur from failure of wire rope under extreme stress. If the rope breaks under high tension, it will act as a whip which could decapitate workers.

Chemical and radiological hazards occur when drilling disturbs or penetrates a contaminated pocket of soil. This happens quite frequently during the drilling process. The rig will stir some dust and will generate heat, which will volatilize organics in the soil. These factors combine greatly to enhance the possibility of exposure to field personnel.

4.2.2 Task: Hand Augering

Likelihood of Exposure: Moderate

Associated Hazards: The hazards for hand augering are similar to those of drilling. The potential for contact with contaminated soils is enhanced, and this operation will have a tendency to stir more dust. Using a powered hand auger may still present the operator entanglement and pinch-point hazards but to a lesser degree than drilling. With a nonpowered hand auger, the probability of physical injury is greatly reduced.

4.2.3 Task: Trenching

Likelihood of Exposure: High

Associated Hazards: The physical hazards associated with trenching operations are based on two main factors: the use of heavy equipment and potential cave-ins on personnel in the trench. Heavy equipment operators are trained to be aware of personnel in the area. However, sometimes the operator is distracted or loses concentration. Therefore, personnel must be alert while the backhoe is operating. Cave-ins occur when the wall of the excavation cannot bear the load and collapses. Cave-ins can occur in trenches of all depths. Physical injuries, as a result of cave-ins, range in severity with the most severe being death.

Chemical/radiological hazards are likely to be encountered while trenching is in progress. Hazards include inhalation of airborne dusts, volatiles, and alpha particles. Although these hazards may be present at all times, higher levels should be expected at certain times. During the actual excavation of the trench, the most concentrated personnel exposure may occur from stirring dust and radioactive particles. The accumulation of vapors inside the trench will conceivably occur after the trench has been completed. Monitoring hazards at these times is critical.

4.2.4 Task: Septic System Sampling

Likelihood of Exposure: Low

Associated Hazards: Physical hazards associated with septic system sampling are the same as described in tasks associated with sampling such as drilling, augering, and trenching.

There is some likelihood that chemical or radiological hazards will be encountered when sampling septic systems, especially in drain fields and seepage pits. Active septic systems are permitted with the NMED, meet permit requirements, and, consequently, have a very low probability that hazardous constituents are present. Prior to permitting, hazardous materials may have been drained into the systems.

4.2.5 Task: High Explosive Sump Sampling

Likelihood of Exposure: Moderate

Associated Hazards: Building TA-33-23, known as the trim building, is reported to have suspect high explosives in a sump located outside the building. The sump discharges to an outfall in Chaquehui Canyon. It is also known that the building was used for the preparation of propellant charges used in firing guns. From knowledge of this process, it is more likely that propellants were prepared in this building than were high explosives. Propellants are not sensitive to shock as are high explosives and, therefore, pose a low likelihood as a hazard. The sump, however, should still be treated as if high explosives are present until screening tests prove that no explosives are present.

4.2.6 Task: Canyon-side Sampling

Likelihood of Exposure: Moderate to High

Associated Hazards: There are several areas where waste materials have been pushed off mesa tops into adjacent canyons. Many of these waste deposits reside on steep slopes or on shelves below vertical cliff faces which are extremely difficult to access for sampling. Use of lifelines and safety belts will be required for activities in these areas.

4.3. Engineering Controls

OSHA regulations state that when possible, engineering controls should be utilized 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 utilizing a ventilation hood in a lab to remove contaminant vapors. Unfortunately, engineering controls are not as easily accomplished in an uncontrollable environment, such as outdoors. However, the following are some suggestions that should be utilized, if possible, while working in the field.

4.3.1 Engineering Controls For Airborne Dust

Airborne dust can be a hazard in two situations: 1) nuisance dust for which standards have been established at 10 mg/m^3 and, 2) attachment of radionuclides and/or hazardous substances to soil particles. In either case, engineering controls may have limited use when airborne dust becomes a hazard.

During drilling or any other activity where localized dust is being generated, a small garden sprayer of water may be used to wet the soil enough to suppress the dust. However, these sprayers do not discharge a large amount of water and spraying must be repeated often to maintain moist soil.

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 will also require frequent spraying to be effective.

4.3.2 Engineering Controls For Airborne Volatiles

Drilling, trenching, soil and tank sampling activities may produce gases, fumes, or mists which may be easily inhaled or ingested by workers without protection. Engineering controls may be implemented to reduce exposure to these hazards. Even nature provides some engineering controls that may be utilized to assist in dissipating vapors. The wind can be used to remove toxic vapors from the work area. This can be accomplished by carefully positioning equipment, such as a drill rig. The most effective means would be to establish a crosswind or position the rig where the wind is blowing toward the side of the rig which allows vapors to be blown away from personnel behind the rig, prevents vapors from collecting under the rig, and allows for an upwind approach of workers not performing duties directly related to the drilling (e.g., a geologist).

Another method is ventilation by mechanical means. This may not be as effective as wind in open areas but may be more desirable in closed or confined spaces. Fans may be used to remove vapors or to supplement a gusting wind. The most effective use of ventilation using mechanical equipment is for sampling tanks or working in a confined space. The fan or other mechanical device may be attached to a large hose to push, or more effectively, pull the contaminant from the confined space. Each has its advantages. Pulling the air from the space is more effective at removing the vapors; whereas forcing air into the confined area better assures acceptable oxygen levels from ambient air. This procedure has been used effectively by fire departments and they should be consulted for information on the most effective method in each situation.

4.3.3 Engineering Controls For Noise

Engineering controls for noise are difficult to design for an uncontrolled environment. Drilling and trenching are likely to produce the highest range of noise levels. Noise produced from drilling is generated by the engine. Drillers perform most of their work behind the rig. On most rigs, the highest range of noise is 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. This demonstrates that barriers seem to work as effective noise reduction. If noise levels reach 90 dB, barriers should be utilized to reduce excessive noise exposure.

4.3.4 Engineering Controls For Trenching

Trenching often presents field personnel with hazards associated with slip, trip, fall, and crushing-type hazards. In most cases, entry into an excavation deeper than 5 ft is avoided if possible. However, it is sometimes necessary to enter trenches to obtain needed information. OSHA has developed regulations for trenches and excavations. Included in the regulations are engineering controls to prevent cave-ins. These controls include the addition of shoring, sloping, and benching to the excavation. Benching is a systematic series of steps dug around the excavation at a specified angle of repose. The angle of repose is determined by the type of soil present. Benching will normally be found in very large excavations, such as surface mining operations. Sloping is a similar system of stabilizing soil but is performed without the steps. Again the angle of repose is determined by the type of soil. This method is generally used for medium-sized excavations, such as removal of a tank. In general, neither of these soil stabilization methods are convenient techniques for exploratory trenches.

The last method that OSHA suggests is shoring. 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. One drawback to utilizing shoring is that it is expensive and time-consuming especially for a trench that is only scheduled to be open for 1 or 2 days.

4.3.5 Engineering Controls For Drilling

Working with and around drill rigs presents workers with a great number of hazards. Hazards are a result of the number of moving parts and the power associated with the equipment. Engineering controls for this apparatus include installing guards where possible to prevent crushing injuries and, more importantly, an inspection program to insure replacement of worn or broken parts. As stated earlier, inspections should be performed at the beginning of the job and periodically during the project.

4.4 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 to which personnel are exposed to a hazard. An example is how long or how close to the hazard the worker is allowed to remain. Administrative controls may be instituted easily in most cases and are effective measures in decreasing personnel exposure.

4.4.1 Administrative Controls For Airborne Chemical and Radiological Hazards

Chemical and radiological hazards are to be monitored during performance of duties in the contaminated zone. If the concentration of radionuclides or toxic materials exceeds the limits established in this plan, personnel may be removed from the area until natural or mechanical ventilation brings the levels to background. This method prevents the necessity for personnel protective equipment. In addition, all nonessential personnel should only enter the contaminated zone when they are required. This not only lowers the exposure but complies with DOE's policy of exposure being as low as reasonably achievable (ALARA).

Because exposure limits consider the average amount of exposure during an 8-hour day, personnel exposed at a higher concentration for a portion of the day may work in an uncontaminated area to lower the average for the day. For chemical contaminants, those higher concentrations must be lower than the immediately dangerous to life and health (IDLH) concentration and the threshold limit value (TLV) ceiling limits.

4.4.2 Administrative Controls for Noise

Administrative controls for noise include both time and distance. The principle is very much like the controls used for both airborne chemical and radiological hazards. In Section 4.1.1.1 noise is discussed. The ACGIH has formally-established administrative controls. The basic idea is the louder the noise, the more distance must be put between the noise and the worker or the worker must spend less time at the source of the noise. Although the principle of sound reduction by distance was not discussed earlier, it is an effective method to reduce noise intensity. Sound pressure or intensity follows the inverse square law in which, as the distance from the source increases, the sound level decreases as the square of the distance. For example, if sound levels at 10 ft from the source are 100 dB and the person doubles the distance or is 20 ft from the source, the sound level drops to 94 dB; 30 ft, or triple the distance to the source, the sound level drops to 90 dB.

Distance is probably the better of the two methods for reducing the level of noise. If neither of these methods is possible, personnel protective equipment must be worn.

4.4.3 Administrative Controls for Trenching

Administrative controls established by OSHA are the most effective methods for reducing the hazards of the trench investigations proposed for TA-33. The basic philosophy behind the administrative controls for trenching is not to create a hazardous condition. Trenches less than 5-ft deep do not require protective systems (sloping, benching, or shoring). All trenches should be excavated to a depth 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. When the area is not occupied all excavations must be marked to restrict access.

One important factor is that even though these standards are followed, accidents may still occur. Human error always plays a role in causing an accident. A backhoe operator may not see or know if there are workers in the trench. Therefore, any time there are personnel in the trench the operator must shut down the equipment until the excavation has been evacuated. Inspections should be made by a competent person before any field team member is allowed to enter the excavation. Additionally, personnel are required to be aware of conditions inside the trench and outside the excavation.

4.4.4 Administrative Controls for Working Near the Mesa Edge

Slip, trip, and fall hazards will 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 will not get closer than 5 ft to the edge. If necessary, bannerguard 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 will be required to be tied to a life line before being allowed to descend over the edge.

5.0 PERSONNEL PROTECTIVE EQUIPMENT AND SYSTEMS

In the event engineering and administrative controls are not suitable, personnel protective equipment should be used. This equipment may be used alone or as a supplement to existing safety systems and to enhance the degree of safety for workers. Personnel protective equipment is a garment or apparatus that is worn by field team members to protect them from a certain type or group of hazards. Some examples of personal protective equipment are: Tyvek clothing, hard hat, gloves, safety harness, and respirator. The maintenance, inspection, procedures, and training in the use of personal protective equipment will follow the health and safety program of the organization that implements this plan. The following sections will discuss the protective equipment or systems to be used in certain situations.

5.1 Protection Levels and Protective Clothing

The Environmental Protection Agency (EPA) has established levels of protection for workers entering potentially hazardous sites. At many of the SWMUs at TA-33, the contaminants have been identified. Therefore, an assessment has been made based on each of the contaminants, investigation activities, and the areas to be investigated. The action levels for upgrades in levels of protection have been selected based on those factors and are given in Section 5.2 of this document, Action Levels for Upgrade in Protection.

The majority of site characterization will begin in modified Level D protection. In certain cases, Levels C and B may be prescribed due to the amount or toxicity of the contaminants present. Personnel entering the contaminated zone are required to meet the level of protection designated for that area. The levels of protection and the minimum equipment allowed for each level of protection are listed below.

5.1.1 Level B Protection

Level B protection will include the following:

- a full-face, positive-pressure, self-contained breathing apparatus (MSHA/NIOSH-approved);
- chemical-resistant disposable clothing suitable for protection against the hazards of concern;
- inner glove (PVC, latex, or nitrile);
- rubber outer gloves providing the best barrier between the wearer and contamination;
- steel-toed safety boots made of rubber or leather when disposable boot covers are donned; and
- hard hat, safety glasses, and hearing protection as needed.

5.1.2 Level C Protection

Level C protection will include the following:

- full face, air purifying respirator (MSHA/NIOSH-approved) with cartridges or canisters capable of filtering contaminants of concern;
- contaminant-resistant clothing suitable for protection against the hazards of concern;
- inner glove (PVC, latex, or nitrile);
- rubber outer gloves providing the best barrier between the wearer and contamination;
- steel-toed safety boots made of rubber or leather when disposable boot covers are donned; and
- hard hat, safety glasses, and hearing protection as needed.

5.1.3 Modified Level D Protection

Modified Level D protection will include the following:

- cloth or Tyvek coveralls or work uniform;
- rubber or leather outer gloves providing the best protection for the activity being performed;
- steel-toed safety boots and optional boot covers as needed; and
- hard hat, safety glasses, and hearing protection as needed.

The Field Team Leaders are required to provide protective equipment to each of their field team members.

Field activities at TA-33 will be conducted according to LANL Administrative Requirement 12-1, Personal Protective Equipment; and LANL Technical Bulletins 1201, Eye and Face Protection; 1202, Protective Clothing; and 1203, Respiratory Protective Equipment.

5.2 Action Levels for Upgrade in Protection

Monitoring instruments are to be used in conjunction with lab analysis to establish the exposure levels of field team members. These instruments will monitor for radiation, volatile organics, corrosives, flammable vapors, and particulates. The action levels established below are based on the results of onsite monitoring. In some instances, analytical lab screening with quick turnaround and lab analysis will be necessary to determine the actual level of the specific chemical contaminant in the air. For instance, there are no direct reading instruments for PCBs, but there is a real-time aerosol monitor (RAM) that determines the amount of respirable dust present in the breathing zone. A PCB soil concentration will be obtained from the lab and plugged into a formula, which will determine the total PCB concentration in air, based on a total particulate reading from the RAM. This data may also be confirmed with air sampling. Air sampling will be used exclusively for determining alpha contamination in air. The organization implementing this plan has not been selected. The organization selected must supply the method of maintenance and calibration for the specific instruments used.

5.2.1 Monitoring Instruments

The following monitoring instruments will be used during this investigation.

5.2.1.1 Photoionization Detector (PID)

A description of the PID may be found in Section 9.3 of the Installation Work Plan (IWP), Annex III, (LANL 1991, 0553).

5.2.1.2 Flame Ionization Detector (FID)

Flame ionization detectors are also used to monitor total organic vapors. However, this instrument uses a flame to ionize the contaminant. It reads in parts per million of methane, which is the calibration gas. The FID is more effective at reading lower-chain compounds.

5.2.1.3 Combustible Gas Indicator (CGI)

A description of the CGI may be found in Section 9.3 of the IWP, Annex III, (LANL 1991, 0553).

5.2.1.4 Oxygen Meter

A description of the oxygen meter may be found in Section 9.3 of the IWP, Annex III, (LANL 1991, 0553).

5.2.1.5 Real-Time Aerosol Monitor (RAM)

The real-time aerosol monitor is designed to monitor respirable particulates (<10 microns). The instrument uses reflective light which is converted to units of mg/m^3. This is useful if there are known concentrations in soil of alpha radiation, particulates, metals, and PCBs. Soil samples will be submitted to the lab and the analysis will be used to determine action levels for the contaminants present.

5.2.1.6 Colorimetric Detector Tubes

A description of the colorimetric detector tubes may be found in Section 3 of the IWP, Annex III, (LANL 1991, 0553).

5.2.1.7 High- and Low-Volume Air Samplers

A description of the high- and low-volume air samplers may be found in Section 9.3 of the IWP, Annex III, (LANL 1991, 0553).

5.2.1.8 Radiation Survey Meters

A variety of radiation survey meters will be used in to determine levels of worker radiation exposure. Alpha scintillometers will be used to screen cores and personnel leaving the contaminated zone. A µR meter or a Geiger-Muller tube detector will be used to establish gamma exposure to field team members. If required by specific activities or tasks, thermoluminescent dosimeters (TLDs) will be worn by personnel while at TA-33.

5.2.2.1 Action Levels

The following guidelines are to be used at each SWMU location. Readings are to be taken according to ER Program SOPs which describe procedures and frequency of monitoring.

5.2.2 Volatiles

Contaminants at TA-33 are estimated from the historical information that has been gathered to prepare this plan. If present, most of these chemicals are expected to be at or near background levels. Therefore, the concentration ranges for each level of protection prescribed below are based on known contaminants.

Benzene has the most restrictive exposure limit of all the chemicals currently known to be present at TA-33. The limit for benzene is 1 ppm and is detected by the PID and the FID with a response factor of 100%. However, benzene does not have the adequate warning properties required for respirator use. Therefore, when PID or FID readings reach 1 unit (ppm as to methane) above background, benzene-specific colorimetric tubes will be used to determine benzene levels. If benzene levels are below 1 ppm, Level D protective equipment is adequate. If benzene levels are above 1 ppm, Level B must be worn or personnel will be evacuated, and engineering controls will be implemented to reduce airborne concentrations. Work may be resumed when benzene levels return to background.

If benzene is determined not present, the action level for engineering controls, or Level C protection is 8.5 units above background. This is based on the chemical with the second most-restrictive exposure limit, which is 1,1,2-trichloroethane. The PEL for 1,1,2-trichloroethane is 10 ppm and has a PID relative response factor of 85%.

The maximum concentration for respirator use is 50 ppm. At this time, Level B protection will be worn or personnel will be evacuated and engineering controls will be implemented to reduce the concentration of airborne contamination.

5.2.2.2 Combustible Vapors

The CGI will be used to monitor for combustible atmospheres during drilling, trenching, and tank sampling. A one-minute downhole reading will be used for drilling, a one-minute reading at different levels will be used for trenching, and a one-minute reading inside the tanks will be used for tank sampling. This will give the instrument time to fully equilibrate. At 20% of the lower explosive limit (LEL), personnel will be evacuated and engineering controls will be utilized to reduce the concentration of combustible vapors. Personnel may resume work when levels drop below 10% of the LEL.

5.2.2.3 Particulates, Metals, PCBs, and Alpha Contamination

A real-time aerosol monitor will be used in conjunction with lab data to determine the concentration of contaminants in air. A sample will be obtained to determine the amount of one or more of these contaminants in soil and an action level will be calculated for that particular work area.

5.3 Safety Systems and Equipment

A variety of safety equipment will be used to protect personnel from physical hazards and to minimize exposure to hazardous chemicals and radionuclides during field activities at TA-33.

5.3.1 Hearing Protection

If noise levels are above 85 dB and both engineering and administrative controls are not practical, hearing protection will be required. There are two basic types of hearing protection available: 1) disposable and reusable ear plugs, and 2) ear muffs. Ear plugs may reduce noise levels 25-30 dB and ear muffs 35-40 dB if worn properly. The specific protective device utilized should be inspected for information on the effective noise reduction rating.

5.3.2 Trench Protection

The one protection device that has been developed for trench operations where shoring, benching, and sloping are not feasible is the trench box or trench shield. A trench box or shield is a box constructed from a strong metal or wood wide enough for workers to move about inside and perform their duties. OSHA regulations require certain specifications be met for the trench box to be safe. The trench box is placed in the trench and attached to the backhoe so that it may be pulled along as the workers progress. This type of system is used mostly in the installation of water systems. It would not be as useful to trench investigations because the walls of the trench may not be viewed from the box, and the protection is voided when workers leave the box.

5.3.3 Life Lines and Safety Belts

Life lines and safety belts will be used to prevent falls when canyon-side sampling is being done. The same type of system will be used when hand augering is performed at the mesa edge.

In addition to these personnel protective devices, other safety equipment may be used as needed. LANL Administrative Requirement 12-2, Seat belts, will be followed. Warming and cooling equipment may be necessary to minimize stress from climatic conditions. Emergency equipment will also be necessary for immediate response and emergency treatment. Additionally, the location of such equipment must be clearly marked and personnel should know the location and be trained in its use.

Fire extinguishers are classed by the type of fire they were designed to extinguish. However, they may be effective for more than one class of fire.

Class A - ordinary combustible materials (wood, paper, and textiles)

Class B - flammable liquids (oil, grease, and paint)

Class C - electrical fires

Class D - metals capable of rapid oxidation (magnesium, sodium, zinc, aluminum, uranium, and zirconium)

5.4 General Safety Practices and Mitigation Measures

Some hazards can be minimized by implementing specific safety procedures, work practices, special equipment, training of personnel, and emergency response equipment in case of an accident. They are listed in Section 9.4 of the IWP, Annex III, (LANL 1990, 0553). In addition, the following measures will be taken:

- Daily planning and/or pre-activity meetings will be held for all personnel involved in field activities. These meetings will discuss health and safety concerns and refresh personnel on the emergency response plans.
- Workers will shower as soon as possible after field work.
- Regulated areas will be established according to the field activity and level of protection. This control zone will be at least 25 ft in diameter and will be established for safety considerations, as well as to control contamination. The actual dimensions of the control zone should include the space required for any Laboratory security requirements.
- If dust persists during augering or drilling activities, water will be used for dust suppression. This action is for the protection of field personnel.

5.4.1 Site Access Control

Restricted-access or exclusion zones will be established before work begins at contaminated sites to protect employees and the general public from unnecessary exposure to toxic materials and to prevent the spread of contamination. A description of these zones may be found in Section 7.0 of the IWP, Annex III (LANL 1991, 0553).

5.4.2 Decontamination

Personnel, equipment, and vehicles that have been in contaminated areas may carry residual contamination. Although protective clothing, respirators, and good work practices can help reduce contamination, decontamination may be necessary to prevent exposure of personnel and migration of contaminants. All vehicles and equipment that are suspected of being contaminated must be steam-cleaned using high-pressure washers. Vehicles and equipment suspected of being contaminated with alpha particles must be screened with an alpha scintillometer before being released from the site.

Personnel decontamination should be performed at all levels of protection. Disposable protective equipment need not be decontaminated but must be disposed of as a hazardous waste. Reusable protective equipment must be decontaminated using a soap and water wash and two successive rinses. Visual inspections of the equipment will help determine the effectiveness of the decontamination process. As with equipment, personnel will be screened with an alpha scintillometer when working with or near alpha-contaminated material. ER Program SOPs will be established to guide decontamination of personnel and equipment. LANL Administrative Requirements for Waste Management are: 10.1, Radioactive Liquid Waste; 10.2, Low-Level Radioactive Solid Waste; 10.3, Chemical, Hazardous and Mixed Waste; 10.4, Polychlorinated Biphenyls; and 10.5, Transuranic Solid Waste.

In addition to the following, Section 10.0 of the IWP, Annex III (LANL 1991, 0553), contains information on decontamination:

1. The level of decontamination required will depend on the nature and magnitude of contamination and the type of protective clothing worn. Disposable clothing (e.g., Tyvek) will not be washed because water may transport contamination through the paper garment to the skin.

2. Wastewater and materials used during decontamination will be contained for appropriate disposal. Arrangements will be made with LANL for acquisition and disposal of drums containing soapy water, rinse water, methanol, and trash.

5.4.3 Worker Training

Worker training will follow the requirements set forth in Section 11.0 of the IWP, Annex III (LANL 1991, 0553).

5.4.4 Employee Medical Program

In addition to the guidance provided in Section 12.0 of the IWP, Annex III, the following paragraph details specific program requirements (LANL 1991, 0553).

Field team members who are exposed to contaminated materials during ER remedial investigations shall participate in a medical examination program provided by the Laboratory according to 29 CFR Part 1910 or DOE Order 5480.11, Chapter VIII Requirements. Suitability of field team members for conducting field sampling activities, including respirator use, shall be evaluated and documented by a physician. Medical programs must comply with the requirements of DOE Order 5480.11, Chapter VIII or 29 CFR Part 1910, as appropriate. LANL Administrative Requirements 2-1, Occupational Medicine Program; 3-6, Biological Monitoring for Radioactive Materials; and 6-4, Biological Monitoring for Hazardous Materials; and LANL Technical Bulletin 606, Biological Sample Monitoring, shall be followed.

5.5 Records, Reporting Requirements, and Employee Information

The ER Health and Safety Project Leader, working the Operable Unit Project Leader and Field Teams Manager will ensure that health and safety records are maintained within the appropriate LANL group as required by DOE orders. The reports are as follows:

- DOE-AL Order 5000.3A, Unusual Occurrence Reporting;
- DOE Form 5484.3, Supplementary Record of Occupational Injuries and Illnesses, Attachment 1;
- DOE Form 5484.4, Tabulation of Property Damage Experience, Attachment 2;
- DOE Form 5485.5, Report of Property Damage or Loss, Attachment 4;
- DOE Form 5484.6, Annual Summary of Whole Body Exposures to Ionizing Radiation, Attachment 13;
- DOE Form 5484.1, Summary of Exposures Resulting in Internal Body Depositions of Radioactive Materials for CY 19____, Attachment 14;
- DOE Form 5484.8, Termination Occupational Exposure Report, Attachment 10;
- DOE Form OSHA-200, Log of Occupational Injuries and Illnesses, Attachment 7;
- DOE Form EV-102A, Summary of Department of Energy and Department of Energy Contractor Occupational Injuries and Illnesses, Attachment 8; and
- DOE Form 5821.1, Unplanned Releases Form, Attachment 15.

Copies of these reports will be stored with the appropriate LANL group. Specific reporting responsibilities are given in the following sections and in Chapter 1, General Administrative Requirements of the LANL Environment, Safety, and Health Manual (LANL 1990, 0335).

5.5.1 Exposure and Medical Records

Confidential records of the medical status of each field team member, obtained through the employee medical program, will be maintained with the appropriate Laboratory group and, as necessary, coordinated with the ER Program office. The requirements established below must be met in addition to the requirements set forth in Section 13.1 of the IWP, Annex III (LANL 1991, 0553). Field team members will be issued a radiation dosimeter by LANL, according to Administrative Requirement 3-1, Personnel Radiation Exposure Control.

DOE Forms 5484.1, Summary of Exposures Resulting in Internal Body Depositions of Radioactive Materials for CY 19___ and 5484.6, Annual Summary of Whole Body Exposures to Ionizing Radiation, will be submitted annually by March 31 for monitored employees. Preparation of these reports will be coordinated with HS-1, the Radiation Protection Group.

5.5.2 Reporting Requirements

It is the employee's responsibility to notify appropriate supervisory personnel of unusual occurrences, accidents, incidents, and unsafe situations.

5.5.2.1 Unusual Occurrences

All unusual occurrences must be reported by the Site Safety Officer to the Health and Safety Project Leader, Field Teams Manager, Operable Unit Project Leader, and building managers in accordance with Section 13.2 of the IWP, Annex III, (LANL 1991, 0553).

5.5.2.2 Accident/Incident Reports

The LANL principal investigator will submit a completed DOE Form F 5484.X for any of the following accidents/incidents, according to LANL Administrative Requirement 1-1.

1. OCCUPATIONAL INJURY is any injury such as a cut, fracture, sprain, or amputation that results from a work accident or from an exposure involving a single incident in the work environment.

   NOTE: Conditions resulting from animal bites, such as insect or snake bites or from one-time exposure to chemicals are considered injuries.

2. OCCUPATIONAL ILLNESS is any abnormal condition or disorder, other than one resulting from an occupational injury, caused by exposure to environmental factors associated with employment. It includes acute and chronic illnesses or diseases that may be caused by inhalation, absorption, ingestion, or direct contact with a toxic material.

3. PROPERTY DAMAGE LOSSES of $1,000 or more must be reported. Accidents that cause damage to DOE property, regardless of fault, or accidents wherein DOE may be liable for damage to a second party, are reportable where damage is $1,000 or more. Include damage to facilities, inventories, equipment, and properly parked motor vehicles. Exclude damage resulting from a DOE-reported vehicle accident.

4. GOVERNMENT MOTOR VEHICLE ACCIDENTS resulting in damages of $150 or more or involving an injury, unless the government vehicle is not at fault; damage of less than $150 is sustained by the government vehicle; and no injury is inflicted on the government vehicle occupants. Accidents are also reportable to DOE if:

   - damage to a government vehicle not properly parked is greater than or equal to $250;

- damage to DOE property is greater than or equal to $500 and the driver of a government vehicle is at fault;
- damage to any private property or vehicle is greater than or equal to $250 and the driver of a government vehicle is at fault; and
- any person is injured and the driver of a government vehicle is at fault.

5.5.3 Employee Information

The Site Safety Officer shall ensure that the following DOE, LANL, and OSHA forms are posted where field team leaders and field team members can easily read them:

- Form F 5480.2, Occupational Safety and Health Protection;
- Form F 5480.4, Occupational Safety and Health Complaint Form;
- LANL Special Work Permit ; and
- OSHA Job Safety and Health Protection Form.

The LANL health and safety standard concerning employees' right-to-know shall also be posted at the work site. Additionally, employees will be required to sign the Field Personnel Signature Page (Fig. III-8) prior to beginning field work.

6.0 EMERGENCY RESPONSE AND NOTIFICATION

This section provides information on responding to emergency situations. LANL Administrative Requirement 1-2, Emergency Preparedness; Administrative Requirement 1-8, Working Alone; and Technical Bulletin 101, Emergency Preparedness were used in developing an emergency response plan.

6.1 Emergency Contacts

The names of persons and services to contact in case of emergencies are given on the Emergency Contacts List (Fig. III-9). This emergency contact form will be copied and posted in prominent locations at the work site. Two-way radio communication will be maintained at remote sites when possible.

The emergency contact number at the Laboratory is 9-911. However, 911 will work but takes longer than dialing 9-911 on Laboratory phones.

6.2 Contingency Plans

This section considers contingency plans for specific types of emergencies. The Site Safety Officer, with assistance from the Field Teams Manager and, if needed, the

FIELD PERSONNEL SIGNATURE PAGE

I understand and have been informed of the contents of the Health & Safety Plan for Operable Unit 1122.

Name	Signature	Date

Fig. III-8. Field personnel signature page to be signed by employees prior to beginning field work.

EMERGENCY CONTACTS LIST

SITE SAFETY OFFICER

Name TBD Call TBD

ENVIRONMENTAL RESTORATION HEALTH AND SAFETY PROJECT LEADER

Name Ted Norris Call 665-5136

24-HR LANL HEALTH/SAFETY COORDINATOR Call 9-911

FIRE Call 9-911

AMBULANCE Call 9-911

POISON CENTER Call 9-911

SECURITY Call 9-911, 7-4437 (Protective Force)

POLICE Call 9-911, 7-4437 (Protective Force), 9-662-8222 (Los Alamos Police)

YOU ARE LOCATED AT

TBD

THE NEAREST TELEPHONE IS LOCATED AT

TBD

THE NEAREST EMERGENCY MEDICAL SERVICES ARE LOCATED AT

Los Alamos County Medical Center

3917 West Road, Los Alamos, NM

DIRECTIONS TO HOSPITAL: Exit TA-33 through the north gate and drive west on State Road 4. Follow State Road 4 to the intersection of Diamond Drive. Turn left on Diamond Drive. Cross the canyon bridge and proceed to the intersection of Trinity Drive and Diamond Drive. The hospital is on the right.

TRAVEL TIME FROM TA-33: approx. 25 minutes

DISTANCE TO HOSPITAL: 15 miles

Fig. III-9. The emergency contacts list is to be copied and posted in prominent locations at the work site.

Field Team Leader, shall have responsibility and authority for coordinating all emergency-response activities until the proper authorities arrive and assume control. A copy of pre-existing TA-33 emergency response plans shall be available at the work site at all times and all personnel working at the site shall be familiar with the plans. Evacuation plans and routes may be found in Section 6.2.3, Emergency Response Plan for TA-33.

6.2.1 Fire/Explosion

In the event of a fire, the work area will be evacuated and the Los Alamos Fire Department will be notified. In the event of an explosion, all personnel will be evacuated, and no one will enter the work area until it has been cleared by Laboratory explosives safety personnel.

If a combustible gas meter indicates gas concentrations at levels of 20% of the lower explosive limit, personnel will be evacuated. The Site Safety Officer will continue monitoring to determine when equipment should be removed or when personnel may re-enter the area and resume work.

6.2.2 Personnel Injuries

In case of serious injuries, the victim should be transported to a medical facility as soon as possible. The Los Alamos Fire Department provides emergency transport services. Minor injuries may be treated by trained personnel in the work area. All injuries should be reported to HS-2, the Occupational Medicine Group. In the event that an injured person has been contaminated with chemicals, decontamination will be performed to prevent further exposure only if it will not aggravate the injury (as outlined in Subsection 5.4.2). Treatment of life-threatening or serious injuries will always be undertaken first. If exposure to hydrofluoric acid occurs, special treatment is required. The hospital must be notified immediately and a special paste will be obtained and applied to the affected area. This paste is currently located at HS-2.

6.2.3 Emergency Response Plan for TA-33

For general emergencies that require evacuation (e.g., fire, medical, security, releases, etc.) an emergency response plan specific to TA-33 is required. This section establishes evacuation routes for personnel to follow in the event of an emergency. In a worst case, evacuation of all personnel from TA-33 would be required; in most instances a safe distance may be established to protect personnel.

If a major fire or explosion were to occur, site personnel with fire extinguishers would be of no use. The signal for an evacuation will be two long blasts on an air horn. The crew would gather at a specified location (normally at the vehicles) and proceed away from the fire. Telephones are available at TA-33. Communications by two-way radio will also be implemented. One person should contact the fire department either by two-way radio or by phone, dialing 9-911. The phone and the evacuation route used by field personnel should be in the direction away from the fire and toward the TA-33 exit. There is only one exit from TA-33, and that is the gate at the north end of the technical area. At the gate, all personnel will wait until every person in the field crew has been accounted for. The Site Safety Officer will determine the next course of action.

A major release or fire involving hazardous or radioactive materials may warrant a different approach. This will be signaled by two short blasts on an air horn. When the signal is heard, personnel will meet at a predetermined area which will be selected based on wind conditions. A portable wind sock or streamer will be positioned at each work location and personnel notified of the location. If the horn is sounded, all personnel will move in an upwind direction as far as possible without entering a plume. If the source of the fire or release is directly upwind, personnel will move to the exit or gate side and away from the plume (if visible). Once a safe distance is reached, all personnel are to be accounted for. The Field Teams Manager and the Site Safety Officer will be responsible for this task. At that time, the Site Safety Officer will determine the next course of action.

For a less severe accident, such as a minor release or small fire, a full evacuation may not be necessary. This will be signaled by one long blast. All personnel will meet at a designated area (e.g., the vehicles) and all personnel will be accounted for. The Field Teams Manager and the Site Safety Officer will be responsible for this task. The Site Safety Officer will give further instructions.

In the case of a security problem, one short blast will be sounded and personnel will stay in place and wait for instruction from a Laboratory guard.

Listed below are the signals for easy reference. These will be reviewed at least once per week to remind field personnel of the procedures and the signals. This information should also be posted at prominent locations at each work site.

- **Major fire** - two long blasts on the air horn
- **Major release** - two short blasts on the air horn
- **Minor fire or release** - one long blast on the air horn
- **Security problem** - one short blast on the air horn

6.2.4 Additional Emergencies

For information on the DOE's four basic response levels, unusual event, site alert, site emergency and general emergency, see section 6.0 of the 1990 IWP, Annex III (LANL 1990, 0144).

6.3 Notification Requirements

The reporting of emergency situations will follow the flow diagram provided in Fig. III-1. Field team members will notify the Site Safety Officer. The Site Safety Officer's responsibility is to notify the appropriate emergency assistance personnel (e.g., fire, police, ambulance), the Field Teams Manager, and the LANL Emergency Management Office (7-6211 or 7-7080 during non-working hours) according to DOE Orders 5500.2, 5500.2B, and 5000.3A. The LANL Emergency Management Office is responsible for implementing notification and reporting requirements according to DOE Order 5484.1A, DOE Order 5484.2, and DOE AL Implementation Order 5484.2.

REFERENCES

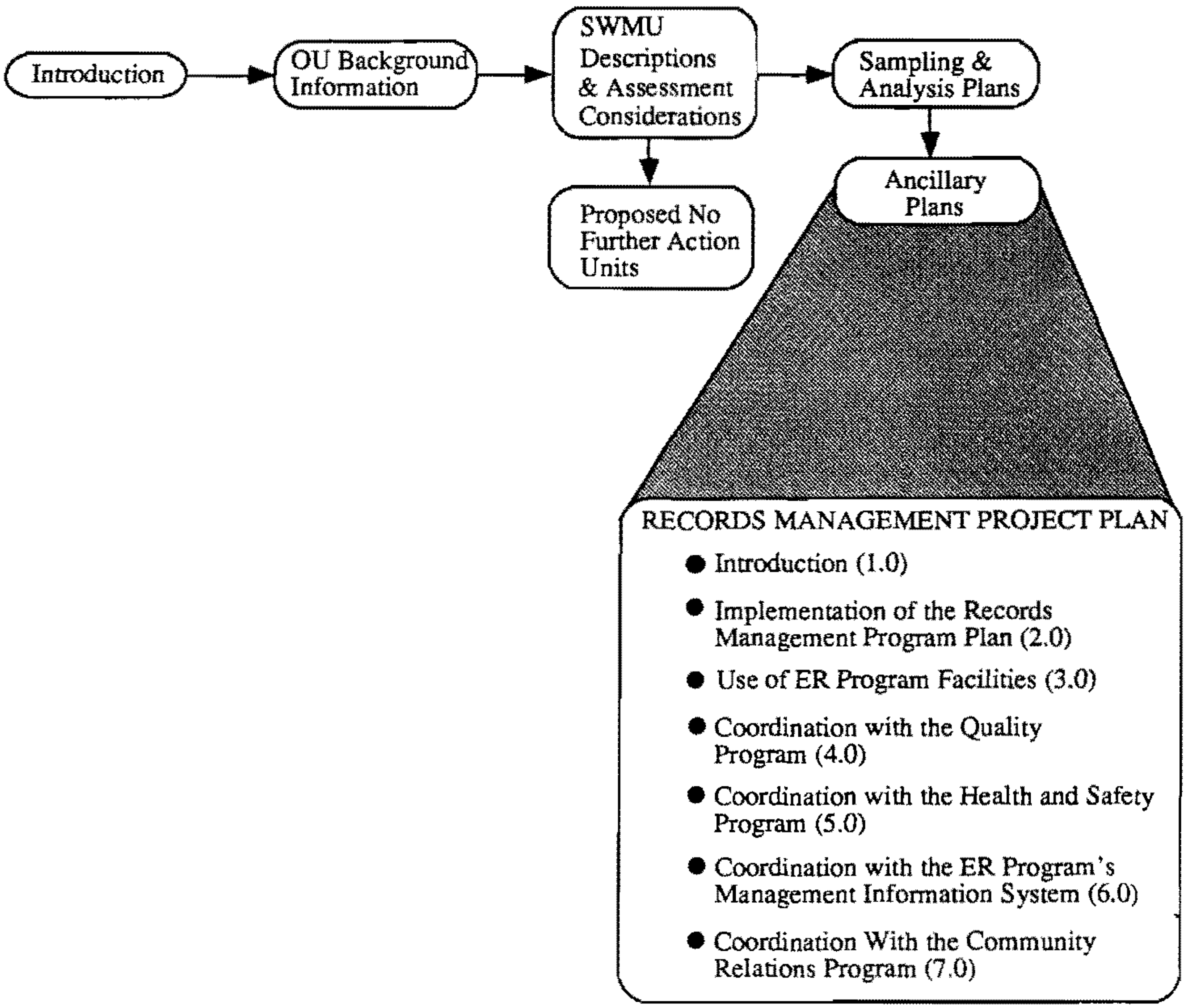
LANL (Los Alamos National Laboratory), November 1990. "Installation Work Plan for Environmental Restoration," Los Alamos National Laboratory Report LA-UR-90-3825, Los Alamos, New Mexico. **(LANL 1990, 0144)**

LANL (Los Alamos National Laboratory), July 31, 1991. "Environment, Safety, and Health Manual," AR 8-2, Hearing Conservation, Los Alamos, New Mexico. **(LANL 1990, 0335)**

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

NIOSH (National Institute for Occupational Safety and Health), Occupational Safety and Health Administration (OSHA), US Coast Guard (USCG), and US Environmental Protection Agency (EPA), October 1985. "Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities," DHHS (NIOSH) Publication No. 85-115, prepared for the US Department of Health and Human Services, Washington DC. **(NIOSH et al. 1985, 0414)**

ANNEX IV


Introduction
OU Background Information
SWMU Descriptions & Assessment Considerations
Sampling & Analysis Plans
Proposed No Further Action Units
Ancillary Plans
RECORDS MANAGEMENT PROJECT PLAN
Introduction (1.0)
Implementation of the Records Management Program Plan (2.0)
Use of ER Program Facilities (3.0)
Coordination with the Quality Program (4.0)
Coordination with the Health and Safety Program (5.0)
Coordination with the ER Program's Management Information System (6.0)
Coordination With the Community Relations Program (7.0)

1.0 INTRODUCTION

The Records Management Program Plan for the Environmental Restoration (ER) Program at Los Alamos National Laboratory (the Laboratory) is described in Annex IV of the Installation Work Plan (IWP) (LANL 1991, 0553). The purposes of the program plan are to meet the requirements for protecting and managing records (including technical data), to provide an ongoing tool to support the technical efforts of the ER Program, and to function as a support system for management decisions throughout the existence of the ER Program.

The ER Program uses the following statutory definition of a record (44 USC 3301):

> Records are defined as "...books, papers, maps, photographs, machine-readable materials, or other documentary materials, regardless of physical form or characteristics,...appropriate for preservation...because of the informational value of the data in them."

The program plan establishes general guidelines for managing records, regardless of their physical form or characteristics, that are generated and/or used by the ER Program. The program plan will be implemented consistently to meet the requirements of the Quality Assurance Program Plan (Annex II of the IWP) and to provide an auditable and legally defensible system for records management. Another important function of the program plan is to maintain the publicly accessible documentation comprising the administrative record required by the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA).

2.0 IMPLEMENTATION OF THE RECORDS MANAGEMENT PROGRAM PLAN

Chapter 2 of the program plan describes the implementation of the records management program. Records management activities at Operable Unit (OU) 1122 will follow the guidelines summarized in that chapter. As the program plan develops to support OU needs, additional detail will be provided in annual updates of the IWP.

The program plan incorporates a threefold approach based on records control and commitment to quality guidelines: a structured work flow for records, the use of approved procedures, and the compilation of a referable information base. ER Program records are those specifically identified in quality procedures (QPs), administrative procedures (APs), standard operating procedures (SOPs), ER program and project plans, management guidance documents, and records identified by ER Program participants as being essential to the program. The records management procedure (LANL-ER-AP-02.1) governs records management activities, which include records identification, submittal, review, indexing, retention, protection, access, retrieval, and correction (if necessary). Other procedures, such as LANL-ER-AP-01.3 (Review and Approval of Environmental Restoration Program Plans and Reports), LANL-ER-AP-01.4 (Distribution of Controlled Documents Prepared for the Environmental Restoration Program), and LANL-ER-AP-01.5 (Revision or Interim Change of Environmental Restoration Program Controlled Documents), are also followed.

Records (including data) will be protected in and accessed through the referable information base. The referable information base includes all the information systems maintained at the Records-Processing Facility (RPF) and the Facility for Information Management, Analysis, and Display (FIMAD). RPF personnel receive ER Program records, assign an ER identification number, and process records for delivery to the FIMAD. The RPF will complement FIMAD in certain aspects of data capture, such as scanning. The RPF also functions as an ER Program reference library for information that is inappropriate either in form (e.g., old records) or in content (e.g., Federal Register) for storage at the FIMAD. FIMAD provides the hardware and software necessary for data capture, display, and analysis. The information will be readily accessible through a network of work stations. Configuration management accounts for, controls, and documents the planned and actual design components of FIMAD.

3.0 USE OF ER PROGRAM RECORDS MANAGEMENT FACILITIES

The RPF and FIMAD will be used for managing records resulting from work conducted at OU 1122. Interaction with these facilities is described in LANL-ER-AP-02.1, the program plan, and other program procedures and management guidance documents, as appropriate.

4.0 COORDINATION WITH THE QUALITY PROGRAM

Records will be protected throughout the process, as described in Chapter 4 of the program plan and in LANL-ER-AP-02.1. The originator is responsible for protecting records until they are submitted to the RPF. The level of protection afforded by the originator will be commensurate with the value of the information contained in the record. Upon receipt of a record, the RPF will temporarily store the original of the record in one-hour, fire-rated equipment and will provide a copy of the record to the FIMAD. The RPF will then send the original record to a dual-storage area for long-term storage in a protected environment.

5.0 COORDINATION WITH THE HEALTH AND SAFETY PROGRAM

The Laboratory's Occupational Medicine Group (HS-2) will maintain medical records because of their confidential nature. Training records will be maintained by appropriate custodians in coordination with Laboratory/DOE policy and will take into account the specific needs of the ER Program. The FIMAD will contain information about the completion of training, dates of required refresher training, and similar information, as well as the specific location of training records for program participants.

6.0 COORDINATION WITH THE ER PROGRAM'S MANAGEMENT INFORMATION SYSTEM

Specific reporting requirements are ER Program deliverables and, as such, are monitored through the ER Program's management information system. Records resulting from work conducted at OUs contribute to the development of these deliverables.

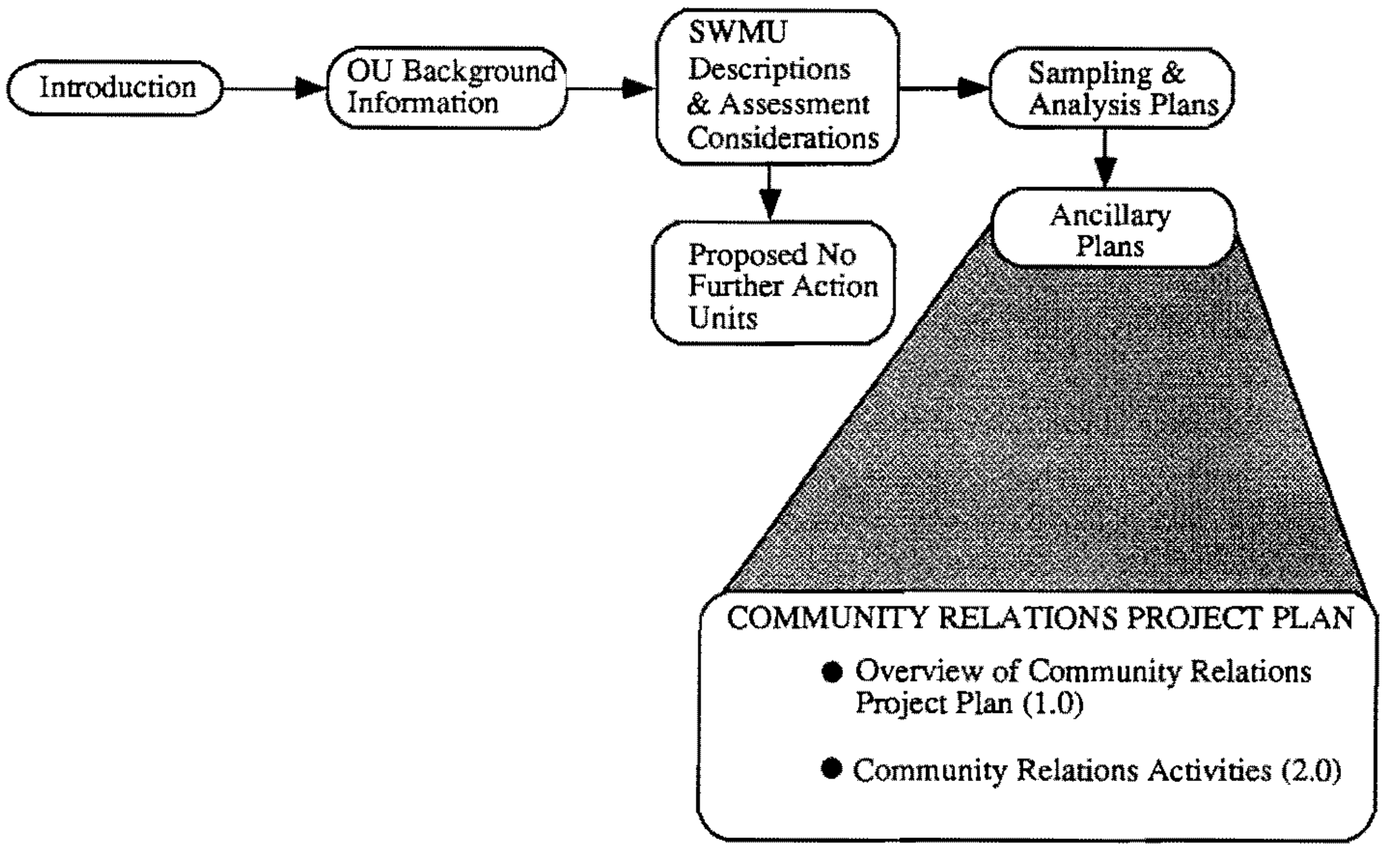
7.0 COORDINATION WITH THE COMMUNITY RELATIONS PROGRAM

RCRA requires that records be made available to the public; CERCLA requires that administrative records be made available to the public. Two complementary methods of providing information to the public, hard copy and electronic access, are being implemented. The community reading room allows public access to hard copies of key documents. A work station and necessary data links are being prepared to allow public access to the FIMAD data base.

REFERENCES

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

ANNEX V


Introduction
OU Background Information
SWMU Descriptions & Assessment Considerations
Sampling & Analysis Plans
Proposed No Further Action Units
Ancillary Plans
COMMUNITY RELATIONS PROJECT PLAN
Overview of Community Relations Project Plan (1.0)
Community Relations Activities (2.0)

1.0 OVERVIEW OF COMMUNITY RELATIONS PROJECT PLAN

The Community Relations Project Plan specific to Operable Unit (OU) 1122 follows the directives, goals, and regulatory requirements set forth in the Community Relations Program Plan in Annex V of the Installation Work Plan (IWP) for Environmental Restoration (ER) (LANL 1991, 0553). This annex describes the community relations activities for OU 1122 during the Resource Conservation and Recovery Act (RCRA) facility investigation (RFI). The activities are based on current knowledge of public information needs and resources available to the Los Alamos National Laboratory (the Laboratory) ER Program staff.

As shown in Fig. V-1, public participation is required by regulation during the corrective action process; therefore, the Laboratory will provide opportunities for public participation during the five-year RFI process as described in this project plan and as illustrated in Fig. V-2. The Hazardous and Solid Waste Amendments (HSWA) Module of the Laboratory's RCRA facility permit (EPA 1990, 0306) requires that the following be addressed in community relations plans:

- establishing a mailing list of interested parties;
- providing to the public news releases, fact sheets, approved RFI work plans, RFI final reports, special permit conditions reports, phase reports, and quarterly progress reports that explain the progress and conclusions of the RFI;
- creating a repository for public information and a reading room at which up-to-date information is provided;
- conducting informal meetings for the public and local officials, including briefings and workshops, as appropriate;
- conducting public tours and briefings to address individual concerns and questions; and
- establishing procedures for immediate notification of neighboring pueblos and other affected parties of any newly discovered off-site release(s).

These items are addressed in Sections 2.1 through 2.6 of this plan.

All information concerning ER Program activities at OU 1122 will originate with or be provided to the public through the community relations project leader:

Community Relations Project Leader
Environmental Restoration Program
Los Alamos National Laboratory
2101 Trinity Drive, Suite 20
Los Alamos, New Mexico 87545
(505) 665-2127

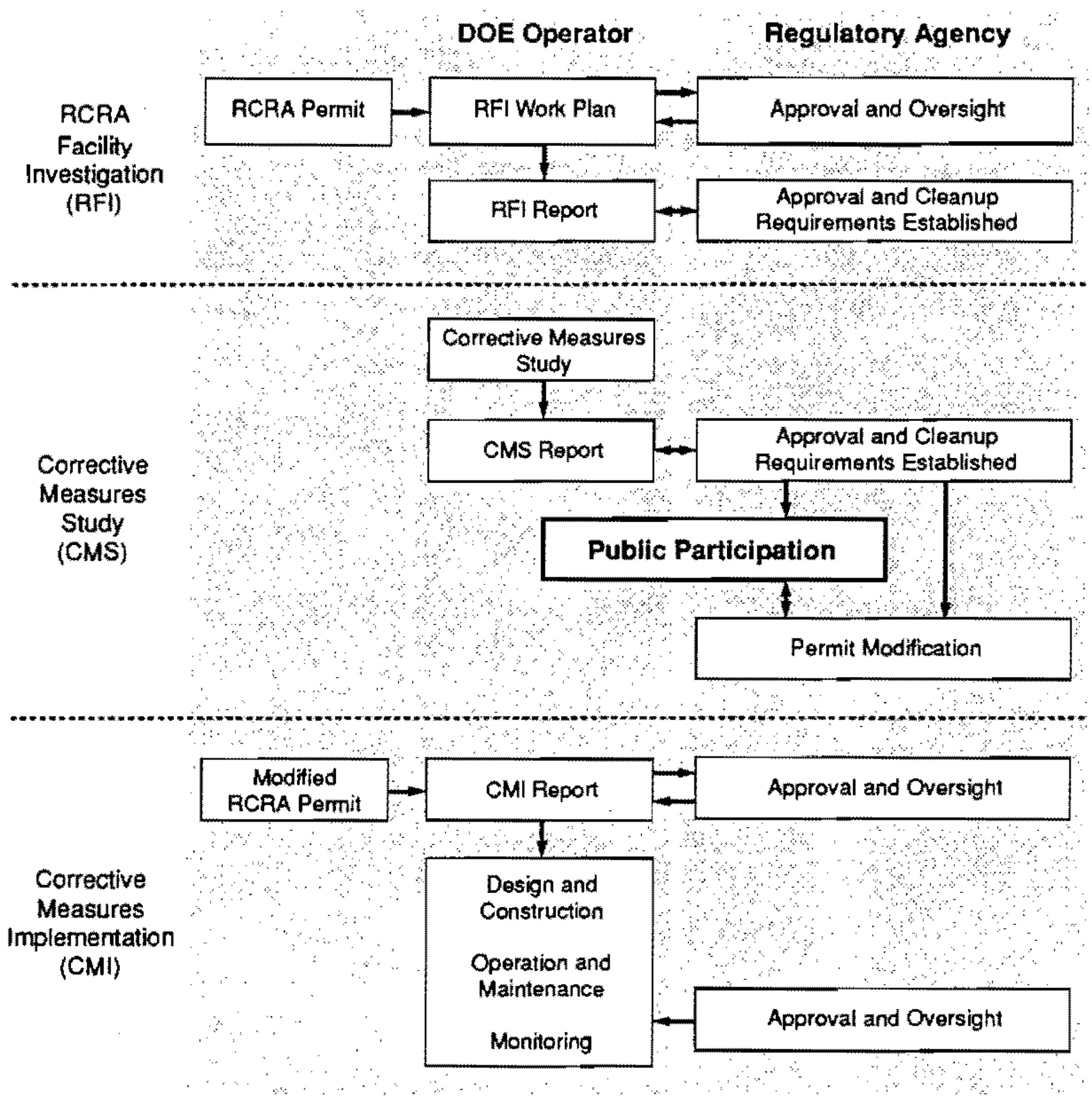


Fig. V-1. Opportunities mandated by regulation for public participation during the RCRA corrective action process.

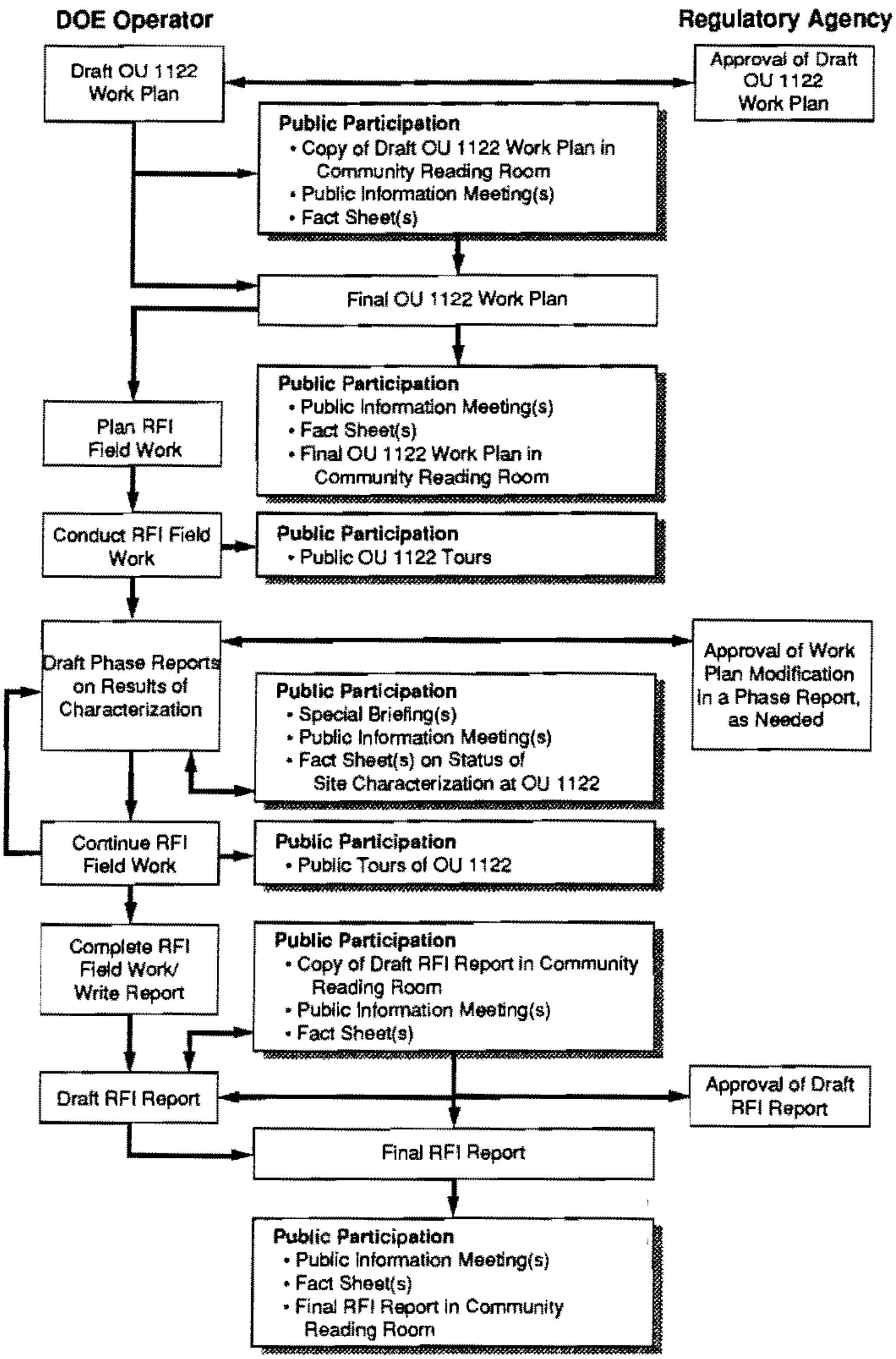


Fig. V-2. Opportunities for public participation during the OU 1122 RCRA Facility Investigation.

2.0 COMMUNITY RELATIONS ACTIVITIES

The following subsections provide a brief description of community relations activities to be conducted at OU 1122 during the RFI activities. The scope of each activity can be tailored to respond to public information needs.

2.1 Mailing List

The Community Relations office will add to the ER Program mailing list any residents and business owners identified as owning property on or adjacent to OU 1122 and current and former workers at OU 1122 to keep them informed of meetings, activities, and schedules pertaining to the OU.

2.2 Fact Sheets

The Community Relations Office has developed a fact sheet with a map inset that shows the location of OU 1122. The fact sheet also summarizes site history and use, known contaminants of concern, and planned activities (Attachment 1). These fact sheets will be updated to reflect changes in public needs and progress made during the remediation process. A map showing SWMU locations in OU 1122 will be available for public review in the ER Program's Public Reading Room.

2.3 ER Program Reading Room

As they are developed, documents and data associated with OU 1122 (such as the RFI work plan, quarterly technical progress reports, and the RFI report) will be made available to the public at the ER Program Reading Room from 9 a.m. to 4 p.m. on Laboratory business days. A draft copy of the RFI work plan for OU 1122 will be available at the reading room in May 1992.

2.4 Public Information Meetings, Briefings, Tours, and Responses to Inquiries

Public information meetings have been held in Los Alamos to introduce the community to the ER Program. The Laboratory and DOE plan to hold quarterly public information meetings to discuss specific activities and significant milestones during the RFI. Tours will be conducted for interested parties upon request.

If an issue of concern but of limited interest is raised at a public information meeting, a subsequent special briefing or a one-to-one meeting may be necessary. The community relations project leader and the OU project leader will coordinate responses to such inquiries.

2.5 Quarterly Technical Progress Reports

As the RFI for OU 1122 is implemented, the Laboratory will summarize technical progress in quarterly technical progress reports, as required by the HSWA Module (Task V, C, p. 46). These reports will be available at the ER Program Reading Room.

2.6 Procedures for Public Notice

The ER Program is preparing an administrative procedure to provide for notifying property owners and residents of any releases that might move off the Laboratory site.

2.7 Informal Public Review and Comment on the Draft RFI Work Plan for OU 1122

The Laboratory will encourage public comment on the field sampling proposed in the draft work plan for OU 1122 after the Environmental Protection Agency has formally approved this document, which will be submitted in May 1992. Public comment regarding numbers of samples, types of samples, and quality assurance samples (e.g., duplicate samples) will be incorporated, as appropriate, in the final RFI work plan for OU 1122.

REFERENCES

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

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

ATTACHMENT I

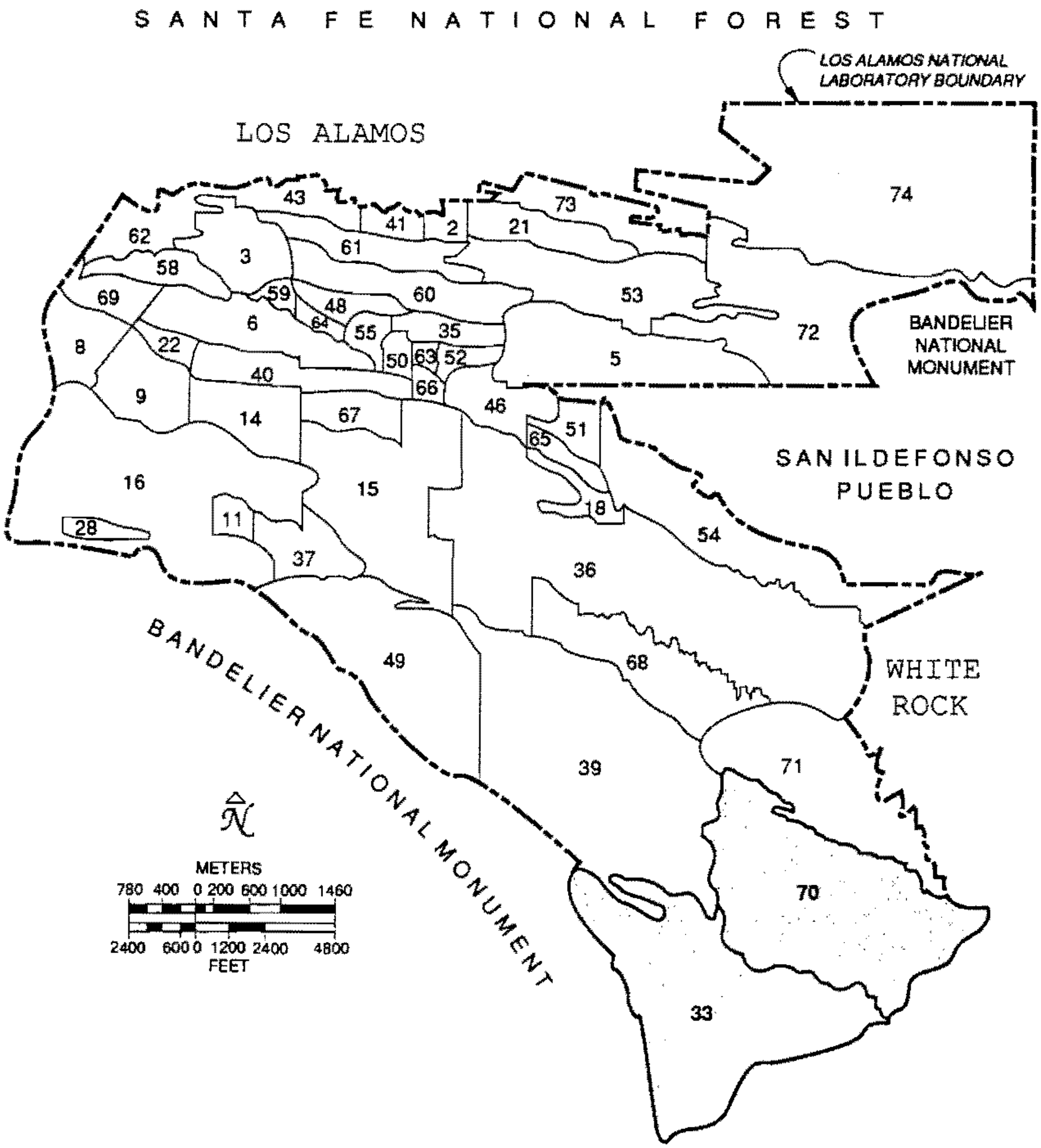
LOS ALAMOS NATIONAL LABORATORY ENVIRONMENTAL RESTORATION PROGRAM FACT SHEET FOR OPERABLE UNIT 1122 (TECHNICAL AREAS 33 AND 70)

TA-33:

- Operated from 1947 to 1970 as test site for weapons experiments using explosives, uranium, beryllium, and radiation sources.
- A high-pressure tritium facility has operated at the area since 1955, ceasing operations late in 1990.
- Some of the wastes presently at this area include: uranium, beryllium, high explosives residues, tritium, metal shrapnel, and organics, such as solvents.
- Current Laboratory environmental monitoring data indicates that contamination present at TA-33 has not gone beyond TA-33 boundaries, and is not expected to present a hazard to human health.
- Area presently used by Laboratory groups which do not contribute additional hazardous/radioactive materials to the TA-33 environment or disturb current environmental conditions.
- The Laboratory is developing a work plan to determine specific areas and amounts of contamination at TA-33. Sampling and studies are scheduled to be initiated during 1992.

TA-70:

- Site is a buffer zone that has never been used for any Laboratory operations and has no known wastes.


SANTA FE NATIONAL FOREST
LOS ALAMOS NATIONAL LABORATORY BOUNDARY
LOS ALAMOS
BANDELIER NATIONAL MONUMENT
SAN ILDEFONSO PUEBLO
WHITE ROCK
BANDELIER NATIONAL MONUMENT
74
73
43
41
2
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METERS
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2400 600 0 1200 2400 4800
FEET
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33

PURPOSE OF THE TECHNICAL AREAS:

Technical Area 33 (TA-33), also known as Hot Point (HP Site), and Technical Area 70 (TA-70) are located at the southeast boundary of the Los Alamos National Laboratory. TA-33 was created in 1947 as a test site for weapons experiments using conventional high explosives, uranium, beryllium, and polonium radiation sources. The experiments were performed in underground chambers, on surface firing pads, and firing sites equipped with large guns that fired projectiles into catcher berms. A high-pressure tritium facility was operated at the area from 1955 until late 1990. Current activities are centered primarily at Main Site with groups occupying portions of the office buildings. Other small buildings and surface areas are also used. The National Radio Astronomy Observatory Very Long Baseline Array 25-meter radiotelescope antenna was located at TA-33 in 1985. TA-70 is a buffer zone created in 1989. It has not been used for any Laboratory operations and has no known wastes.

WASTES PRESENT AT TECHNICAL AREA 33:

Primary wastes at TA-33 consist of uranium, beryllium, high explosives residues, tritium, and ordinary solid wastes such as timber, wire and cable segments, and tin cans. Other minor wastes associated with laboratory operations include: plutonium, cadmium, silver, lead, mercury, and solvents. The primary wastes are mostly accumulated into inactive soil-covered waste pits, however, finely divided material as well as shrapnel is dispersed at most firing sites. Several inactive landfills with metal pieces, timber, wire and cable segments are present at the firing sites. The tritium and laboratory-associated wastes are located at Main Site near the laboratory buildings.

PREVIOUS CLEANUP AT TECHNICAL AREA 33:

A surface disposal site that contained spent capacitors, uranium turnings, and solid waste was cleaned up in 1974. Building HP-21, which contained plutonium contamination was demolished in 1974 with all equipment, structural debris, and the associated septic system removed for disposal at TA-54. In 1984, radioactive materials were removed from East Site and disposed at TA-54, with the remaining non-radioactive wastes buried on site.

FUTURE ACTION AND PROPOSED TIME FRAME:

Future action is focused on the further assessment of the extent of contamination and the selection among possible remedial alternatives by the Environmental Protection Agency (EPA) with input from the public. The alternatives range from long-term monitoring and institutional controls to excavation and disposal of contaminated soils and restoration. The Hazardous and Solid Waste Amendment (HSWA) module of the Laboratory's Resource Conservation Recovery Act (RCRA) operating permit specifies the sequence of events by which contaminated areas are identified, characterized, and remediated. The RCRA Facility Investigation (RFI) Work Plan that describes characterization activities is being developed and is scheduled to be completed in May 1992.

CONCLUSION:

Ensuring the safe management of past, present, and future waste requires the cooperation of government, industry, and the public. The Laboratory's commitment is to provide to the public information, such as this fact sheet, concerning actions taken during investigation and throughout the entire cleanup process. If you have any additional questions about Operable Unit 1122 or about the Laboratory's Environmental Restoration Program, please do not hesitate to call or write:

Community Relations Project Leader
Environmental Restoration Program
Los Alamos National Laboratory
2101 Trinity Drive, Suite 20
Los Alamos, NM 87545
(505) 665-2127

APPENDIX A

CULTURAL RESOURCE SUMMARY

OU 1122 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 1991 at Operable Unit (OU) 1122. 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.

Sixty-seven archaeological sites eligible for inclusion on the National Register of Historic Places under Criterion D are located within the survey area: Laboratory of Anthropology (LA) site numbers LA 4635-A, LA 4635-B, LA 4636, LA 4645 through LA 4649 A-D, LA 4650-A, LA 4651-A and LA 4651-B, LA 12672-A and LA 12672-B, LA 12673, LA 13365 through LA 13369, LA 13409, LA 71406, LA 71407, LA 86564 through LA 86579 A-C, and LA 86580 through LA 86600.

The attributes of these sites which make them eligible for inclusion on the National Register will not be affected by any ER sampling activities proposed at OU 1122. A report documenting the survey area, methods, results, and monitoring recommendations, if any, will be transmitted to the New Mexico State Historic Preservation Officer (SHPO) for his concurrence in a "Determination of No Effect". 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 for his 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.

REFERENCE

Environmental Restoration Program, Operable Unit 1122, Cultural Resource Survey Report (in preparation)

APPENDIX B

BIOLOGICAL SUMMARY

BIOLOGICAL SUMMARY FOR TA-33, OPERABLE UNIT 1122

1.0 INTRODUCTION AND FURTHER INFORMATION

During 1991, field surveys were conducted by the Biological Resource Evaluations Team of the Environmental Protection Group (EM-8) for Operable Unit 1122, Technical Area 33. Personnel of the operable unit propose to collect sediment samples and surface soil samples. The sediment samples are to be taken from existing sediment basins within canyons located in the operable unit. Soil samples will be collected from surface to depths of 6 inches (i.e., trowel and shovel). Subsurface samples will be obtained by drilling. In some locations, trenching may be necessary. Further information concerning the biological surveys for Operable Unit 1122 is contained in the full report "Biological Assessment for Environmental Restoration Program, Operable Unit 1122". The Biological Assessment will contain specific information on survey methodology, results, and mitigation measures. This assessment will also contain information that may aid in defining ecological pathways and vegetation restoration.

2.0 LAWS

Field surveys were conducted for compliance with the Federal Endangered Species Act of 1973, New Mexico's Wildlife Conservation Act, New Mexico Endangered Plant Species Act, Executive Order 11990 "Protection of Wetlands" and Executive Order 11988 "Floodplain Management", 10 CFR 1022, DOE Order 5400.1, and the National Environmental Policy Act (NEPA).

3.0 METHODOLOGY

The purpose of the surveys was three-fold. The first was to determine the presence or lack of presence of any critical habitat for any State or Federal sensitive, threatened, or endangered plant or animal species within the operable unit boundaries. Secondly, surveys were conducted to identify the presence or lack thereof of any sensitive areas such as floodplains and wetlands that may be present within the areas to be sampled and the extent of the areas and general characteristics. The third purpose was to provide additional plant and wildlife data concerning the habitat types within the operable unit. This data provides further baseline information about the biological components of the site for site characterization and determination of pre-sampling conditions. This information is also necessary to support the NEPA documentation and determination of a categorical exclusion for site characterization.

After searching the database maintained in EM-8 containing the habitat requirements for all State and Federally listed sensitive, threatened, or endangered 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 and 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 database 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. If habitat requirements were met, then specific surveys for the species of concern were conducted. The specific species 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 floodplains within the survey area were noted using National Wetland Inventory Maps and field checks. Characteristics of wetlands, floodplains, and riparian areas are noted using criteria outlined in the Federal Manual for Identifying and Delineating Jurisdictional Wetlands (1989).

4.0 SPECIES IDENTIFIED

Database searches indicated that the species of concern for this operable unit were:

* black hawk (*Buteogallus anthracinus* - State Endangered);
* bald eagle (*Haliaeetus luecocephalus* - Federally and State Endangered);
* Mississippi kite (*Ictinia mississippiensis* - State Endangered);
* peregrine falcon (*Falco peregrinus* - Federally and State Endangered);
* broad-billed hummingbird (*Cynanthus latirostris* - State Endangered);
* willow flycatcher (*Empidonax trailii* - Federal Candidate and State Endangered);
* whooping crane (*Grus americana* - State and Federally endangered);
* least tern (*Sterna antillarum* - State and Federally endangered);
* spotted bat (*Euderma maculatum* - State Endangered);
* meadow jumping mouse (*Zapus hudsonicus* -- State Endangered and Federal Candidate);
* Rio Grande silvery minnow (*Hybognathus amarus* - State Endangered);
* bluntnose shiner (*Notropis simus* - State Endangered);
* Say's pond snail (*Lymnaea captera* - State Endangered);
* Wright's fishhook cactus (*Mammillaria wrightii* - State Endangered);
* Santa Fe cholla (*Opuntia viridiflora* -State Endangered and Federal Candidate);
* grama grass cactus (*Pediocactus papyracanthus* - State Endangered and Federal Candidate);
* sessile-flowered false carrot (*Aletes sessiliflorus* - State Sensitive);
* threadleaf horsebrush (*Tetradymia filifolia* - State Sensitive);
* Plank's catchfly (*Silene plankii* - State Sensitive);
* Santa Fe milkvetch (*Astragalus feensis* - State Sensitive);
* Mathew's wooly milkvetch (*Astragalus mollissimus* - State Sensitive);
* Taos milkvetch (*Astragalus puniceus* - State Sensitive);
* cyanic milkvetch (*Astragalus cyaneus* - State Sensitive);
* tufted sand verbena (*Abronia bigelovii* - State Sensitive); and
* Pagosa phlox (*Phlox caryophylla* - State Sensitive).

5.0 RESULTS AND MITIGATION

As a result of a habitat evaluation and previous data of the operable unit, nine of the above (4.0) species appear to have potential for occurrence in the area: the bald eagle; peregrine falcon; broad-billed hummingbird; spotted bat; meadow jumping mouse; Rio Grande silvery minnow; bluntnose shiner; Wright's fishhook cactus; and grama grass cactus.

5.1 Bald Eagle

An eagle's nest was found in a ponderosa pine during survey efforts in Chaquehui Canyon. At the time of the survey, it was not determined if this nest was a golden eagle or a bald eagle nest. Terrell Johnson, regional eagle expert was consulted. Bald eagles are known to roost in the White Rock Canyon system, but no nesting activity has been recorded here. However, very few systematic surveys for eagles have been conducted above Frijoles Canyon. The habitat at Cochiti Reservoir as well as the headwaters delta provides the diversity of habitat that could provide for suitable nesting for bald eagles (Johnson, T.L., 1991). Growth of the headwaters river delta of Cochiti Reservoir should induce bald eagles to roost further upstream on LANL land (Johnson, T.L., 1991). Mr. Johnson recommended that a buffer zone be established around the eagle's nest so that the disturbance to the bird would not occur. He recommended a minimum of 1 700 meters be established. In late winter of 1992, Mr. Johnson will further survey the eagle's nest and determine the type. He will also look for roosting trees utilized by bald eagles. If sampling for site characterization is to be conducted in the canyon bottoms, then EM-8 must be contacted to delineate the appropriate buffer zones for eagles. Maintaining the buffer zones will insure that no adverse impact to the eagles will occur.

5.2 Peregrine Falcon

Some foraging areas for peregrine falcons occur in White Rock Canyon close to Ancho and Chaquehui Canyons. There are no recorded eyries in either Ancho or Chaquehui Canyon. The sampling activities proposed for site characterization should have minimal impact on the foraging activities of the falcon as long as noisy and heavy equipment is used to a minimal.

5.3 Broad-Billed Hummingbird

Vagrant broad-billed hummingbirds have been recorded in Bandelier National Monument and near Los Alamos. Bird transects were conducted during the summer of 1991. No broad-billed hummingbirds were discovered.

5.4 Spotted Bat

Spotted bat (*Euderma maculatum*) is found in piñon-juniper, ponderosa, mixed conifer, and riparian habitats. The two critical requirements for the spotted bat are a source of water and roost sites (caves in cliffs or rock cervices).

Ancho and Chaquehui Canyons appear to provide both requirements. Mist netting for bats was scheduled during July 1991. Mist netting was conducted over a small pooling area of Ancho Springs. Due to heavy rains experienced during the mist netting, the survey was incomplete (bat activity is drastically reduced during rain). However, mist netting did occur at TA-16. No spotted bats were captured. Mist netting surveys have also taken place in adjacent Bandelier National Monument (Guthrie, D.A., and Large, N., 1980, "Mammals of Bandelier National Monument"). These surveying efforts have not yielded any spotted bats. An intensive bat survey at LANL is scheduled for the summer of 1992 and will include portions of Ancho and Chaquehui Canyons. Due to the nature and extent of the proposed site characterization for Operable Unit 1122, no adverse impact will occur to the spotted bat (if present) as long as small caves and rock crevices are not disturbed and the water sources within the canyon are not altered.

5.5 Meadow Jumping Mouse

The meadow jumping mouse inhabits meadows along streams or other similar water sources. A Level 3 survey was conducted in August 1991 along a portion of the stream channel in Ancho Canyon. There were no meadow jumping mice found during the survey. However, heavy rains occurred during the trapping session resulting in invalidating survey results (many traps were tripped by the heavy rain). The area along the stream of Ancho Canyon has marginally suitable habitat due to cattle grazing stream-side vegetation. If the area had not received cattle grazing, the habitat would be more suitable. Since trapping could not confirm the presence or absence of the meadow jumping mouse, sampling for site characterization should not occur in or around stream-side vegetation. Further surveys for the meadow jumping mouse are scheduled for 1992.

5.6 Rio Grande Silvery Minnow and Bluntnose Shiner

Both fish species are endemic to the Rio Grande. Rio Grande silvery minnow appears to be confined to perennial reaches of the Rio Grande from Santa Domingo Pueblo south to Socorro. The bluntnose shiner is thought to be extinct in the Rio Grande, but surveys are still recommended. A survey of fish species occurring in the Rio Grande through White Rock Canyon was conducted in conjunction with Bandelier National Monument. Neither protected species was found.

5.7 Wright's Fishhook Cactus and Grama Grass Cactus

Wright's fishhook cactus can occur in desert grasslands or piñon-juniper woodlands. Grama grass cactus is usually found in piñon-juniper woodlands associated with basalt outcrops. Teralene Foxx (EM-8), plant ecologist, conducted systematic plant surveys throughout Ancho and Chaquehui Canyons and Frijoles Mesa. Neither Wright's fishhook cactus or grama grass cactus were found.

From the above surveys conducted, there should be no adverse impacts to any threatened and endangered species as long as described mitigation measures are followed

5.8 Wetlands/Floodplains

Some wetlands are located within the operable unit. Monitoring and delineating of these areas will be required just prior to sampling in the canyon bottoms. Sampling for site characterization in canyon bottoms may have to be modified slightly to avoid impact to a wetland. However, potential floodplains are found within the canyon systems. Although present, these floodplains will not be adversely impacted by the proposed action and, therefore, no mitigation measures are necessary.

6.0 BEST MANAGEMENT PRACTICES

Impacts to non-sensitive plant species should be avoided when possible. Off-road driving is especially harmful to plants and soil crust. Vehicular travel should be restricted to existing roads whenever possible. If off-road travel is required, EM-8 should be contacted to monitor the activity. Revegetation may be required at some sites. A list of native plants suitable for revegetation for Operable Unit 1122 is contained in the final report "Biological Assessment for Environmental Restoration Program, Operable Unit 1122".

APPENDIX C

LIST OF CONTRIBUTORS

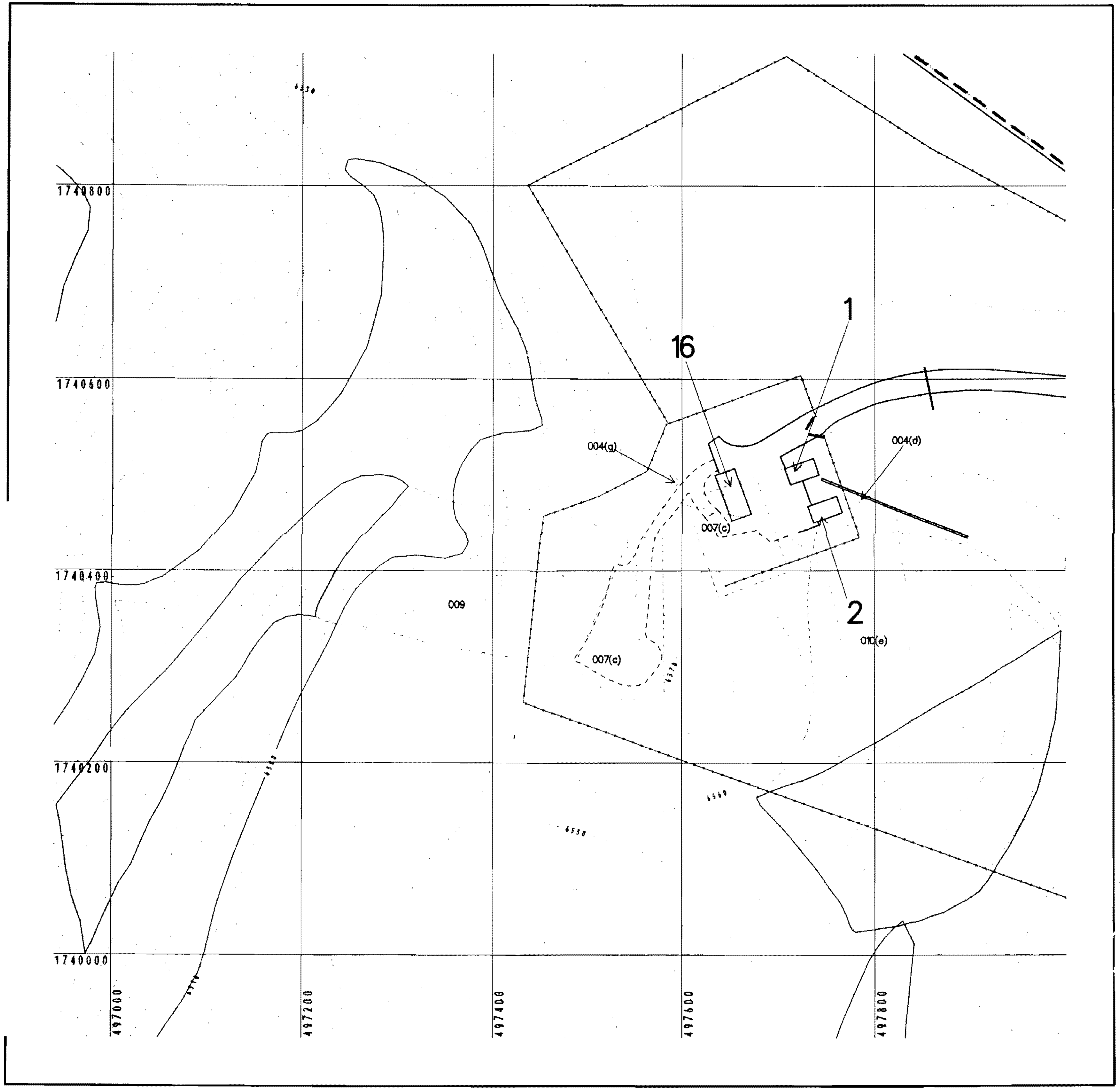
EDUCATION AND RELEVANT EXPERIENCE OF OPERABLE UNIT 1122 TEAM MEMBERS

NAME AND AFFILIATION	EDUCATION/ EXPERTISE	ER PROGRAM ASSIGNMENT
Keith Dowler (CLS-1)	B.S. Metallurgical Engineering 16 years experience in handling and examining irradiated material and management experience	Operable Unit Project Leader
Margaret Burgess (IS-11)	B.A. English 8 years experience as a technical writer/editor	Technical Writer/Editor
Katherine Campbell (A-1)	Ph.D. Mathematics 12 years experience with statistical sampling/presentation/evaluation of geochemical and hazardous waste/chemistry data	Technical Team Leader, Statistics and Data Quality Objectives
Don Hickmott (EES-1)	Ph.D. Geochemistry 4 years experience in trace element geochemistry, coal benefication studies, and aqueous geochemistry	Geology, technical review
Dorothy Hoard (CLS-1)	B.A. Biochemistry 17 years experience in analytical chemistry	Archival research, technical review
Bill Laughlin (EES-1)	Ph.D. Geology 23 years experience in geology, geochemistry, and project management	Technical Team Leader, Geology/ Geophysics

APPENDIX D

CONTOUR MAPS OF OU 1122

TA-33 Area 6 Site SWMUs



LEGEND

- Contours, 100 foot
- Contours, 10 foot
- Fence, Industrial
- Fence, Security
- Gate
- Material Disposal Area
- Roads, Dirt
- Roads, Paved
- Road/Trail
- Sewer Line
- Storm Drain/Culvert
- SWMU, Present
- SWMU, Probable
- SWMU, Possible

STRUCTURES

- Former
- Permanent
- Temporary
- Underground

NORTH, NM State Plane

Grid provides NMSP coordinates, in feet

Grid interval, in feet: 200

0 100 200 300 FEET ON GROUND

NOTICE: Information on this map is provisional and has not been checked for accuracy

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Earth & Environmental Sciences Division
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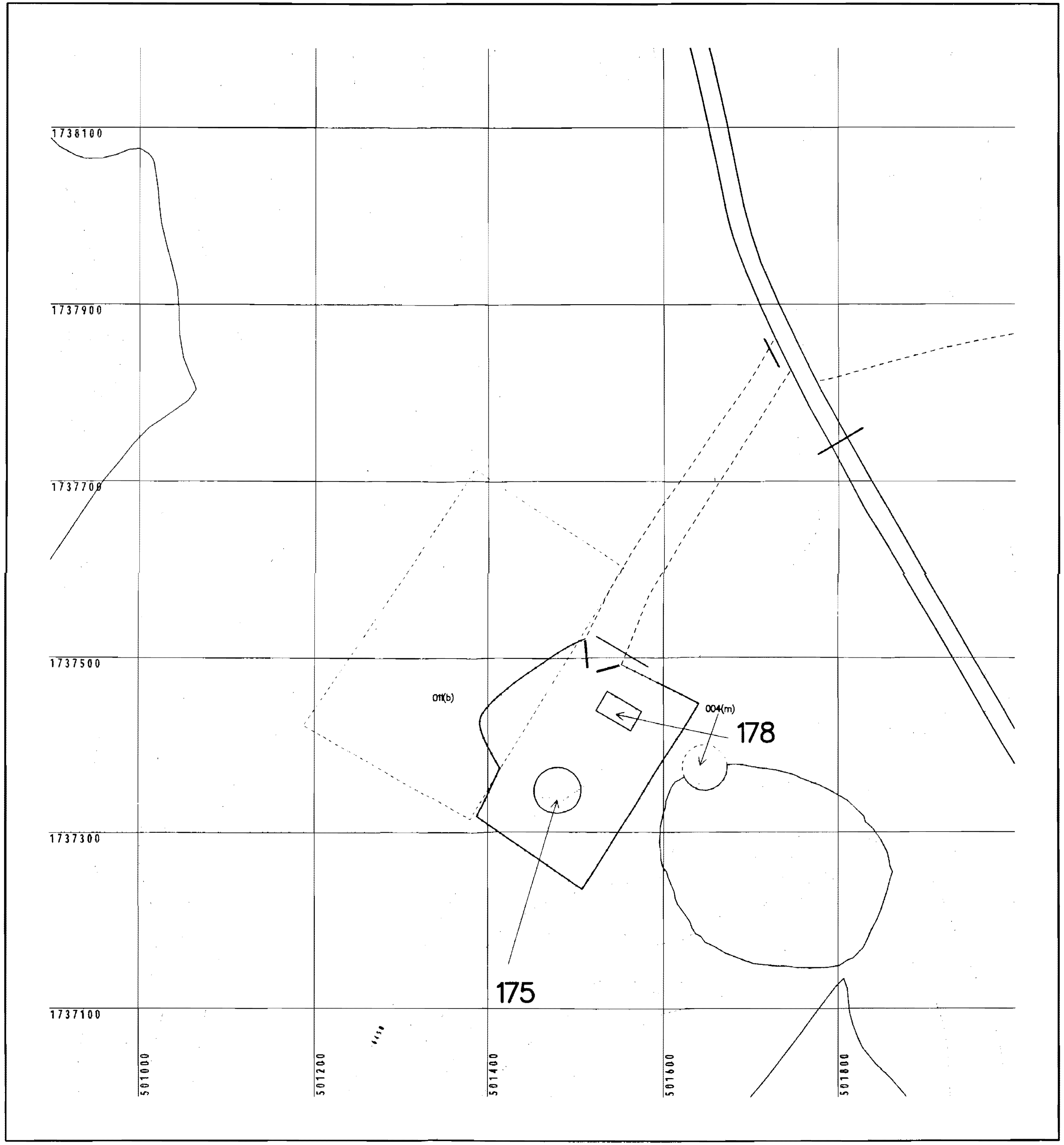
Date: 92-04-24

TA-33 NRAO Site SWMUs



LEGEND

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Contours, 10 foot
Fence, Industrial
Fence, Security
Gate
Material Disposal Area
Roads, Dirt
Roads, Paved
Road/Trail
Sewer Line
Storm Drain/Culvert
SWMU, Present
SWMU, Probable
SWMU, Possible

STRUCTURES
Former
Permanent
Temporary
Underground

NORTH, NM State Plane

Grid provides NMSP coordinates, in feet

Grid interval, in feet: 200

0 100 200 300 FEET ON GROUND

NOTICE: Information on this map is provisional and has not been checked for accuracy

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Earth & Environmental Sciences Division
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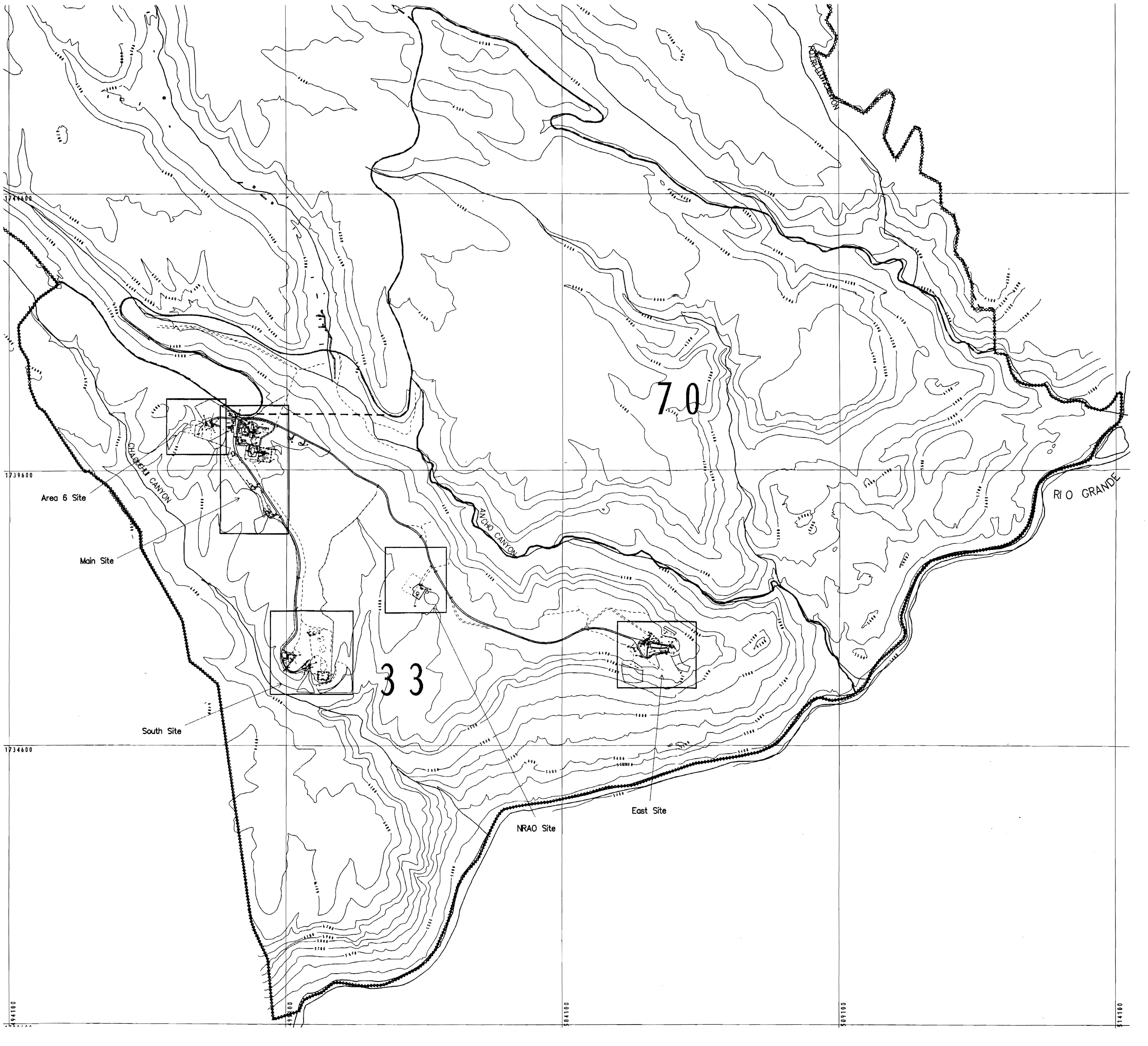
Date: 92-04-24

Key to SWMU Map Co[v]



LEGEND

- Boundary, LANL
- Boundary, OU
- Boundary, TA
- Contours, 100 foot
- Fence, Industrial
- Fence, Security
- Gate
- Material Disposal Area
- Radioactive Liquid Waste
- Roads, Dirt
- Roads, Paved
- Road/Trail
- Sewer Line
- Storm Drain/Culvert
- SWMU, Present
- SWMU, Probable
- SWMU, Possible

- Permanent Structures
- Former Structures

NORTH, NM State Plane

Grid provides NMSP coordinates, in feet

Grid interval, in feet: 5000

0 875 1750 2625 FEET ON GROUND

NOTICE: Information on this map is provisional and has not been checked for accuracy

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Los Alamos National Laboratory
Earth & Environmental Sciences Division
FIMAD Facility for Information Management, Analysis and Display
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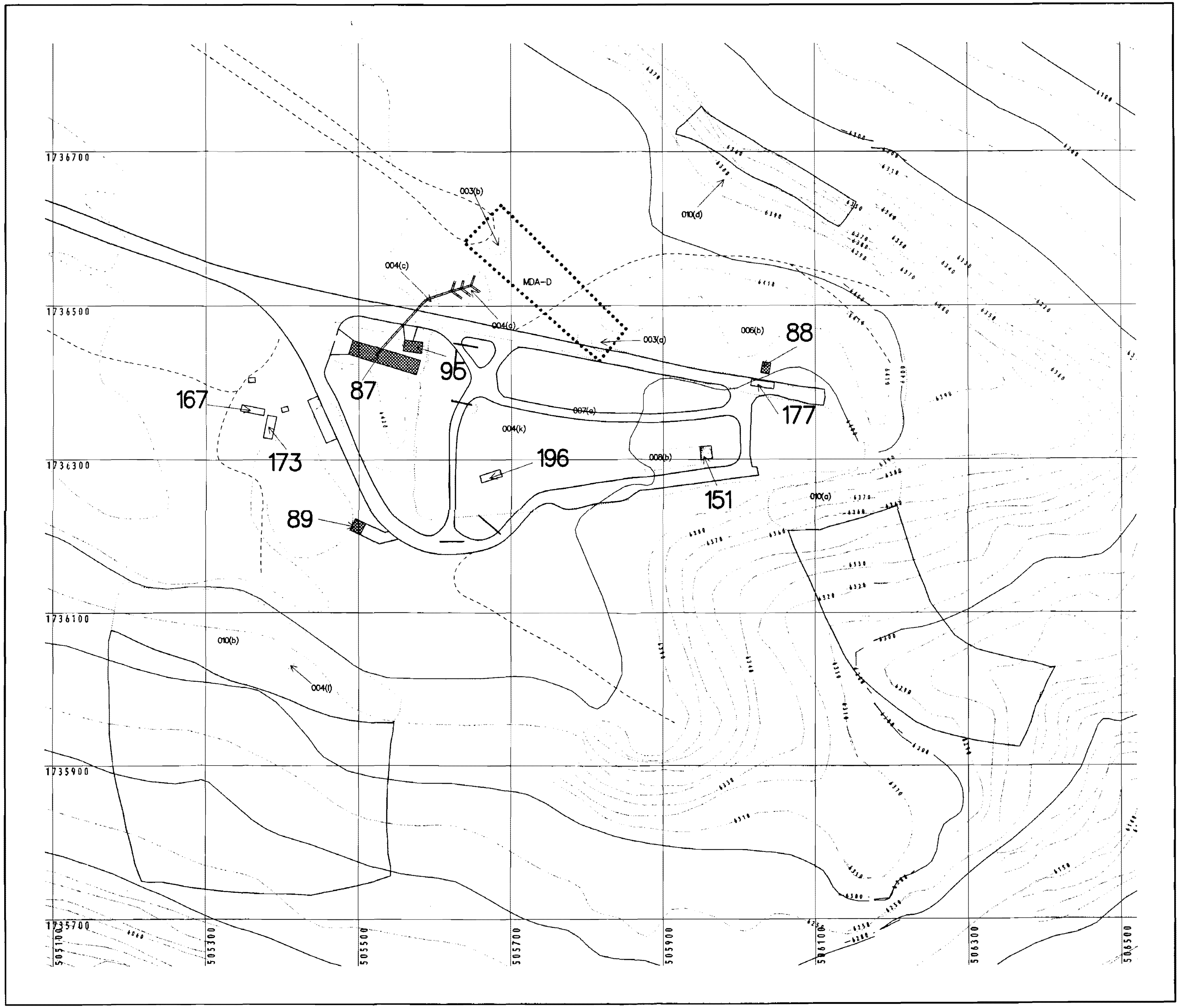
TA-33 East Site SWMUs



LEGEND

- Contours, 100 foot
- Contours, 10 foot
- Fence, Industrial
- Fence, Security
- Gate
- Material Disposal Area
- Roads, Dirt
- Roads, Paved
- Road/Trail
- Sewer Line
- Storm Drain/Culvert
- SWMU, Present
- SWMU, Probable
- SWMU, Possible

STRUCTURES

- Former
- Permanent
- Temporary
- Underground

NORTH, NM State Plane

Grid provides NMSP coordinates, in feet

Grid interval, in feet: 200

0 100 200 300 FEET ON GROUND

NOTICE: Information on this map is provisional and has not been checked for accuracy

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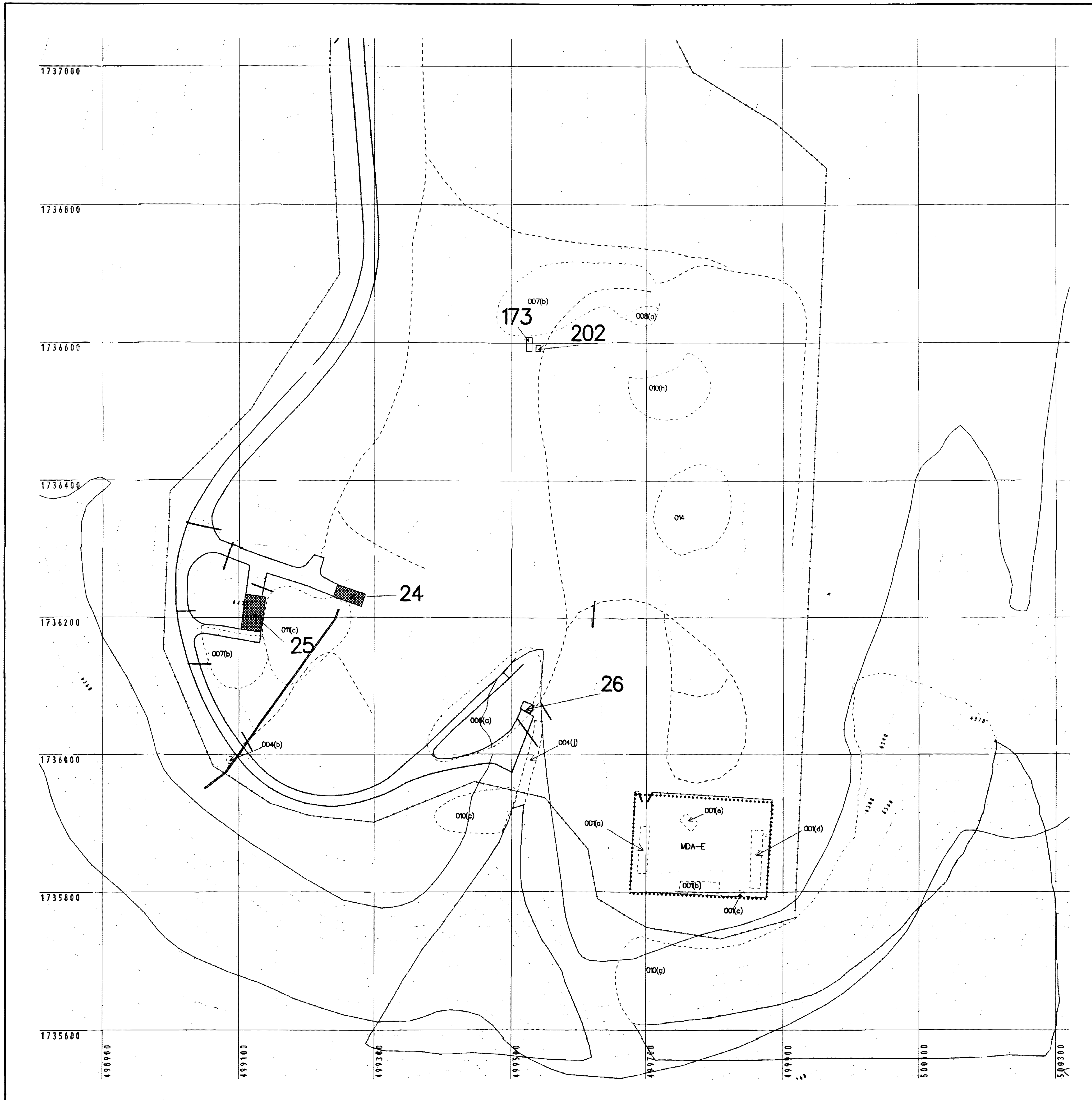

TA-33 South Site SWMUs

LEGEND

- Contours, 100 foot
- Contours, 10 foot
- Fence, Industrial
- Fence, Security
- Gate
- Material Disposal Area
- Roads, Dirt
- Roads, Paved
- Road/Trail
- Sewer Line
- Storm Drain/Culvert
- SWMU, Present
- SWMU, Probable
- SWMU, Possible

STRUCTURES

- Former
- Permanent
- Temporary
- Underground

NORTH, NM State Plane

Grid provides NMSP coordinates, in feet

Grid interval, in feet: 200

0 100 200 300 FEET ON GROUND

NOTICE: Information on this map is provisional and has not been checked for accuracy

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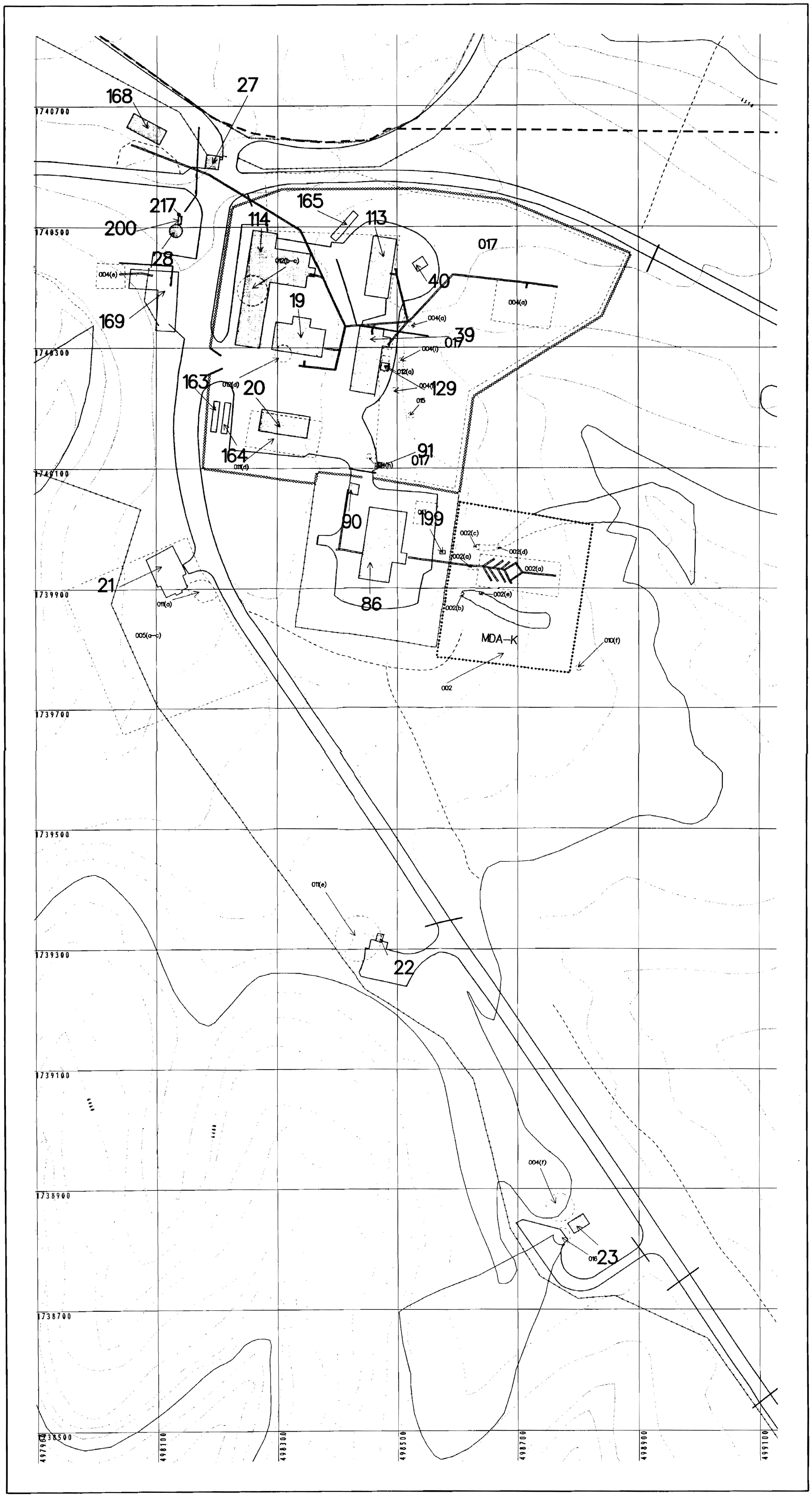

TA-33 Main Site SWMUs

LEGEND

- Contours, 100 foot
- Contours, 10 foot
- Fence, Industrial
- Fence, Security
- Gate
- Material Disposal Area
- Roads, Dirt
- Roads, Paved
- Road/Trail
- Sewer Line
- Storm Drain/Culvert
- SWMU, Present
- SWMU, Probable
- SWMU, Possible

STRUCTURES

- Former
- Permanent
- Temporary
- Underground

NORTH, NM State Plane

Grid provides NMSP coordinates, in feet

Grid interval, in feet: 200

0 100 200 300 FEET ON GROUND

NOTICE: Information on this map is provisional and has not been checked for accuracy

University of California
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Earth & Environmental Sciences Division
FIMAD Facility for Information Management, Analysis and Display
Produced by: Marcia Jones
Date: 92-04-24

GLOSSARY

alluvial fan a fan-shaped accumulation of sediment deposited by a stream

alluvium sediment deposited by flowing water

andesite a gray, fine-grained volcanic rock, chiefly plagioclase and pyroxene

aquifer sand, gravel, or a permeable body of rock capable of yielding quantities of water to wells and springs

basalt a hard, dense, dark volcanic rock composed chiefly of plagioclase, augite, olivine, and magnetite

characterization describing the qualities or peculiarities of something; defining

cinder cone a conical hill formed by the accumulation of cinders and other matter ejected from a volcano

clinoptilolite a zeolite mineral

cobble a rock fragment larger than a pebble and smaller than a boulder

colluvium rock debris accumulated at the base of a cliff or slope, brought there principally by gravity

conglomerate a rock consisting of pebbles and gravel embedded in a loosely cementing material

dacite a fine-grained extrusive rock containing plagioclase, quartz, alkali feldspar, pyroxene, hornblende, and biotite

discomfort curve quantification of decision maker's tolerance for making the wrong decision, as a function of the amount by which the true condition of the site is above or below the action level. If the truth is very close to action levels, larger probabilities of error are acceptable than when the truth is much worse than, or much better than, those action levels. There is also a difference between tolerance for Type I and Type II errors.

eolian sediment sediment deposited by the wind

evapotranspiration discharge of water from the earth's surface to the atmosphere by evaporation from lakes, streams, and soil surfaces, and by transpiration from plants

fanglomerate a sedimentary rock, originally deposited in an alluvial fan and subsequently cemented into a firm rock

field duplicate a second specimen collected as near as possible to one already included in the sample. In channel sediment sampling, field duplicates come from the same sediment catchment as another specimen.

half-life the time required for one-half of any quantity of identical radioactive atoms to undergo radioactive decay to other atoms

hornblende a silicate mineral containing magnesium, iron, calcium, sodium, and aluminum

indurated hardened

initiator a nuclear weapons component

intertonguing interfingering

latite an extrusive volcanic rock containing plagioclase and alkali feldspars, pyroxene, and/or hornblende

migration pathway route (e.g., a stream or river) for potential movement of contaminants to environmental receptors (plants, animals, humans)

neighbor a second specimen collected nearer to another sampling location than the average distance between samples. In channel sediment sampling, a neighbor would be collected from a different sediment catchment than the first specimen.

null hypothesis default hypothesis, which will be accepted unless sufficiently conclusive evidence that it is false is obtained

paleogroundwater ancient groundwater

phenocryst a relatively large, conspicuous crystal in a porphyritic rock

porphyritic said of the texture of an igneous rock in which larger crystals (phenocrysts) are set in a finer groundmass

receptor a person, plant, animal, or geographical location that is exposed to a chemical or physical agent released to the environment by human activities

rhyodacite a group of extrusive porphyritic igneous rocks intermediate in composition between dacite and rhyolite, with quartz, plagioclase, and biotite (or hornblende) as the main phenocryst minerals and a fine-grained to glassy groundmass

sample This word is used in two senses. (1) A statistical sample is a set of specimens taken from the target population, for which various parameters of interest are measured. If the target population consists of discrete items, then a sample consists of a subset of these items. If the target population is an environmental continuum (e.g., surface soil in some well-defined region or channel sediments in a drainage), then specimens must be collected according to a standard operating procedure which specifies how much soil is to be included in each specimen, how to collect and store it, etc. (2) A field or laboratory sample is an individual specimen taken from a target population, or sometimes the product of a field activity such as the filter from a air monitor or a thermoluminescent dosimeter (TLD), which is submitted for laboratory analysis following a period of exposure at the site.

sanidine a high-temperature mineral of the alkali feldspar group

secondary alteration minerals minerals formed by processes after the original formation of the rock by chemical changes to the original minerals or by deposition along fractures

statistic a function of the sample data, such as the average of the observed values (the sample mean), or the largest observed value (the sample maximum), or the number of observations exceeding a predefined level (the number of exceedances)

stratification classification of the target population into two or more non-overlapping and exhaustive categories (strata) on the basis of characteristics which are known *a priori* for the entire population

stratified sample statistical sample including specimens from all strata of the target population. If the target population has spatial extent, and characteristics of interest may have important variability from one part to another, care must be taken to ensure that the sample is not concentrated in one area. If the target population has both mesa-top surface soils and soils or sediments in drainage channels, and there is reason to believe that contaminants might move through or sorb on these different types of soil in different manners, then the sample should include specimens of both types.

stratigraphy the study of rock strata to include age relationships

subpopulation a subset of the target population

target population a collection of items or an environmental region to be characterized. The target population must be explicitly defined prior to sampling so that a sample which represents important features of this population can be selected. Some target populations mentioned in Chapter 3 are: surface soils within a defined area, channel sediments within defined drainages, projectiles in berms, debris in landfills, and sludge in septic tanks.

topography the physical features of a place or region

Type I error incorrectly concluding that the null hypothesis is false. In remedial investigations the usual null hypothesis is that the site is contaminated. It is a Type I error to conclude that a site is not contaminated when it is. In routine monitoring, the null hypothesis may be that the site is not contaminated; it is a Type I error to conclude that the site is contaminated when, in fact, it is not.

Type II error incorrectly concluding that the null hypothesis is true. In remedial investigations the usual error is concluding that a site is contaminated when it is not. In routine monitoring, it may refer to failure to detect contamination.

xenocrysts a crystal foreign to the igneous rock in which it occurs

zeolite any of a group of approximately thirty hydrous aluminum silicate minerals