RFI Work Plan for Operable Unit 1114

Environmental Restoration Program

July 1993

A Department of Energy
Environmental Cleanup Program

238

FINAL DRAFT

Los Alamos
NATIONAL LABORATORY

LA-UR-93-1000

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EXECUTIVE SUMMARY

Purpose

The primary purposes of this Resource Conservation and Recovery Act (RCRA) facility investigation (RFI) work plan are to provide rationales for determining the nature and extent of past releases of hazardous waste or hazardous constituents (if any) from solid waste management units (SWMUs) in Operable Unit (OU) 1114, and to determine the need for corrective measures studies (CMSs). Secondly, this document satisfies part of the regulatory requirements contained in Los Alamos National Laboratory's (the Laboratory's) permit to operate under RCRA. OU 1114 includes Technical Areas (TAs) 3, 30, 59, 60, 61, and 64. These TAs are located in the northeastern section of the Laboratory's holdings. Within these TAs are 313 potential release sites (PRSs), which are located on lands owned by the Department of Energy (DOE).

Module VIII of the permit, known as the HSWA (Hazardous and Solid Waste Amendments) Module (the portion of the permit that responds to the requirements of HSWA) was issued by the Environmental Protection Agency (EPA) to address potential corrective action requirements for SWMUs at the Laboratory. These permit requirements are addressed by the DOE's Environmental Restoration (ER) Program at the Laboratory.

This document describes the field sampling plans that will be followed to implement the RFI at OU 1114. This document, together with nine work plans to be submitted to the EPA in 1993, and nine work plans previously submitted, meets the requirement in the HSWA Module to address a cumulative percentage of the Laboratory's PRSs in RFI work plans by August 27, 1993.

Installation Work Plan

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

Both the IWP and this work plan address radioactive materials and other hazardous substances not subject to RCRA. Sites that potentially contain only non-RCRA materials are called areas of concern (AOCs). The term SWMU is used when specifically referring to a numbered unit identified in the 1990 SWMU Report. The term PRS is the generic name for both SWMUs and AOCs. It is understood that the language in this work plan pertaining to subjects outside the scope of RCRA is not enforceable under the Laboratory's operating permit.

Background

The PRSs within Operable Unit 1114 fall into three general categories, as follows:

- surface contamination areas where contaminants were released at or onto the land surface, such as 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 landfills where solid wastes were placed or buried as a result of either programmatic experiments, disposal of waste from experiments, or active Los Alamos County and Laboratory regulated waste.

Primary contaminants in OU 1114 consist of solvents, metals, polychlorinated biphenyls (PCBs), inorganics, pesticides, mercury, and radionuclides. Other minor contaminants associated with OU 1114 include beryllium, lead, diesel and gasoline fuels, and acids.

One SWMU, 3-010(a), a mercury spill in TA-3-30, is being remediated under a voluntary corrective action (VCA) effort in accordance with a sampling and analysis plan and remediation plan approved by both the EPA and the New Mexico Environment Department (NMED). This VCA should be completed during the summer of 1993.

Technical Approach

For the purposes of designing and/or implementing the sampling and analysis plans described in this work plan, most PRSs are grouped into aggregates, although selected PRSs are investigated individually as necessary. This work plan presents the description and operating history of each PRS or aggregate, together with an evaluation of the existing data, if any, in order to develop a preliminary conceptual exposure model for the site. For some sites, no further action (NFA) can be proposed on the basis of this review; these sites are discussed in Chapter 6. For other, currently active sites, this review is sufficient to determine that investigation and remediation (if required) may be deferred until the site is decommissioned. These and the remaining sites, for which RFI fieldwork and/or voluntary corrective actions are proposed, are discussed in Chapter 5.

The technical approach to field sampling followed in this work plan is designed to refine the conceptual exposure models for the PRSs or aggregates to a level of detail sufficient for baseline risk assessment and the evaluation of remedial alternatives (including voluntary corrective actions). The approach for assessing ecological risk is currently under development; therefore, ecological risk will be addressed as part of a later phase of this investigation. Subsection 4.4 presents the status of ecological assessments. A phased approach to the RFI is used to ensure that any environmental impacts associated with past and present activities are investigated in a manner that is cost-effective and complies with the HSWA Module. This phased approach permits intermediate data evaluation, with opportunities for additional sampling, if required.

For PRSs for which there are no existing data and little or no historical evidence that a release has occurred, the Phase I sampling strategy for OU 1114 will focus on determining the presence or absence of hazardous and radioactive contaminants. If contaminants are detected at concentrations above conservative screening action levels, a baseline risk assessment may be required, or a voluntary corrective action may be proposed.

If conducted, the baseline risk assessment will determine the need for further corrective action. If the data collected during Phase I are insufficient to support a baseline risk assessment, additional RFI Phase II sampling will be undertaken to characterize the nature and extent of the release in more detail.

For some PRSs in OU 1114, there are existing data and/or strong historical evidence to support the hypothesis that a release has occurred. In these cases, the existing information has been evaluated to determine whether it is sufficient to support a baseline risk assessment and/or the evaluation of remedial alternatives. If not, Phase I for these sites will collect data as required to refine the site conceptual exposure model.

Data quality objectives to support the required decisions are developed for RFI Phase I sampling and analysis plans described in this work plan to ensure that the right type, amount, and quality of data are collected. Fieldwork for many sites includes field surveys and field screening of samples on which the selection of samples for laboratory analysis will be based. Laboratory analyses will be performed in mobile and fixed analytical laboratories.

The body of the text in this work plan is followed by five annexes, which consist of project plans corresponding to the program plans in the IWP: project management, quality assurance, health and safety, records management, and community relations.

Schedule, Costs, and Reports

The RFI fieldwork described in this document requires seven years to complete. A single phase of fieldwork is expected to be sufficient to complete the RFI for most PRSs; however, a second phase will occur if warranted by the results of the first phase, in which case the fieldwork will take longer than the estimated seven years to complete.

Cost estimates for baseline activities for OU 1114 are provided in Table ES-1. The estimated cost for implementing the RFI and reporting is $33.8 million. A CMS is not necessary for OU 1114; therefore, no cost estimates are required.

TABLE ES-1

ESTIMATED COSTS OF BASELINE ACTIVITIES AT OU 1114

TASK	BUDGET ($K)	SCHEDULED START	SCHEDULED FINISH
RFI work plan	3 600	01 Oct 92	20 Dec 96
RFI	18 828	01 Oct 93	25 Jul 00
RFI report	8 871	07 Jan 98	30 Nov 01
Activity data sheet (ADS) management	1 549	01 Oct 92	30 Nov 01
Voluntary corrective action	770	01 Mar 93	28 Sep 01
ADS management remediation	434	02 Oct 00	28 Sep 12
Voluntary corrective action remediation	18 812	01 Mar 01	28 Sep 12
Estimate to completion	52 864		
Escalation	28 330		
Prior years	967		
Total at completion	82 161		

The total estimated cost for the corrective action process at OU 1114 is approximately $20.0 million. Costs estimated above are unescalated.

The HSWA Module specifies the submittal of monthly reports and quarterly technical progress reports. In addition, RFI phase reports will be submitted at the completion of a significant number of sampling plans to make reporting less frequent. The RFI phase reports will serve as

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

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

Public Involvement

Module VIII and RCRA regulations mandate public involvement in the corrective action process. In addition, the Laboratory is providing a variety of opportunities for public involvement, including meetings held as needed to disseminate information, to discuss significant milestones, and to solicit informal public review of the draft work plan. The Laboratory also distributes meeting notices and updates the ER Program mailing list; prepares fact sheets (Annex V, Attachment 1) summarizing completed and future activities; and provides public access to plans, reports, and other ER Program documents. These materials are available for public review between 9:00 a.m. and 4:00 p.m. on Laboratory business days at the ER Program's public reading room at 1450 Central Avenue in Los Alamos and at the main branches of the public libraries in Española, Los Alamos, and Santa Fe.

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LIST OF ACRONYMS AND ABBREVIATIONS

ACGIH	American Conference of Governmental Industrial Hygienists
ADS	Activity data sheet
AEA	Atomic Energy Act
AEC	US Atomic Energy Commission
ALARA	As low as reasonably achievable
ANSI	American National Standards Institute
AOC	Area of concern
AP	Administrative procedure
AR	Administrative requirement
CDC	Centers for Disease Control
CEARP	Comprehensive Environmental Assessment and Response Program
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CGI	Combustible gas indicator
CMS	Corrective measures study
COC	Contaminant of concern
cpm	Counts per minute
CRZ	Contamination reduction zone
D&D	Decontamination and decommissioning
DA	Deferred action
dB	Decibel
DOE	US Department of Energy
DOE/AL	US Department of Energy/Albuquerque Operations Office
DOE/HQ	US Department of Energy/Headquarters
DQO	Data quality objective
EM	Environmental Management (Division)
EPA	US Environmental Protection Agency
ER	Environmental Restoration (Program)
ERIA	Environmental Restoration Interim Action
ERPG	Emergency Response Planning Guideline
ES&H	Environment, Safety, and Health
FID	Flame ionization detector
FIMAD	Facility for Information Management, Analysis, and Display
FWS	US Fish and Wildlife Service
FY	Fiscal year
GC	Gas chromatography
GET	General employee training
HAZWOP	Hazardous Waste Operations Program
HAZWOPER	Hazardous Waste Operations and Emergency Response
H&S	Health and safety, Health and Safety (Division)
HSWA	Hazardous and Solid Waste Amendments
IDLH	Immediately dangerous to life and health
IWP	Installation work plan
kV	Kilovolt
LAAO	Los Alamos Area Office (a branch of the Department of Energy)
LANL	Los Alamos National Laboratory
LASL	Los Alamos Scientific Laboratory (the Laboratory before January 1, 1981)
LLD	Lower limit of detection
LLW	Low-level waste
LP	Laboratory procedure
MDA	Material disposal area
NEPA	National Environmental Policy Act

NIOSH	National Institute of Occupational Safety and Health
NDA	Non-detectable activity
NFA	No further action
NMED	New Mexico Environment Department (prior to April 1991, the NMEID)
NPDES	National Pollutant Discharge Elimination System
NTS	Nevada Test Site
OEL	Occupational exposure limit
OSHA	Occupational Safety and Health Administration
OU	Operable unit
OUPL	Operable unit project leader
PAH	Polycyclic aromatic hydrocarbon
PC	Protective clothing
PCB	Polychlorinated biphenyl
PCOC	Potential contaminant of concern
PEL	Permissible exposure limit
PID	Photoionization detector
ppb	Parts per billion
PPE	Personal protective equipment
ppm	parts per million
PRS	Potential release site
PVC	Polyvinyl chloride
QA	Quality assurance
QAPjP	Quality assurance project plan
QC	Quality control
QPP	Quality program plan
RCRA	Resource Conservation and Recovery Act
RESRAD	Residual radioactive material
RFA	RCRA facility assessment
RFI	RCRA facility investigation
SAA	Satellite accumulation area
SAL	Screening action level
SARA	Superfund Amendments and Reauthorization Act
SCF	Sample coordination facility
SEN	Secretary of Energy notice
SM	South Mesa
SOP	Standard operating procedure
SPCC	Spill Prevention Control and Countermeasure Plan
SVOC	Semivolatile organic compound
SWMU	Solid waste management unit
TA	Technical area
TAL	Target analyte list
TCL	Target compound list
TCLP	Toxicity characteristic leaching procedure
TLV	Threshold limit value
TPH	Total petroleum hydrocarbons
TSCA	Toxic Substances Control Act
TSD	Treatment, storage, disposal
USGS	US Geological Survey
UST	Underground storage tank
VCA	Voluntary corrective action
VOC	Volatile organic compound
WWTP	Waste water treatment plant
XRF	X-ray fluorescence

GLOSSARY OF TERMS

Aliquot A subsample removed from a sample (grab or composite) for analysis. **(Campbell)**

Alluvial fan A fan-shaped accumulation of sediment deposited by a stream. **(1122)**

Alluvium Clay, silt, sand, gravel, or other rock materials transported by flowing water and deposited in fairly recent geologic time as sorted or semisorted sediments in riverbeds, estuaries, flood plains, lakes, shores, and fans at the base of mountain slopes. **(CDR)**

Alpha radiation Ionizing radiation composed of alpha particles emitted in the radioactive decay of certain nuclides. It is the least penetrating of the three common types of radiation—alpha, beta, gamma. **(CDR; DOE 1991)**

Analyte That which is being sought via analysis.

Andesite A gray, fine-grained, volcanic rock, chiefly plagioclase and pyroxene. **(1122)**

Aquifer An underground rock formation composed of materials such as sand, soil, or gravel that can store and supply groundwater to wells and springs. Most aquifers used in the United States are within a thousand feet of the earth's surface. **(DOE 1991)**

Background levels The distribution of concentrations of naturally occurring or widely distributed constituents in environmental media. **(Campbell)**

Bandelier Tuff A rhyolitic (fine-grained equivalent of granite) tephra (volcanic ejecta including dust, ash, pumice, and bombs) that was erupted during formation of the Valles and Toledo Calderas in the Jemez volcanic field. It is divided into lower (Otowi, formed 1.5 million years ago) and upper (Tshirege, formed 1.1 million years ago) members, each associated with caldera collapse. **(Dictionary of Geological Terms)**

Basalt A hard, dark volcanic rock. **(Dictionary of Geological Terms)**

Baseline risk assessment A risk assessment that uses an appropriate, site-specific exposure scenario but assumes no mitigating or corrective measures beyond those already in place. **(Campbell)**

Bedrock Solid rock that underlies all soil, sand, clay, gravel, and loose material on the earth's surface. **(CDR)**

Bentonite A clay containing the mineral montmorillonite and variable amounts of magnesium and iron, that formed over time by the alteration of volcanic ash. Bentonite can adsorb large quantities of water and expand to several times its normal volume. **(CDR)**

Beta radiation Radiation emitted from a nucleus during fission. Beta radiation can be stopped by an inch of wood or a thin sheet of aluminum. **(DOE 1991)**

Bias A systematic discrepancy between the actual and correct results of a sampling and analysis procedure. Bias may result from imperfect procedures for sampling (e.g., use of judgment samples), for measurement (e.g., errors in instrument calibration), or both. **(Campbell)**

Cerros del Rio volcanic field Basalts and basaltic andesites that lie below the Otowi Member of the Bandelier Tuff. **(Dictionary of Geological Terms)**

Characterization Description or definition of the qualities or peculiarities of a thing. **(1122)**

Cleanup Actions undertaken during a removal or remedial response to physically remove or treat a hazardous substance that poses a threat or potential threat to human health and welfare and the environment and/or real or personal property. **(DOE 1991)**

Closure The actions that must be performed at a hazardous waste facility if it will no longer receive waste for treatment or disposal, as prescribed by regulations implementing the Resource Conservation and Recovery Act. The actions include, among many others, the placement of a final cover on buried waste, the establishment of a long-term groundwater monitoring program, and the filing of a notice in State property records that a hazardous waste facility has been closed at the location. The monitoring and property record notice are also termed post-closure actions. **(Environmental Science 1991)**

Colloid A substance made up of tiny, insoluble, nondiffusible particles that remain suspended in a medium or different matter. **(Webster's 1973)**

Colluvium Rock debris at the base of a cliff or slope, accumulated principally by gravity. **(1122)**

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) A federal law passed in 1980 and modified in 1986 by the Superfund Amendments and Reauthorization Act (SARA) of 1986. The acts created a special tax that goes into a trust fund, commonly known as Superfund, to investigate and clean up abandoned or uncontrolled hazardous waste sites.

Conceptual exposure model A conceptual model whose objects are qualitative or quantitative descriptions of sources of contamination, environmental transport pathways for contamination, or biota that may be impacted by contamination (called receptors), and whose relationships describe the release of contamination from sources, the movement of contamination along pathways to exposure points, and/or the uptake of contaminants by receptors. **(Campbell)**

Conglomerate Rock consisting of pebbles and gravel embedded in a loosely cementing material. **(1122)**

Constituent Any compound or element present in environmental media, including both naturally occurring and man-made elements. **(Campbell)**

Contaminant, contaminant of concern (COC) Any constituent present in environmental media or on structural debris at a concentration above its screening action level. **(Campbell)**

Corrective measures study (CMS) The portion of a Resource Conservation and Recovery Act corrective action that is generally equivalent to a feasibility study taken under Superfund. **(DOE 1991)**

Data quality objectives (DQOs) Qualitative and quantitative statements that are developed before sampling begins to allow EPA to identify the quality of data that must be collected during Superfund actions. **(DOE 1991)**

Decision model A conceptual model whose objects are qualitative or quantitative descriptions of options (decision alternatives), knowledge (and uncertainties), and objectives (or values) with respect to a given problem. **(Campbell)**

Decommissioning The permanent removal from service of surface facilities and components necessary for preclosure activities only, after facility closure, in accordance with regulatory requirements and environmental policies. **(CDR)**

Decontamination The removal of unwanted material (especially radioactive material) from the surface of or from within another material. **(CDR)**

Deferred action (DA) Postponement of selection and of implementation of corrective measures until a future date, usually following decommissioning of an active site. **(Campbell)**

Detection level The minimum concentration of a substance that can be measured with a 99% confidence that the analytical concentration is greater than zero. **(DOE 1991)**

Detection limit The smallest amount of a particular chemical that can be detected by a specific analytical instrument or method. **(Environmental Science 1991)**

Dose The quantity of radiation absorbed, per unit of mass, by the body or by any portion of the body. **(CDR)**

Eolian Pertaining to the wind, especially said of sediment deposition by the wind, of structures such as wind-formed ripple marks, or of erosion accomplished by the wind. **(CDR)**

Ephemeral stream A stream or portion of a stream which flows only in direct response to precipitation. It receives little or no water from springs and no long-continued supply from melting snow or other sources. Its channel is at all times above the water table. **(Dictionary of Geological Terms)**

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. **(1122)**

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. **(1122)**

Gamma radiation A form of electromagnetic, high-energy radiation emitted from a nucleus. Gamma rays are essentially the same as x-rays and require heavy shieldings, such as concrete or steel, to be stopped. **(Environmental Science 1991)**

Gas chromatograph The analytical instrument used to perform qualitative and quantitative evaluations of sample mixtures of volatile substances. **(Environmental Science 1991)**

Geothermal Describing hot water, steam, or energy that is produced by the transfer of heat from the interior of the earth to geological deposits close to the surface. **(Environmental Science 1991)**

Groundwater Water in a saturated zone or stratum beneath the surface of land or water. **[CERCLA 101(12)]**

High-efficiency air particulate (HEPA) filter An air filter capable of removing from an air stream at least 99.97% of particulate material as small as 0.3 micron in diameter. **(CDR)**

Immunoassay An analysis that can combine the specific binding characteristics of an antibody molecule with a readout system that can detect and quantify compounds.

Leaching The dissolution of soluble constituents of a solid material by the natural action of percolating water or chemicals. **(CDR)**

Low-level waste (LLW) Radioactive waste material with a radiation intensity of less than 10 nanocuries per gram. **(Environmental Science 1991)**

Mass wasting A general term for a variety of processes by which large masses of earth material are moved by gravity either slowly or quickly from one place to another.

Matrix Relatively fine material in which coarser fragments or crystals are embedded; also called "ground mass." **(CDR)**

Migration pathway Route (e.g., a stream or river) for potential movement of contaminants to environmental receptors (plants, animals, humans). **(1122)**

Mitigation (1) Avoiding an impact altogether by not taking a certain action or parts of an action. (2) Minimizing impacts by limiting the degree or magnitude of the action and its implementation. (3) Rectifying the impact by repairing, rehabilitating, or restoring the affected environment. (4) Reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action. (5) Compensating for the impact by replacing or providing substitute resources or environments. **(CDR)**

Outfall The location where waste water is released from a point source into a receiving body of water. **(Environmental Science 1991)**

Perched water Zones of saturated rock above an impermeable bed, underlain by unsaturated rocks of sufficient permeability to allow movement of groundwater.

Phase I Under RCRA , the first phase of the assumption of responsibility by a state for administering the RCRA hazardous waste (Subtitle C) program. Phase I state authorization refers to regulations identifying hazardous wastes and the standards for generators, transporters, and treatment, storage, or disposal facilities with interim status. **(Environmental Science 1991)**

Phase II Under RCRA, the second phase of the assumption of responsibility by a state for the hazardous waste (Subtitle C) program, which covers the detailed, technical requirements for issuing final permits to treatment, storage, or disposal facilities for hazardous wastes. **(Environmental Science 1991)**

Photoionization detector (PID) An analytical instrument that determines the amount of a specific organic material present in a gas stream by exposing the gas to ultraviolet energy that will be absorbed by that material. **(Environmental Science 1991)**

Population A set of entities or a continuum in a physical, biological or social system, e.g., the residents of Los Alamos County, or the water in an alluvial aquifer, or the plants in Pajarito Canyon. **(Campbell)**

Quality assurance (QA) All the planned and systematic actions necessary to provide adequate confidence that a structure, system, or component is constructed to plans and specifications and will perform satisfactorily. **(CDR)**

Quality assurance/quality control (QA/QC) A system of procedures, checks, audits, and corrective actions used to ensure that fieldwork and laboratory analysis during the investigation and cleanup of Superfund sites meet established standards. **(DOE 1991)**

Radionuclide An unstable form of an element that undergoes radioactive decay, emitting energy in the form of gamma rays or mass in the form of alpha particles or beta particles.

Receptor A person, plant, animal, or geographical location that is exposed to a chemical or physical agent released to the environment by human activities. **(1122)**

Recharge The process by which water is added to the zone of saturation, either directly into a geologic formation or indirectly by way of another formation or through unconsolidated sediments. **(CDR)**

Representativeness Similarity between the measurements produced by a specified sampling and analysis procedure and the true target population parameters. **(Campbell)**

Resource Conservation and Recovery Act (RCRA) A federal law that established a structure to track and regulate hazardous wastes from the time of generation to disposal. The law also regulates the disposal of solid waste that may not be considered hazardous. **(DOE 1991)**

Risk assessment An assessment of the potential human health or environmental risk associated with contamination of environmental media. Risk assessment includes hazard identification, exposure assessment, and dose response analysis. **(Campbell)**

Screening action level (SAL) Media-specific concentration level for a constituent derived using conservative criteria. **(Campbell)**

Screening assessment Evaluation of information about a PRS to determine whether hazardous or radioactive constituents are present above the levels of concern defined by media-specific screening action levels or regulatory standards. **(Campbell)**

Scrubber A device designed to remove pollutant particles or gases from exhaust streams produced by combustion or industrial processes. **(Environmental Science 1991)**

Stratigraphy The study of rock strata to include age relationships. **(1122)**

Superfund Amendments and Reauthorization Act (SARA) of 1986 The 1986 amendments to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) that included provisions that increased the size of the Hazardous Substances Superfund, required new cleanup standards, and started the Superfund Innovative Technology Evaluation (SITE) program. **(40 CFR 300.5)**

Topography The physical features of a place or region. **(1122)**

Toxicity characteristic leaching procedure (TCLP) A test that measures the mobility of organic and inorganic chemical contaminants in wastes. The test, designed by the United States Environmental Protection Agency, produces an estimate of the potential for leachate formation by a waste if it is placed in the ground. **(Environmental Science 1991)**

Tuff A compacted pyroclastic deposit of volcanic ash and dust that contains rock and mineral fragments incorporated during eruption or transport.

Unsaturated zone The zone between the land surface and the regional water table. **(DOE 1991)**

Vadose zone The zone above the water table where water is present but does not saturate the host medium. **(Dictionary of Geological Terms 1974)**

Volatile organic compound (VOC) An organic (carbon-containing) compound that evaporates (volatilizes) readily at room temperature. **(DOE 1991)**

Voluntary corrective action (VCA) Selection and implementation of an obvious and effective corrective action during or following the RFI. **(Campbell)**

Water table The uppermost level of the below-ground, geological formation that is saturated with water. **(Environmental Science 1991)**

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Chapter 1

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1.0 INTRODUCTION

1.1 Statutory and Regulatory Background

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

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

The HSWA Module lists PRSs in which the facility has placed solid wastes. These wastes may be either hazardous or nonhazardous (for example, construction debris). Table A of the HSWA Module identifies 603 SWMUs at the Laboratory, and Table B lists those SWMUs that must be investigated first. In addition, the Laboratory has identified areas of concern (AOCs), which do not meet the HSWA Module's definition of a SWMU. These sites may contain radioactive materials and other hazardous substances not listed under RCRA. SWMUs and AOCs are collectively referred to as PRSs. The Environmental Restoration (ER) Program uses the mechanism of recommending no further action (NFA) for AOCs as well as SWMUs. However, using this approach for AOCs does not imply that AOCs fall under the jurisdiction of the HSWA Module.

For the purposes of implementing the cleanup process, the Laboratory has aggregated PRSs that are geographically related in groupings called operable units (OUs). The Laboratory has established twenty-four OUs, and an RFI work plan is prepared for each. This work plan for OU 1114 addresses PRSs located in six of the Laboratory's technical areas (TAs): TAs 3, 30, 59, 60, 61, and 64. This document, together with nine other work plans to be submitted to EPA in 1993 and nine plans submitted in 1990 and 1991, meets the schedule requirements of the HSWA Module, which are to address a cumulative total of 55% of the PRSs in Table A and a cumulative total of 100% of the 182 priority PRSs listed in Table B.

As more information is obtained, the Laboratory proposes modifications in the HSWA Module for EPA approval. When applications to modify the permit are pending, the ER Program submits work plans consistent with current permit conditions. Program documents, including RFI reports and the *Installation Work Plan (IWP)*, are updated and phase reports are prepared to reflect changing permit conditions.

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

1.2 Installation Work Plan

The HSWA Module requires that the Laboratory prepare a master plan, called an installation work plan, to describe the Laboratory-wide system for accomplishing all RFIs and corrective measures studies (CMSs). The IWP has been prepared in accordance with the HSWA Module and is consistent

TABLE 1-1

RCRA FACILITY INVESTIGATION GUIDANCE FROM THE HSWA MODULE

Scope of the RCRA Facility Investigation (RFI)	ER Program Equivalent	
The RFI consists of 5 tasks:	*LANL Installation RI/FS* Work Plan:*	*LANL Task/Site RI/FS:*
Task I: Description of Current Conditions A. Facility Background B. Nature and Extent of Contamination	**I. LANL Installation RI/FS Work Plan** A. Installation Background B. Tabular Summary of Contamination by Site	**I. Quality Assurance Project Plan** A. Task/Site Background B. Nature and extent of contamination
Task II: RFI Work Plan A. Data Collection Quality Assurance Plan B. Data Management Plan C. Health and Safety Plan D. Community Relations Plan	**II. LANL Installation RI/FS Work Plan** A. General Standard Operating Procedures for Sampling Analysis and Quality Assurance B. Technical Data Management Program C. Health and Safety Program D. Community Relations Plan	**II. LANL Task/Site RI/FS Documents** A. Quality Assurance Project Plan and Field Sampling Plan B. Records Management Project Plan C. Health and Safety Project Plan D. Community Relations Project Plan
Task III: Facility Investigation A. Environmental Setting B. Source Characterization C. Contamination Characterization D. Potential Receptor Identification	**III. Task/site Investigation** A. Environmental Setting B. Source Characterization C. Contamination Characterization D. Potential Receptor Identification	**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. LANL Task/Site Investigative Analysis** A. Data Analysis B. Protection Standards	**IV. LANL Task/Site Investigative Analysis** A. Data Analysis B. Protection Standards
Task V: Reports A. Preliminary and Work Plan B. Progress C. Draft and Final *RI = Remedial Investigation FS = Feasibility Study	**V. Reports** A. LANL Installation RI/FS Work Plan B. Annual Update of LANL Installation RI/FS Work Plan C. Draft and Final	**V. LANL Task/Site Reports** A. Quality Assurance Project Plan, Field Sampling Plan, Technical Data Management Plan, Health and Safety Plan, Community Relations Plan B. LANL Task/Site RI/FS Documents and LANL Monthly Management Status Report C. Draft and Final

TABLE 1-2

LOCATION OF HSWA MODULE REQUIREMENTS IN ER PROGRAM DOCUMENTS

HSWA MODULE REQUIREMENTS FOR RFI WORK PLANS	INSTALLATION WORK PLAN AND OTHER PROGRAM DOCUMENTS	DOCUMENTS FOR OPERABLE UNIT 1114
Task I: Description of Current Conditions		
A. Facility Background	IWP Section 2.1[a]	A. Task/Site Background, Subsections 2.1 and 2.2
B. Nature and Extent of Contamination	IWP Section 2.4 and Appendix F	B. Nature and extent of contamination, Subsection 2.3 and Appendix I
Task II: RFI Work Plan		
A. Data Collection Quality Assurance Plan	IWP Annex II (Quality Program Plan)	RFI Work Plan Annex II
B. Data Management Plan	IWP Annex IV (Records Management Program Plan)	RFI Work Plan Annex IV
C. Health and Safety Plan	IWP Annex III (Health and Safety Program Plan)	RFI Work Plan Annex III
D. Community Relations Plan	IWP Annnex V (Community Relations Program Plan)	RFI Work Plan Annex V
E. Project Management Plan	IWP Annex I (Program Management Plan)	RFI Work Plan Annex I
Task III: Facility Investigation		
A. Environmental Setting	IWP Chapter 2	RFI Work Plan Chapter 3
B. Source Characterization	IWP Appendix F	RFI Work Plan Chapter 5
C. Contamination Characterization	IWP Appendix F	RFI Work Plan Chapter 4 and 5
D. Potential Receptor Identification	IWP Section 4.2	RFI Work Plan Chapter 4 and 5
Task IV: Investigative Analysis		
A. Data Analysis	IWP Section 4.2	Phase report and RFI report
B. Protection Standards	IWP Section 4.2	RFI report
Task V: Reports		
A. Preliminary and Work Plan	IWP, Rev. 0[b]	Work plan
B. Progress	Monthly reports, quarterly reports, and annual revisions of IWP	Phase reports
C. Draft and Final		Draft and final RFI report

[a] LANL 1992, 0768
[b] LANL 1990, 0144

with EPA's "Interim Final RFI Guidance" (EPA 1989, 0088) and proposed Subpart S of 40 CFR 264 (EPA 1990, 0432), which proposes the cleanup program mandated in Section 3004(u) of RCRA. The IWP was first prepared in 1990 and is updated annually. This work plan follows the requirements specified in Revision 2 of the IWP (LANL 1992, 0768).

The IWP describes the aggregation of the Laboratory's PRSs into 24 OUs (Subsection 3.4.1). It presents a facilities description in Chapter 2 and a description of the structure of the Laboratory's ER Program in Chapter 3. Chapter 4 describes the technical approach to corrective action at the Laboratory. Annexes I-V contain the Program Management Plan, an overview of the Quality Assurance Program Plan (LANL 1991, 0781), Health and Safety Program Plan, Records Management Program Plan, and the Community Relations Program Plan, respectively. The document also contains a proposal to integrate RCRA closure and corrective action, and a strategy for identifying and implementing interim remedial measures. When information relevant to this work plan has already been provided in the IWP, the reader is referred to the appropriate revision of the IWP.

1.3 Description of OU 1114

OU 1114 is located in Los Alamos County in north-central New Mexico (Fig. 1-1). The TAs within this operable unit contain PRSs of like physical characteristics, historical use, or similar release occurrences, and are aggregated accordingly. They are not grouped by technical area.

The following table (Table 1-3) describes PRS aggregates and the basis for aggregation. Individual PRS description and history is located in Chapter 5 if sampling is required, or Chapter 6 if NFA is proposed.

The PRSs in Chapter 6 that are being recommended for NFA or deferred action (DA) were addressed using the four-step criteria described in Table 1-4. These criteria are explained in more detail in Appendix I, Subsection 4.1 of the IWP (LANL 1992, 0768) and Chapter 6 of this work plan. Chapter 6 addresses fifty-seven PRSs listed on the HSWA Module and twenty-one PRSs listed in the 1990 SWMU Report, but not in the HSWA Module (LANL 1990, 0145).

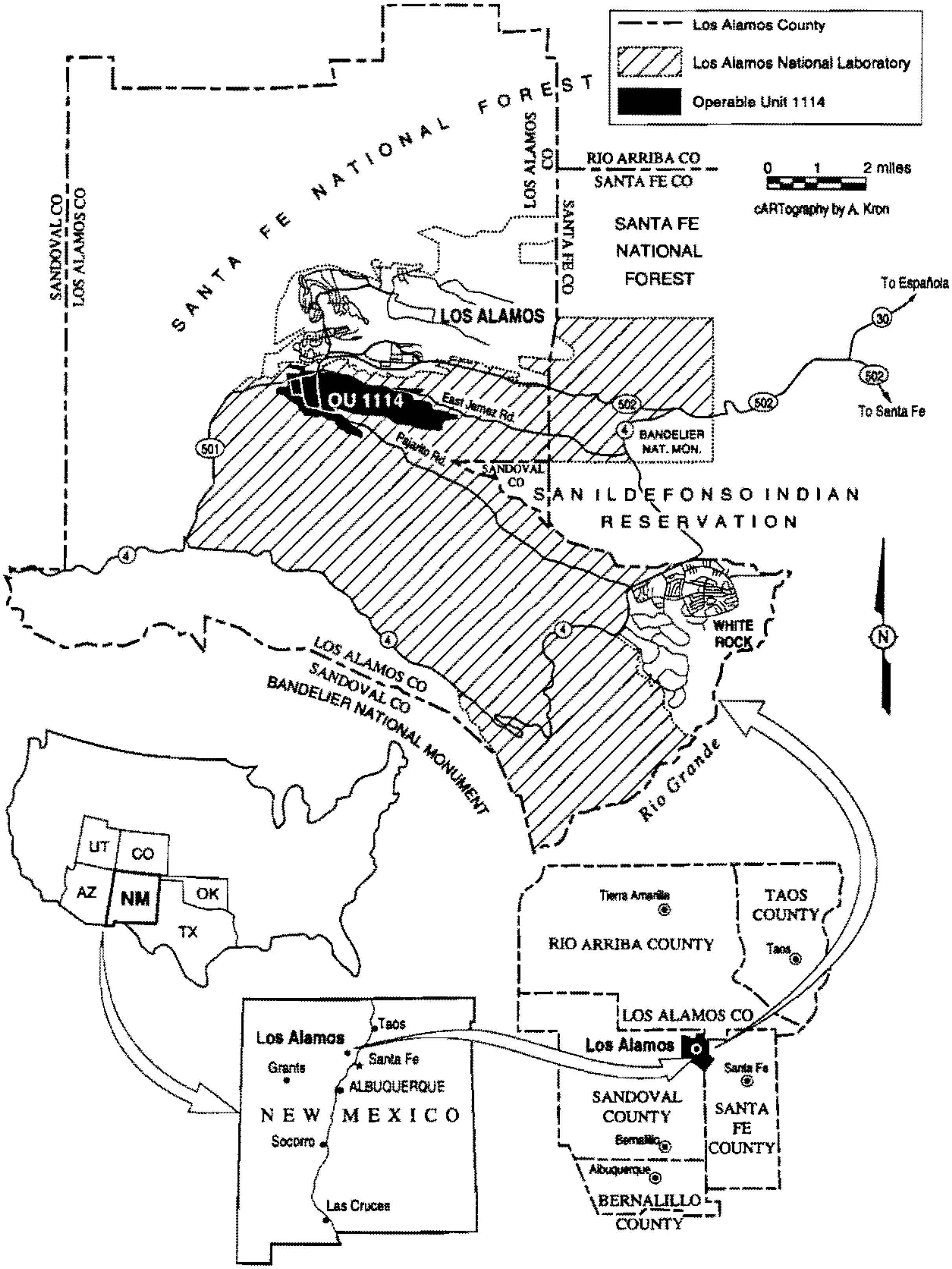

Fig. 1-1. Location of Operable Unit 1114.

TABLE 1-3

PRS AGGREGATION BASIS

SWMU OR AOC ID	SINGLE PRS OR AGGREGATE DESCRIPTION	SUB-SECTION	BASIS OF AGGREGATION	NUMBER OF PRSs IN AGGREGATE
3-002(c)	Decommissioned storage	5.1	N/A	1
C-60-005 60-007(b)	Motor pool	5.2	Similar in proximity	2
3-015, 59-004	Outfalls	5.3	Physically similar	2
3-033	Point/spot spill	5.4	N/A	1
3-012(b), 3-014(a-z), 3-014(a2-c2)	Sanitary treatment system	5.5	Similar historical use and proximity	34
60-006(a)	Septic tank	5.6	N/A	1
60-004(b), 60-004(d), 60-004(e), 60-007(a)	Sigma Mesa east	5.7	Similar historical use and proximity	4
60-004(c), 60-005(a)	Sigma Mesa solar pond	5.8	Similar proximity	2
3-013(a), 3-013(b)	Storm drains	5.9	Originate from same structure	2
3-003(a), 3-003(b), 3-056(c),. 61-001	Waste oil storage areas	5.10	Similar historical use and physical description	4

1.3.1 Location of PRSs in OU 1114

Maps of the OU and the technical areas are located in Appendix E.

1.4 Organization of This Work Plan

This work plan follows the generic outline provided in Table 3-3 of the IWP (LANL 1992, 0768). Following this introductory chapter, Chapter 2 provides background information on OU 1114, which includes a description and history of the OU, a description of past waste management practices, and a discussion of current conditions at technical areas in the OU.

Chapter 3 of this work plan describes the environmental setting. Chapter 4 presents the technical approach to the field investigation. Chapter 5 contains an evaluation of all of the PRSs in OU 1114, which includes a description

TABLE 1-4

NO FURTHER ACTION CRITERIA

STEP	CRITERIA
Step 1 NFA	• PRS has undergone regulatory closure • SWMU Report is inaccurate
Step 2 NFA	• PRS began operation after 1987 • PRS is an approved accumulation area
Step 3 DA	• PRS is undergoing regulatory closure • PRS is active site with no credible off-site pathways • PRS is inactive; characterization disrupts active site • PRS is undergoing voluntary corrective action (VCA)
Step 4 NFA	• PRS poses no threat to on-site or off-site workers, the general public, or the environment

and history of each PRS, a conceptual exposure model, remediation alternatives and evaluation criteria, data needs and data quality objectives, and a sampling plan. Chapter 6 of this work plan provides a brief description of each PRS proposed for NFA and the rationale for that recommendation.

The body of the text is followed by five annexes, which consist of project plans corresponding to the program plans in the IWP: project management, quality assurance, health and safety, records management, and community relations. There are also five appendixes, which consist of a cultural resource summary, a biological resource summary, a list of contributors, the field investigation approach and methods and OU contour maps showing the locations of PRSs.

1.4.1 HSWA Permits

Subsection 3.5 of the IWP states that each OU work plan may contain an application for a Class III permit to modify Table A of the HSWA Module when it is determined that a PRS needs no further investigation or when it is necessary to add PRSs to the current listing. Refer to Chapter 6, Table 6-12, for HSWA-listed PRSs proposed for NFA or DA.

1.4.2 Other Useful Information

The units of measurement used in this document are expressed in both English and metric units, depending on which unit is commonly used in the field being discussed (Table 1-5). For example, English units are used in text pertaining to engineering, and metric units are often used in discussions of geology and hydrology. When information is derived from some other published report, the units are consistent with those used in that report.

TABLE 1-5

APPROXIMATE CONVERSION FACTORS FOR SELECTED SI (METRIC) UNITS

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

A list of acronyms and a glossary of terms precede Chapter 1. A glossary of terms is also provided in the IWP (LANL 1992, 0768).

REFERENCES

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

EPA (US Environmental Protection Agency), April 10, 1990. Module VIII of RCRA Permit No. NM0890010515, EPA Region 6, issued to Los Alamos National Laboratory, Los Alamos, New Mexico, effective May 23, 1990, EPA Region 6, Hazardous Waste Management Division, Dallas, Texas. **(EPA 1990, 0306)**

EPA (US Environmental Protection Agency), July 27, 1990. "Corrective Action for Solid Waste Management Units (SWMUs) at Hazardous Waste Management Facilities," proposed rule, Title 40 Parts 264, 265, 270, and 271, Federal Register, Vol. 55. **(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), June 1991. "Los Alamos National Laboratory Quality Program Plan for Environmental Restoration Activities," Rev. 0, Los Alamos National Laboratory Report LA-UR-91-1844, Los Alamos, New Mexico. **(LANL 1991, 0781)**

LANL (Los Alamos National Laboratory), November 1992. "Installation Work Plan for Environmental Restoration," Revision 2, Los Alamos National Laboratory Report LA-UR-92-3795, Los Alamos, New Mexico. **(LANL 1992, 0768)**

Executive Summary

Chapter 1
Introduction

Chapter 2
Background Information

Chapter 3
Environmental Setting

Chapter 4
Technical Approach

Chapter 5
Evaluation of PRS Aggregates

Chapter 6
PRSs Recommended for No Further Action or Deferred Action

Annexes

Appendixes

Chapter 2

- Description
- History
- Waste Management Practices

2.0 BACKGROUND INFORMATION FOR OPERABLE UNIT 1114

2.1 Description

Operable Unit (OU) 1114 consists of six technical areas (TAs): 3, 30, 59, 60, 61, and 64, as shown in Fig. 2-1. Technical Area 30 was decommissioned and removed in 1948. The OU covers 1 216 acres at the western end of South Mesa, which separates Los Alamos Canyon and Twomile Canyon. The mesa slopes gently from west to east, with a western elevation of 7 400 ft and an elevation loss of only about 240 ft in 2 miles. Two canyons, Sandia and Mortandad, originate within OU 1114, dividing the eastern two-thirds of South Mesa into finger-like projections. The middle mesa has been named Sigma Mesa. The entire area is set in a ponderosa pine and piñon-juniper forest; canyons and some fringe areas are heavily wooded. Core areas within OU 1114 are highly developed.

The Installation Work Plan (IWP) includes maps of the wetlands and well locations of Los Alamos County and adjacent locales (Appendix C). Chapter 2 of the IWP contains maps of drainage patterns (LANL 1992, 0768).

The technical areas and their functions are listed below.

2.1.1 Technical Area 3, South Mesa (SM) Site

TA-3 contains the core of operational facilities at Los Alamos National Laboratory. Included in TA-3 are the principal administration buildings, library, cafeteria, shops, warehouses, several large laboratory buildings housing diverse groups and programs, and numerous smaller buildings serving specialized functions. A gas-fired electrical generating plant, gas station and garage, and sewage treatment plant are located at TA-3.

TA-3 is almost completely developed. Roads and large paved parking lots surround the buildings. Unpaved areas are landscaped. Several buildings dominate the site. The Administration Building (TA-3-43) is four stories tall. An annex, the Otowi Building (TA-3-261) is three stories tall. The Chemistry and Metallurgy Research (CMR) Building (TA-3-29) has a central spine one-eighth mile long. Equally as large are the Physics Building complex (TA-3-40 and TA-3-215), the main shops building (TA-3-39), and the central warehouse (TA-3-30). Medium-sized and smaller buildings and transportable buildings are interspersed throughout the site. Approximately one-third of the area,

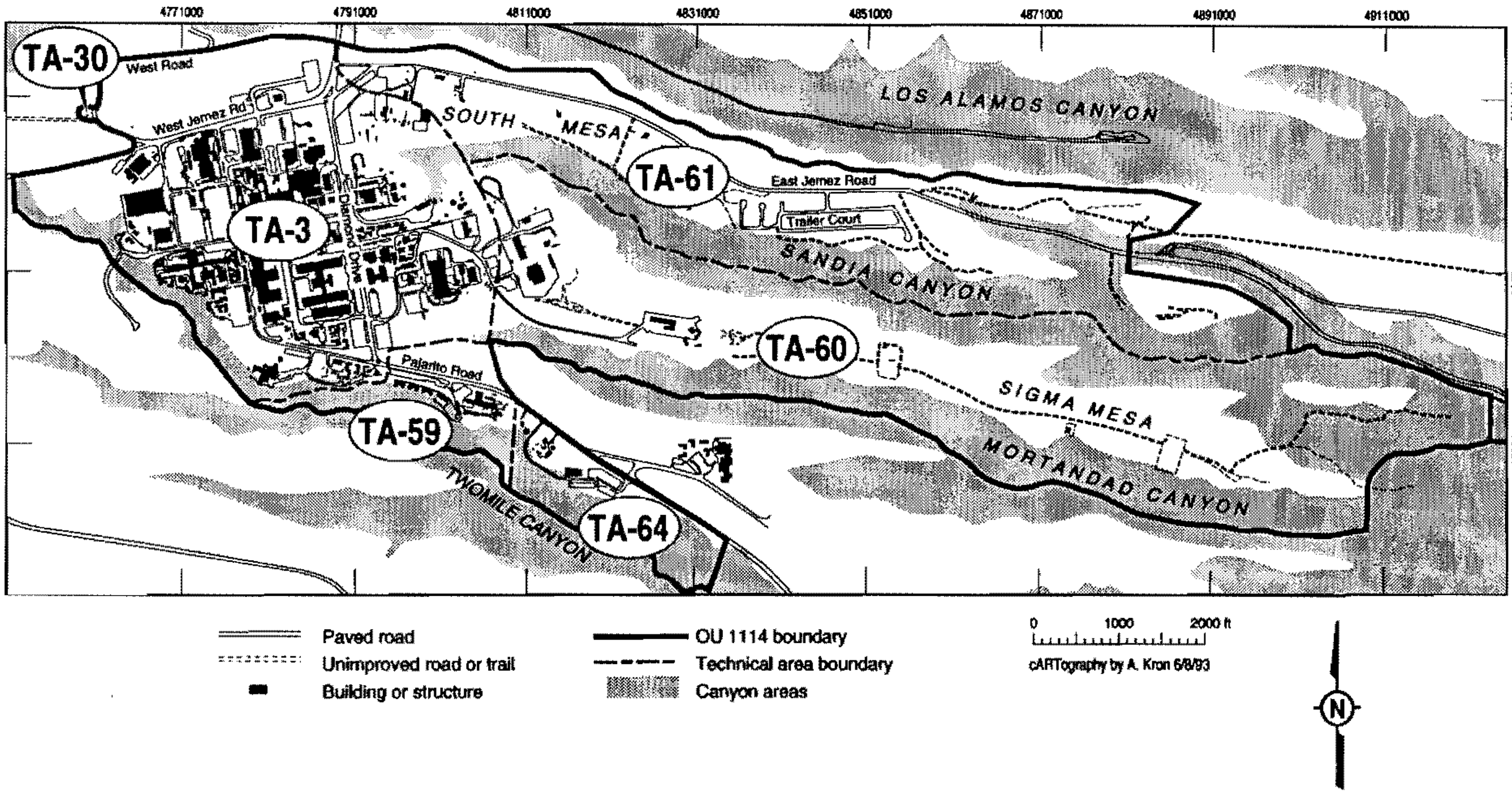

Fig. 2-1. Locations of technical areas within OU 1114.

including the Administration Building and the CMR Building, is enclosed within a security fence. Several other building complexes are also fenced for controlled access. The site is bounded on the north by 300-ft-deep Los Alamos Canyon and on the south by 80-ft-deep Twomile Canyon.

2.1.2 Technical Area 30

TA-30 was developed as an electronics testing area during World War II. It was decommissioned in 1948. The quarter-acre site lies within the current boundaries of TA-3. TA-30 was located in the northwest angle of the intersection of the old Anchor Ranch Road and West Road. The area is in a gently sloping pine forest that has been thinned for firebreak purposes. A short length of culvert and scattered gravel are all that remain of the site.

2.1.3 Technical Area 59, Occupational Health (OH) Site

TA-59 houses some of the occupational health, safety, and environmental groups serving the Laboratory. Included in the complex are a laboratory building, office building, and several transportable structures.

TA-59 lies at the southern edge of South Mesa on the rim of Twomile Canyon. The site is divided into two levels. The main laboratory-office facility (TA-59-1) and several support buildings are located on the mesa near the canyon rim. A large office building (TA-59-3) and three transportable complexes are located against the canyon wall approximately 20 ft below the canyon rim. Paved roads and parking areas serve both levels. The steep bank cut separating the two levels has been partially stabilized with gunite. The remainder of TA-59 consists of pine forest on the steep north wall of Twomile Canyon.

2.1.4 Technical Area 60, Sigma Mesa Site

TA-60 contains Laboratory support and maintenance operations and contractor service facilities. The Nevada Test Site (NTS) test fabrication facility; the NTS test tower; several small abandoned experimental areas including a solar pond and a test drill hole; and storage sites for pesticides, topsoil, and recyclable asphalt are located on Sigma Mesa.

TA-60 lies east of TA-3 on a finger-like mesa between Sandia Canyon on the north and Mortandad Canyon on the south; each canyon is 200 ft deep. The main operational building (TA-60-1), the NTS test fabrication facility (TA-60-17), and the NTS test tower (TA-60-19) are located at the western end of the site adjacent to TA-3. Most of TA-60 consists of undeveloped mesa top. The mesa was an agricultural area during the homestead days prior to 1943. It is covered with low invasive shrubs, unforested except for pines at the edges of the mesa and a few young pines beginning to invade the fields. An abandoned solar pond experiment is approximately one mile east of the buildings. An outdoor storage area is approximately one-half mile farther east. The areas are served by a single graveled road that is secured by a locked gate at the western end of the mesa just beyond TA-60-19.

2.1.5 Technical Area 61, East Jemez Site

TA-61 contains the Los Alamos municipal sanitary landfill. A few small support buildings are located at the northern end of TA-61. A residential trailer park is located within the boundaries.

TA-61 lies in the northeast quadrant of OU 1114. It is bounded on the north by 300-ft-deep Los Alamos Canyon and on the south by Sandia Canyon. Much of the site occupies the upper end of Sandia Canyon, which is approximately 400 ft wide and 40 to 140 ft deep along the length of the OU. The Los Alamos municipal sanitary landfill dominates the site. Large trenches and disposal areas have been excavated from the north wall of the canyon to accommodate the landfill. The landscaped trailer park is at the northeast corner of the site. East Jemez Road traverses the north edge of the site near the rim of Los Alamos Canyon. The remainder of TA-61 appears to be naturally vegetated with ponderosa pine forest. A thicket of cattails grows in the bottom of Sandia Canyon.

2.1.6 Technical Area 64, Central Guard Site

TA-64 contains the central administrative facility for the protective guard force. It also contains Laboratory infrastructure support structures, including two water towers, a pumping station, and a storage area. TA-64 is a small area on the north rim of Twomile Canyon east of TA-59. The only building (TA-64-1) is on a leveled bench approximately 20 ft below the mesa top. A parking area is located east of the building. Two water towers are on the mesa above. The north wall of Twomile Canyon, 150 ft deep at this point, is forested.

2.2 History of OU 1114

2.2.1 Technical Area 3

TA-3 was originally built as a firing site prior to 1945. It contained several wooden structures that served as an administration building, a shop, hutments (10 x 10 ft fiberboard buildings used for storage, minor assembly, and checkout of scientific hardware), and magazines. The area also contained a burn pit for destroying explosives (Betts 1947, 17-512). The site was decommissioned and cleared in 1949.

In the summer of 1950, construction began on the major buildings at the South Mesa site, which was built to replace operational facilities in the current Los Alamos town site. Buildings became operational between the summer of 1951 and autumn of 1952. First was the Van de Graaff accelerator (TA-3-16), located at the southwestern corner of TA-3 on the rim of Twomile Canyon. It consists of a laboratory (TA-3-16), an accelerator building (TA-3-18), and associated support structures (steam plant, fuel tanks, cooling tower, and storage buildings). Next came the Communications Building (TA-3-28) located near the center of TA-3. Over the years the building housed various shops: electronic, machine, printed circuit fabrication, chemical metal finishing, and copper plating. From the late 1970s to the present, the building has been occupied by Information Services Division, whose activities include printing, motion picture production, illustration, and editing. The CMR Building was ready for occupancy in the autumn of 1952. It is a large laboratory facility that houses diverse chemical and metallurgical operations involving plutonium, uranium, other radionuclides, metals, inorganic and organic compounds, acids, and solvents of every nature (ENG-7 building records).

The general warehouse (TA-3-30), the chemical warehouse (TA-3-31), and the cryogenics facility (TA-3-33) were also completed in 1952. Also included in the initial development of TA-3 were shops (TA-3-38 and TA-3-39), a fire house (TA-3-41), and the Physics Building. The latter is a large office and laboratory facility that once housed two accelerators and a cyclotron.

Radioactive materials used in the building over the years include plutonium, uranium, and tritium. Metals and solvents were used extensively. As part of the TA-3 site development, a waste water treatment plant (TA-3-47 to TA-3-52), service station and maintenance garage (TA-3-36 and TA-3-37), and a gas-fired electrical generating plant were constructed to service these facilities. An asphaltic concrete plant (TA-3-73) was moved from the airport area to the complex southwest of the Physics Building in 1953; it was moved to its present site at the northeast corner of TA-3 in 1954 (ENG-7 building records).

The Administration Building was completed in 1956. In addition to offices, it housed laboratory and shop facilities and extensive photographic operations. In 1959 Sigma Building (TA-3-66) was completed at the eastern end of the site. The building houses a complex array of equipment and activities concerned with metallurgical and ceramics research and fabrication. Construction of new facilities continued through the 1960s and 1970s. Office buildings, shops, storage areas, an addition to the waste water treatment plant, a cement batch plant, and numerous transportables filled areas between the initial buildings. Construction continued with the Oppenheimer Study Center in 1977, an annex to the Administration Building in 1981, and a computer facility and several national centers for various scientific activities in the 1990s (ENG-7 building records).

Despite these diverse activities, facilities at TA-3 have never contained or released significant amounts of hazardous constituents. Radionuclides were (and are) used in experimental amounts; there are no production facilities at TA-3. Releases to the environment have been only occasional, short-term spills of low concentrations that were quickly cleaned up.

2.2.2 Technical Area 30

TA-30 was an electronics test area. It was a small site with a single wooden hutment equipped with an oil-burning stove, built in 1945 (Betts 1947, 17-512). Engineering records indicate that the hutment was removed in 1946. The area was decommissioned in 1948.

2.2.3 Technical Area 59

TA-59 was established in 1966 with the opening of the Occupational Health Building (TA-59-1). The building contained offices and laboratories of the Industrial Hygiene and Field Test Studies Group serving the Nevada Test Site. Over the years, groups located at TA-59 included Industrial Hygiene; Environmental Surveillance; Epidemiology, Health, and Environmental Chemistry; and Meteorology. Low-level radioactive material has been handled in TA-59-1 since its opening. Samples include employee bioassay tissue and urine, and environmental samples of soil, water, vegetation, foodstuffs, and animals. Several electronics laboratories were located at TA-59 (LASL 1966, 17-518). The site expanded with the addition of transportable buildings surrounding TA-59-1. In the 1970s a three-story office building was constructed near TA-59-1 (ENG-7 building records). A parking lot and several transportables serve that building. Occupational health and environmental surveillance remain the principal activities at TA-59.

2.2.4 Technical Area 60

TA-60 was created in 1989 when the Laboratory redefined its technical areas. Southeastern portions of TA-3 were renamed and structures were renumbered from TA-3 to TA-60. All of the buildings are clustered at the western end of the site. The mobile equipment repair shop (TA-3-382) and warehouse (TA-3-381) were built in 1972. They were redesignated TA-60-1 and TA-60-2 in 1989. The buildings are surrounded by support structures for automotive repair, including a gas station and steam-cleaning facility. The test rack facility was built in 1985 to assemble racks used in underground testing of nuclear devices at the Nevada Test Site. The buildings are numbered TA-60-17 and TA-60-19 (ENG-7 building records).

In the 1970s, a solar pond was built on Sigma Mesa to test the feasibility of reducing the volume of low-level radioactive waste water from the TA-50 waste treatment facility. The experiment was not successful and the pond was abandoned. Details are discussed in Subsection 5.8 of this work plan. In 1979, a test geothermal well was drilled at the eastern end of Sigma Mesa. The site was not suitable for geothermal development and the experiment was terminated. Details are discussed in Subsection 6.2. In 1984, a small pesticide storage building was assembled just east of the test rack assembly enclosure (once numbered TA-3-1486, the structure has been redesignated TA-60-29). Other areas on the mesa were designated as storage sites over the years.

2.2.5 Technical Area 61

TA-61 was created during the Laboratory technical area redesignation in 1989. The few buildings at TA-61 were previously part of TA-3. A major feature at the site is the municipal landfill, established in 1974; the landfill is still in use. The privately-owned one square mile of land for the Royal Crest Trailer Court, established when Los Alamos became a permanent community after World War II, is also located at TA-61, as are two privately-owned cement mixing plants that operate on land leased from the Department of Energy (DOE).

2.2.6 Technical Area 64

TA-64 was created during the Laboratory technical area redesignation in 1989. Its only building, the Central Guard Facility, was built in 1987 (ENG-7 building records). The building houses offices and support facilities for the protective guard force.

2.3 Waste Management Practices

2.3.1 Past Waste Management Prectices

Los Alamos National Laboratory has practiced, and continues to conform to, contemporary waste management procedures. During World War II and the beginning of the Cold War, waste debris was hurriedly disposed of, often into adjacent canyons. Aqueous and organic waste solutions were poured or piped to the nearest drainage. For example, in the 1950s, workers at the vacuum repair shop in warehouse TA-3-30 poured mercury-contaminated pump oil over the bank into Twomile Canyon directly west of the building. An estimated 150 to 200 pounds of mercury were disposed of in this manner (Ahlquist 1985, 17-215). Details are described in Chapter 6.

Emphasis focused on worker safety. Degreasing operations were performed outside the Van de Graaff buildings and the loading dock of the shops so that fumes dispersed. Solvents included acetone, trichloroethylene, methylethylketone, and alcohols (Ferran 1968, 17-130). Several buildings had *cadmium, thallium, antimony,* and bismuth machining operations. Work stations in shops and laboratories were equipped with hoods to draw fumes away from workers (Ettinger 1963, 17-097; Schulte 1962, 17-092). Stacks typically vented unfiltered to the atmosphere.

Waste management practices became more controlled in the early 1950s. The TA-3 waste treatment plant was completed in 1951, and many floor drains were routed to sewer lines. Handling procedures for radioactive waste were strengthened through continuous monitoring and approval by Health Division personnel during handling, storage, and transportation of the radioactive waste (Enders 1973, 17-177). Chemical treatment plants were also established in the early 1950s to treat dilute radioactive and acid wastes separately (Emelity 1977, 17-247). Hoods holding radioactive materials were equipped with high-efficiency particulate air filters. Baghouses and cyclone gas-cleaners were put on the stacks of exhaust fans. Residues collected in the bags are disposed off site by service personnel. With the establishment of the permanent material disposal areas (MDAs) in 1957, material has been packaged for disposal in the radioactive area (MDA G) or nonradioactive area (MDA L) at TA-54 (Enders 1968, 17-148). Drum collection became the standard waste disposal mechanism at the Laboratory. Solvents, scrap metal, acids, sludge from storage tanks, waste water, unused paint, gasoline, diesel oil, transmission fluid, and solvent-contaminated rags and tissues were stored in drums. These drums were often trucked out of work areas and stacked at remote sites, such as the drilling area at the end of Sigma Mesa.

As regulations tightened in the 1980s, the Laboratory established a formal waste disposal program as required under 40 CFR 262, Standards Applicable to Generators of Hazardous Waste (EPA 1992, 17-791). Designated storage areas were established in each facility that generated hazardous waste. These satellite and less-than-ninety-day accumulation areas are operated per generator regulations. Any spills or releases from these units are managed under the Laboratory's Spill Prevention Control and Countermeasure Plan (Delta H. Engineering, Ltd. 1990, 17-820). The units are regularly monitored, and have limits on amounts and time that wastes may be stored.

2.3.2 Current Waste Management Practices

Waste-generating operations at OU 1114 conform to Laboratory waste management polices as described in Administrative Requirements (AR-1 through AR-6) of the Laboratory's 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 transuranic waste. These Laboratory waste policies are derived from and meet the requirements of appropriate DOE orders, the State of New Mexico hazardous waste management regulations, and Laboratory practices.

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3.0 ENVIRONMENTAL SETTING

This section describes the existing environmental information for Operable Unit (OU) 1114 technical areas (TAs) 3, 30, 59, 60, 61, and 64, and provides conceptual models for the potential migration pathways of contaminants from solid waste management units (SWMUs) that have been identified in OU 1114.

3.1 Physical Description

OU 1114 is located on the Pajarito Plateau (Fig. 3-1). The Pajarito Plateau is bounded on the west by the Jemez Mountains volcanic complex at an elevation of about 7 800 ft and on the east by the Rio Grande, whose canyon walls descend from an elevation of about 6 300 ft. Potential release sites (PRSs) in OU 1114 are located on South Mesa, and on the mesas between Twomile, Sandia, and Mortandad Canyons. Vegetation varies from ponderosa pine on the west to piñon-juniper woodland at the eastern end of the OU.

The canyons, up to 400 ft deep, drain east-southeast to the Rio Grande. The surface of the plateau narrows from west to east as the canyons get progressively wider. The sides of the canyons are generally very steep, colluvium-covered slopes or bedrock cliffs. The wider parts of the canyons generally possess wider alluvium-filled floors than do the narrower canyons, in which sediment storage is limited (Fig. 3-2).

The mesa tops, which generally have a thin veneer of surficial deposits covering bedrock, change from fairly broad mesas in the west to narrow fingertip mesas at their eastern termini. The topography of the mesas in OU 1114 has undergone considerable cultural modification over the years because of the installation of various roads, buildings, and other Laboratory facilities. The Laboratory's administrative and facility support and several scientific operations are located in TAs 3, 30, 59, 61, and 64. Only TA-60 maintains the original character of the Pajarito Plateau.

3.2 Climate

Los Alamos County has a semiarid, temperate mountain climate. Bowen describes the climate of the county in detail (Bowen 1990, 0033). Climatic data have been collected in the county since 1911. Currently, eight weather stations on the Pajarito Plateau collect precipitation data.

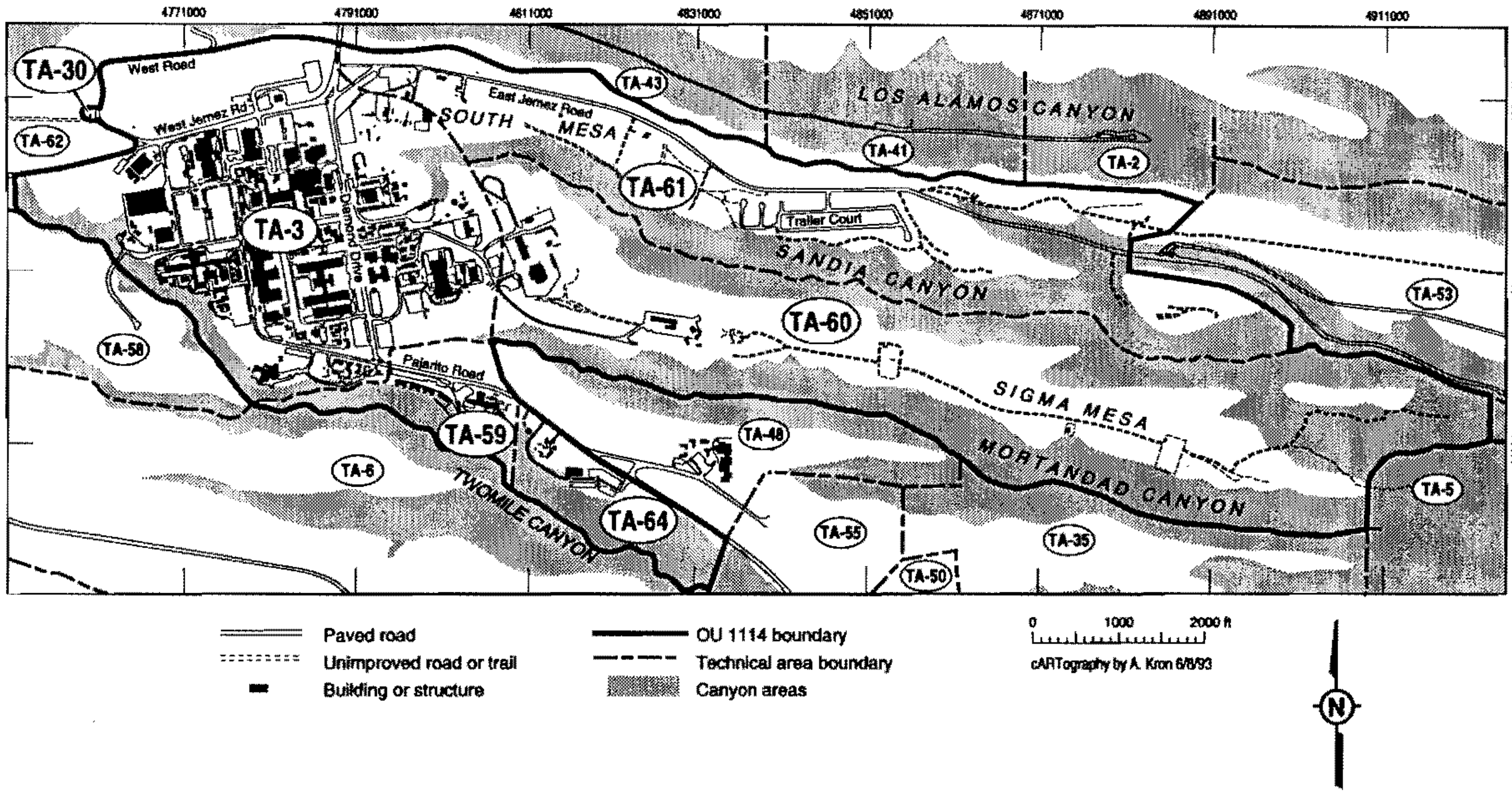

Fig. 3-1. Map of OU 1114 showing major physiographic features and surrounding technical areas.

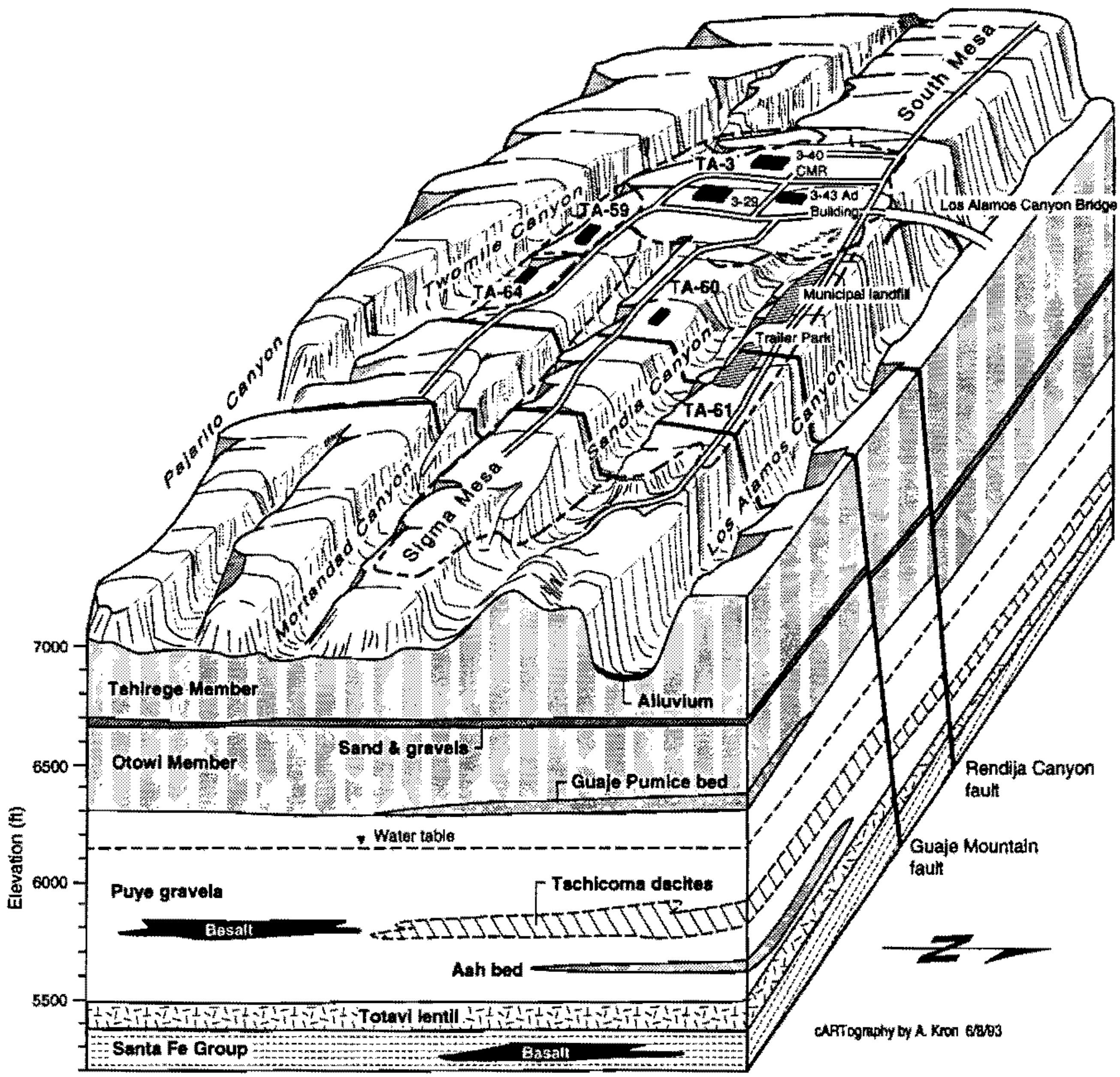

Fig. 3-2. Conceptual geologic model of OU 1114.

Wind directions and speeds are fairly evenly distributed around the compass in frequency and maximum speed, except in the east and southwest. Easterly winds are less frequent and lowest in speed. The southwesterly winds are most frequent (25% of the time) and the strongest (over 20 mph). These prevailing winds blow from OU 1114 toward the main residential area of Los Alamos. Summer afternoon temperatures in Los Alamos are typically in the 70s and 80s (°F), infrequently reaching 90°F, and nighttime temperatures are typically in the 50s. Typical winter temperatures are from 30 to 50°F in the daytime and from 15 to 25°F at night, occasionally dropping to 0°F or below (Bowen 1990, 0033).

Annual precipitation (including both rain and snow) averages about 18 in., and annual snowfall averages about 51 in. Precipitation generally decreases eastward toward the Rio Grande and increases westward toward the Jemez Mountains. As summarized by Bowen, "Los Alamos precipitation is characteristic of a semiarid climate in that variations in precipitation from year to year are quite large" (Bowen 1990, 0033). Recorded extremes in annual precipitation range from 6.8 to 30.3 in. An average of 40% of the annual precipitation falls during thunderstorms in July and August, often in brief, high-intensity rains. Daily rainfall extremes of 1 in. or greater occur in most years, and the estimated 100-year daily rainfall extreme is about 2.5 in. Snowfall is greatest from December through March, and heavy snowfall is infrequent in other months (Bowen 1990, 0033).

3.3 Cultural and Biological Resources

Cultural and biological resource summaries are provided in Appendixes A and B.

3.4 Geology

3.4.1 Bedrock Stratigraphy

The mesa surfaces at OU 1114 are immediately underlain by the Bandelier Tuff of Pleistocene Age, which is underlain by older units (Fig. 3-3). The Bandelier Tuff, which outcrops in a few places on mesa surfaces and is exposed along all canyon walls, comprises two units: the Tshirege and Otowi Members. The Tshirege Member is the uppermost rock unit. It consists of multiple-flow units of crystal-rich ash-flow tuff and displays

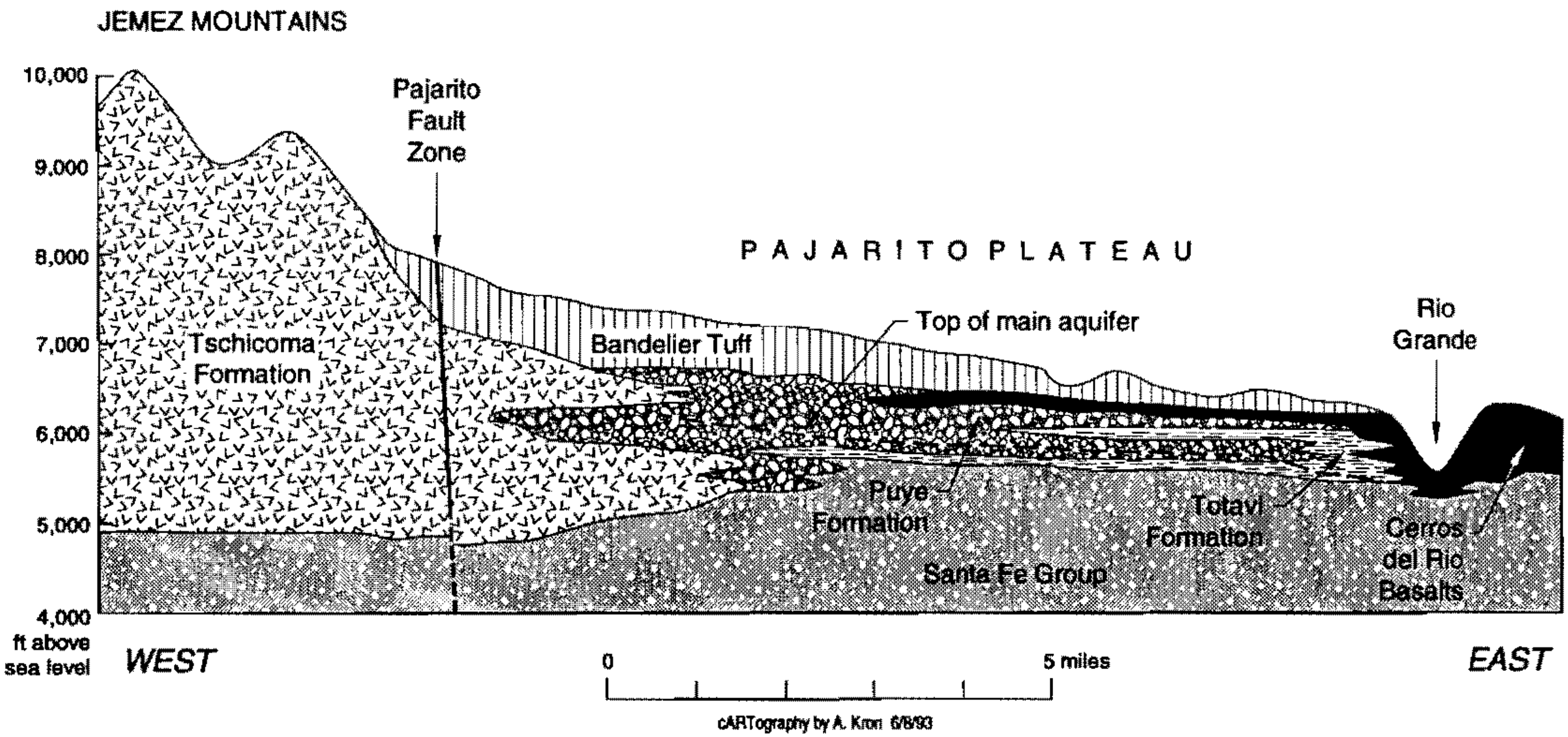

Fig. 3-3. Generalized cross section showing stratigraphy and structure of the Pajarito Plateau from the Sierra de los Valles to the Rio Grande.

significant variations in welding and vapor phase alteration within a single stratigraphic section (Smith and Bailey 1966, 0377). The Otowi Member underlies the Tshirege Member and is a nonwelded, vitric ash-flow tuff composed of multiple-flow units. These tuff units are located in the unsaturated zone and contain massive unfractured porous sequences that appear to provide a thick, absorbent barrier to downward movement of fluids. In this climate, neither natural precipitation nor conceivable amounts of fluids applied to the surface could saturate these layers sufficiently to allow movement of surface water to the elevation of the main aquifer. Potential contamination of the main aquifer because of infiltration from streams or surface runoff will be addressed in the OU 1049 work plan (canyons).

Beneath the Bandelier Tuff, a sequence of intrastratified sedimentary and volcanic rocks of Miocene to Pleistocene Age occur. The Tschicoma Formation consists of voluminous domes and flows of dacite and andesite that interfinger with sediments of the Puye Formation. The Puye beds include stream flow deposits, debris flow deposits, volcanic ash and block flow deposits, and ash fall and pumice fall deposits (Waresback and Turbeville 1990, 0543). Beneath the eastern edge of the Pajarito Plateau, basaltic and andesitic flows, breccias, and scoria associated with the Cerros del Rio volcanic field, which are exposed east of the Rio Grande, interfinger with the Puye Formation. The Totavi Lentil is a coarse, poorly-consolidated axial channel conglomerate deposited by the ancestral Rio Grande, which occurs at the base of the Puye Formation and overlies Santa Fe Group sediments. Rocks of the Puye Formation and Santa Fe Group consist of fluvial sandstone, siltstone, and conglomerate with subordinate eolian deposits, ash beds, and lacustrine sediments. These rocks host the main aquifer in the Los Alamos area.

A general discussion of the geology at the Laboratory can be found in Subsection 2.6 of the Installation Work Plan (IWP) (LANL 1992, 0768).

3.4.2 Structure

A number of near-vertical faults have been observed that show small amounts of displacement in the Bandelier Tuff within the boundaries of OU 1114. Only two of these faults (the Guaje Mountain and Rendija Canyon faults, see Fig. 3-2) have broken the surface of Bandelier Tuff within the confines of the operable unit (Gardner and House 1987, 0110). The Guaje Mountain fault zone crosses OU 1114, running essentially north-south through TA-35, the eastern portion of TA-60, TA-61, and adjacent canyons. The Rendija Canyon fault zone crosses the OU, again running essentially north-south, through TA-48, South Mesa, and adjacent canyons, and is evident as numerous fractures in the Pajarito Road cut in the southwestern corner of TA-55. Another branch of the Rendija Canyon fault has been located parallel to the main fault, lying beneath the intersection leading to TA-48 and north to Los Alamos Canyon, past the western end of the Royal Crest Trailer Park. Broad zones of intense fracturing superimposed on the primary cooling joints sometimes accompany these faults (Vaniman and Wohletz 1990, 0541). In contrast to cooling joints, these tectonic fractures are more likely to cross flow-unit and lithologic-unit boundaries and, thus, may provide more continuous and more deeply-penetrating flow paths for groundwater migration than are provided by cooling joints. However, no PRSs are close to these faults and potential for contamination transport through the Bandelier Tuff is considered minimal.

3.4.3 Surficial Deposits

3.4.3.1 Alluvium and Colluvium

Surficial deposits on the plateau surface of OU 1114 consist of coarse-grained colluvium on steep hill slopes and along the base of cliffs, generally fine-grained fluvial and colluvial sediments with a thin cover of eolian fine-grained sediments on the flatter parts of mesa surfaces, and alluvial fan deposits at the mouths of drainages cut into the mountain front or escarpments related to post-Bandelier faulting. Deposits in the major canyons consist of colluvial materials on and at the base of cliffs and canyon walls, representing large-volume mass wasting, and fluvial sediments deposited by intermittent streams along the axis of canyon floors. Alluvial fans may be present at the mouths of smaller canyons. Fluvial sediments dominate the surficial materials found on the canyon floors, and colluvial materials, including small, local landslides and finer-grained debris flow sediments, predominate on and at the base of canyon walls. Alluvium in the canyons tends to thicken eastward as the canyons widen in the downstream reaches. Older alluvial deposits are represented by terrace deposits along canyon margins at elevations higher than elevations of the modern alluvium that covers the canyon floors.

3.4.3.2 Soils

A large variety of soils have developed in rocks and sediments in OU 1114. Based on a soil survey of Los Alamos County, Nyhan et al. describe the general character of these soils and their association with rock type, climate, slope, and vegetation (Nyhan et al. 1978, 0161).

Soils covering OU 1114 are primarily Carjo loam as classified and mapped and described by Nyhan et al. (1978, 0161). Also present are Tocal, Nyjack, and Seaby series soils. Typical sections of these soils are shown in Fig. 3-4.

3.4.3.3 Erosional Processes

Erosion on the mesa tops in OU 1114 is caused primarily by shallow runoff on the relatively flat part of the mesas, by deeper runoff in channels cut into the mesa surfaces, and by rockfall and colluvial transport on the walls of canyons. Erosion on canyon bottoms occurs primarily by channel flow along stream courses on the canyon floors.

In OU 1114 there are many areas where water is funneled from large impervious surfaces (buildings, parking lots, and other paved surfaces) into drainage channels, which may experience considerable erosion during periods of heavy precipitation. Much spatial variability in erosion rates is to be expected depending on, for example, gradient, vegetation, degree of welding of the tuff, and slope faces. Erosion rates in alluvium of the canyon bottoms is also quite variable, depending on water volume, gradient, vegetation, and local base lines.

The fine loamy soils may become airborne during episodes of high winds, particularly where natural vegetation has been removed or disturbed.

Contaminants stored in soils or sediment fills on mesa tops may be transported into the canyons by extreme runoff events on the mesa surface or may be carried in masses of rock and debris as they slide down canyon walls. Contaminated sediments along the canyon floors are likely to be moved toward the Rio Grande during major runoff events. Waste sites most

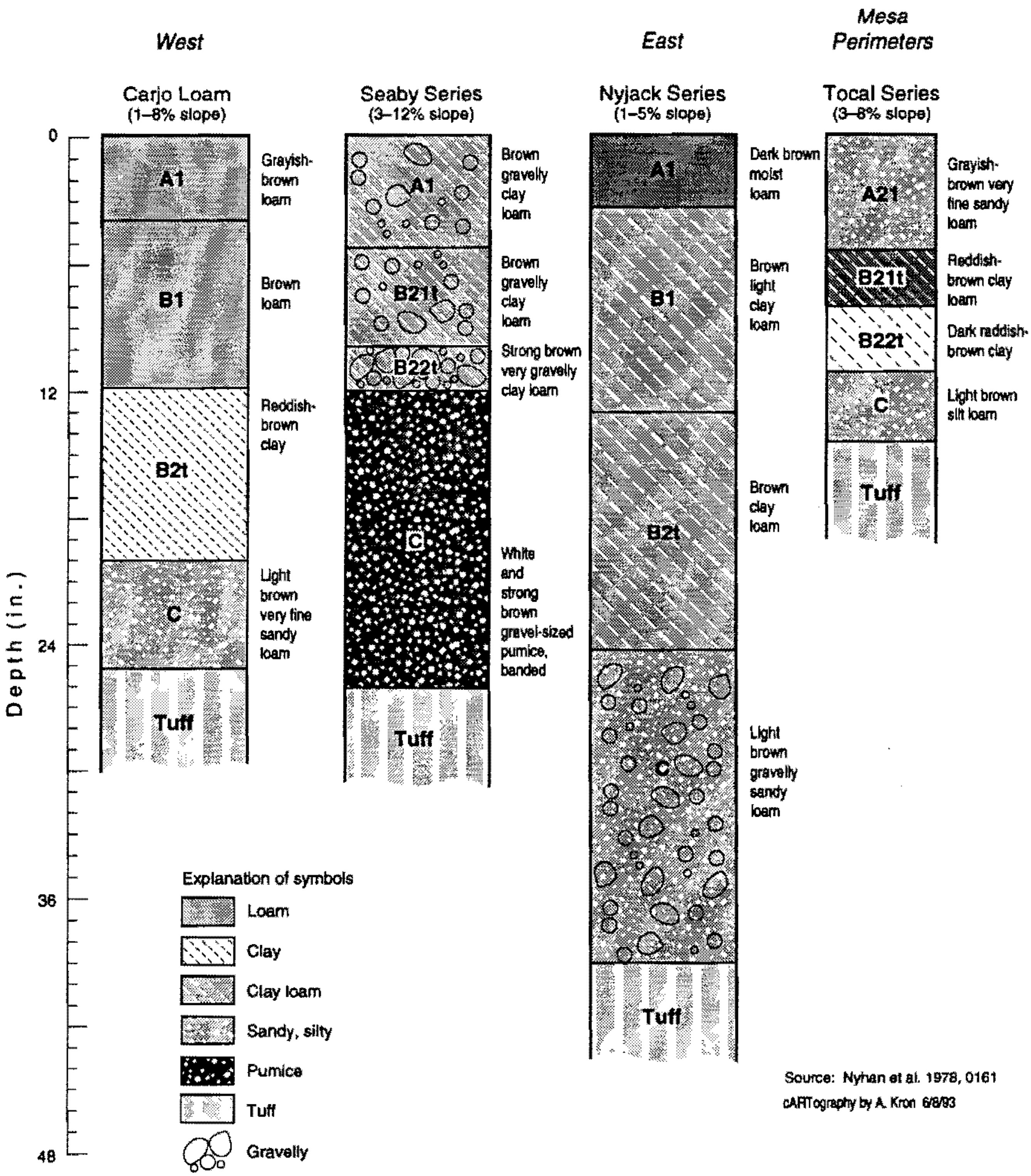

Fig. 3-4. Typical profiles of common soils at OU 1114.

likely to be exposed by erosion in OU 1114 are those that lie close to the edges of mesas or near active drainage channels.

3.5 Conceptual Hydrologic Model

The hydrogeology of the Pajarito Plateau and the occurrence of surface water and groundwater are summarized in Subsection 2.6 of the IWP (LANL 1992, 0768). The canyon and mesa topography and the volcanic ash deposits of the Bandelier Tuff are key features of the Pajarito Plateau and are important in controlling the hydrogeology of OUs. The hydrology (occurrence and movement of water in surface and subsurface environments) of specific PRS sites in OU 1114 is primarily controlled by the topographic location of the PRS on either a canyon rim or mesa top. The majority of PRSs in OU 1114 are located on mesa tops. The groundwater pathway is unlikely to be an important transport pathway in OU 1114 because of the great depth to the main aquifer. However, surface and vadose zone hydrology may strongly influence the stability and movement of contaminants.

3.5.1 Surface Water Hydrology

Surface runoff and soil infiltration are the most important hydrologic transport pathways in OU 1114. Aspects of the surface hydrology that may be relevant to contaminant transport include the: 1) location of pathways of surface water runoff and associated sediment deposition; 2) rates of soil erosion, transport, and sedimentation; 3) effects of operational disturbances on surface hydrology; 4) relative importance of surface runoff as opposed to infiltration as a transport pathway in different soil types; and, 5) nature of interactions between soils and water-borne contaminants.

3.5.1.1 Surface Water Runoff

Surface water runoff is an effective means of transporting many contaminants, particularly highly soluble contaminants. Runoff can potentially mobilize contaminants or concentrate dispersed surficial contaminants through solution and re-precipitation processes. Surface water runoff flows from the mesa tops into canyons and ultimately into the Rio Grande or downgradient aquifers. There is no evidence for the hydraulic connection of surface water and the regional aquifer at the Laboratory (LANL 1992, 0768). However, the potential for contamination reaching the main aquifer from streams and surface runoff will be readdressed in the OU 1049 work plan.

As described in Subsection 3.2, the heaviest precipitation on the Pajarito Plateau occurs during summer thunderstorms. These thunderstorms yield transient high discharge rates that may potentially transport significant amounts of dissolved material, colloids, and contaminated sediments. Both these rain-induced events and snowmelt may yield ephemeral stream flows in the major canyons that may impact the Rio Grande.

No comprehensive study of surface runoff from the major mesa tops and canyons constituting the surface watershed of the Pajarito Plateau has been completed.

3.5.1.2 Surface Water Infiltration

Surface water infiltration is considered to be a minor transport mechanism at the Laboratory because of the great depth of the regional aquifer, the high evaporative potential of the upper tuff, the likelihood of vegetative transpiration, and the resulting naturally low moisture content and high porosity of the tuffs (LANL 1992, 0768). However, the potential for contamination reaching the main aquifer from streams and surface runoff will be readdressed in the OU 1049 work plan.

3.5.2 Hydrogeology

3.5.2.1 Vadose Zone

The mesa top area of OU 1114 overlies up to 1 100 ft of unsaturated volcanic tuff and sediments of the Bandelier and Puye Formations and Cerros del Rio basalts. The hydrology of the mesa top vadose zone is discussed in Subsection 2.6.3 of the IWP, "Review of Studies of the Geohydrology of Mesa Tops and Vadose Zone" (LANL 1992, 0768). Numerous investigations focusing on hydrologic characterization of the upper 100 ft of the Bandelier Tuff have been conducted in the Los Alamos area since the 1950s. These studies suggest that water movement through the tuff to the main aquifer is limited or nonexistent. Factors inhibiting extensive water movement are a high ratio of evapotranspiration to precipitation, a thick vadose zone, and low *in situ* moisture content of the vadose zone.

The hydrologic properties of the Bandelier Tuff have been described by Abeele et al. Porosity of the tuff varies from 20 to 60%; below approximately 35 ft, moisture content of the tuff is consistently less than 10%. Abeele et al. (1981, 0009) noted that weathering and plant roots were absent below 35 ft in the tuff, suggesting that water movement below this depth is very slow and unusual. Abrahams et al. reported limited water movement into the tuff from a small soil pit that held a constant head of water for a period of 99 days. Abrahams et al. (1961, 0015) also monitored soil moisture in a variety of locations and found no evidence of rapid water movement from the soil to the tuff.

The movement of water and contaminants deeper within the tuff has been studied by Purtymun et al. (1989, 0214) and Nyhan et al. (1985, 0168). Purtymun et al. performed injection well experiments into the Bandelier Tuff; 335 000 gal. of water were pumped into the tuff at a depth of 65 ft over a period of 89 days. After 200 days, the water plume extended to a depth of 200 ft. The authors concluded that, unless large quantities of water are provided continuously, there was little chance of water movement from the surface to the main aquifer. Although the vadose zone below 100 ft has not been thoroughly characterized, the general findings summarized in the IWP indicate that the Bandelier Tuff (which forms the mesa top vadose zone) does not bear water except in very shallow and localized areas (LANL 1992, 0768). The low moisture content and extensive thickness of the unsaturated zone minimize the potential for downward movement of water through the Bandelier Tuff and onto the main aquifer. Moreover, it can only be assumed that findings from mesa top studies conducted in areas outside of OU 1114 are representative of conditions in this OU.

3.5.2.2 Saturated Alluvium

Surface water in saturated alluvium within canyons is discussed in Subsection 2.6.4 of the IWP (LANL 1992, 0768). Surface water occurs primarily as an ephemeral stream in Mortandad and Twomile Canyons adjacent to OU 1114, and perennial water flow occurs in Sandia Canyon because effluent is discharged from the sewage treatment plant. Stream loss caused by infiltrating the underlying alluvium typically prevents water flow from discharging across the eastern boundary of the Laboratory. During periods of voluminous runoff from thunderstorm or snowmelt, surface flow may reach the Rio Grande. The areal extent of alluvial aquifers along the main axes of the canyons is not well defined. The OU 1049 work plan will address this infiltration and potential contamination of the main aquifer and the Rio Grande.

3.5.2.3 Perched Aquifers

As water flows downgradient (eastward) in the alluvium, water is lost to evaporation, transpiration, and infiltration into underlying sediments. Infiltration of alluvial groundwater appears to be the main source of recharge for any deeper perched water bodies that may exist. Although the nature and location of the perched layers are not known, the main aquifer does not appear to be hydrologically connected to the overlying perched zones. Hence, these aquifers are not drinking water sources and are not a viable contamination exposure route to the public.

3.5.2.4 Main Aquifer

The main aquifer beneath the Laboratory serves as the municipal water supply for the Los Alamos area and is located in the lower Puye Formation and Santa Fe Group sediments. Depths to the main aquifer are approximately 1 000 ft at the mesa tops and 700 ft in canyon bottoms in OU 1114. Based on current knowledge of the hydrology of the plateau as reflected in the IWP, the potential for impact to the main aquifer and/or the municipal drinking water supply from PRSs in OU 1114 is thought to be extremely low. No significant migration pathway from the plateau's surface or the canyon bottom to the main aquifer is currently recognized by the Laboratory's hydrologists (IWP, Subsection 2.6.2.1) (LANL 1992, 0768). The OU 1049 work plan will address the potential role of faults, fractures, and streams in the possible migration of surface water to the main aquifer.

3.6 Conceptual Three-Dimensional Geologic/Hydrologic Model

A conceptual model for OU 1114 has been developed based on the discussion of the environmental setting presented in Subsection 3.1. The conceptual model is presented in diagram form in Fig. 3-5. The physical

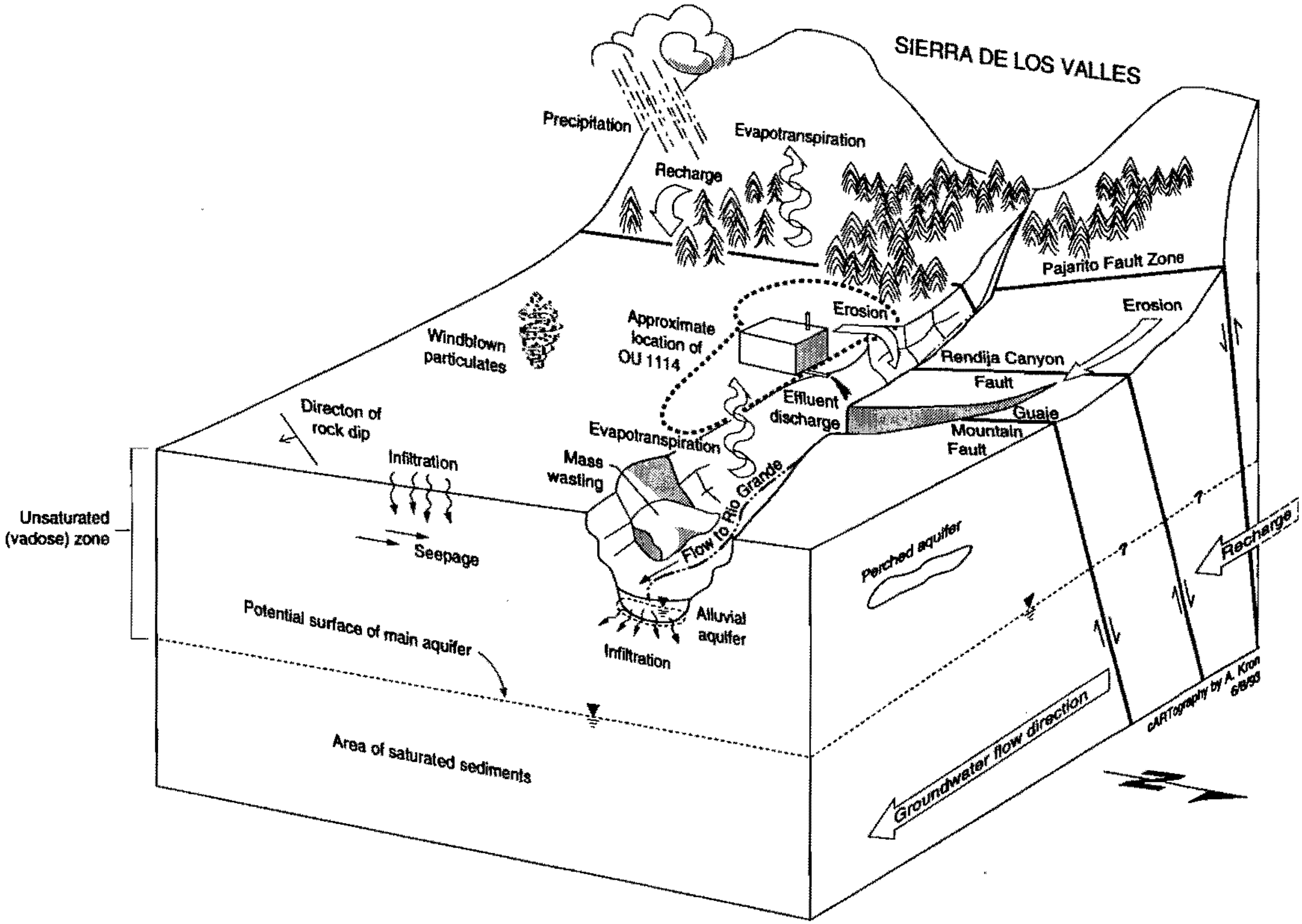

Fig. 3-5. Conceptual hydrologic model of Pajarito Plateau showing general location of OU 1114.

processes and major pathways included in the model are based on current knowledge of the OU environment and the types of PRSs present at OU 1114. The processes and pathways discussed below provide the basis for the PRS-specific conceptual models for potential contaminant releases. The primary release mechanisms and migration pathways of concern are:

- surface runoff and sediment transport,
- infiltration and transport in the vadose zone, and
- atmospheric dispersion.

These pathways are believed to provide the greatest potential for release and transport of contaminants, when they are present, to the environment at OU 1114. Based on existing data presented in the IWP and the present level of knowledge of the PRSs in OU 1114, it is strongly felt that no pathway exists to the main aquifer below the plateau. The OU 1049 work plan will address this issue in greater detail, especially for the canyon bottoms. Therefore, groundwater is not discussed further in this work plan. Release mechanisms and migration pathways of concern are discussed below.

3.6.1 Surface Water Runoff and Sediment Transport

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

3.6.2 Infiltration and Transport in the Subsurface

Infiltration into surface soils and tuff and fluid transport in the subsurface depend on the rates of precipitation and snowmelt, the amount of ponding, antecedent moisture content, and the hydraulic properties of soil and tuff.

In OU 1114, the only surface that is broad, flat, and gently sloping enough to consider infiltration as a transport mechanism is TA-3. Much of this area is paved and/or has a well-developed drainage system to allow runoff from storms and snowmelt to flow into surrounding canyons with little or no penetration of the surface soils. TAs 59, 60, 61, and 64 are located along the edge of a mesa or on narrow mesas: there is little resident time for surface water to infiltrate into the surface soils. Surface runoff has a short, direct route into the canyons and beyond the OU boundaries. The contribution of this runoff to infiltration and subsurface flow will be addressed in RFIs for other OUs, particularly the OU 1049 work plan. This study will include lateral flow and/or perched water at geologic unit contacts between layers whose hydraulic properties differ and in alluvial aquifers in the bottoms of canyons.

3.6.3 Atmospheric Dispersion

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

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- Conceptual Exposure Models
- Potential Response Actions and Evaluation Criteria
- Sampling Strategies
- Analytical Methods

4.0 TECHNICAL APPROACH

4.1 Aggregation of Potential Release Sites (PRSs)

The potential release sites (PRSs) to be evaluated in this Resource Conservation and Recovery Act (RCRA) facility investigation (RFI) work plan were aggregated in Operable Unit (OU) 1114 by proximity, physical similarity, and similarity of historical use. Table 4-1 lists 10 aggregates in OU 1114, the solid waste management unit (SWMU) numbers, and generic strategies for aggregation. These PRSs are discussed in Chapter 5. PRSs that are candidates for *no further action* (NFA) or deferred action (DA) are listed in Table 4-2 and discussed in Chapter 6, including the criteria used for these decisions. An NFA decision that is based on absence of human health risk does not imply that ecological risks do not exist. The first digit(s) of the SWMU or AOC number identify the technical area in which it is located.

TABLE 4-1

PRS AGGREGATION BASIS

SWMU OR AOC ID	SINGLE PRS OR AGGREGATE DESCRIPTION	SUB-SECTION	BASIS OF AGGREGATION	NUMBER OF PRSs IN AGGREGATE
3-002(c)	Decommissioned storage	5.1	N/A	1
C-60-005, 60-007(b)	Motor pool	5.2	Similar in proximity	2
3-015, 59-004	Outfalls	5.3	Physically similar	2
3-033	Point/spot spill	5.4	N/A	1
3-012(b), 3-014(a-z), 3-014(a2-c2)	Sanitary treatment system	5.5	Similar historical use and proximity	34
60-006(a)	Septic tank	5.6	N/A	1
60-004(b), 60-004(d), 60-004(e), 60-007(a)	Sigma Mesa east	5.7	Similar historical use and proximity	4
60-004(c), 60-005(a)	Sigma Mesa solar pond	5.8	Similar proximity	2
3-013(a), 3-013(b)	Storm drains	5.9	Originate from same structure	2
3-003(a), 3-003(b), 3-056(c), 61-001	Waste oil storage areas	5.10	Similar historical use and physical description	4

TABLE 4-2

PRSs PROPOSED FOR NO FURTHER ACTION OR DEFERRED ACTION

SWMU ID	LOCATION	DESCRIPTION	SUBSECTION	STEP	RATIONALE
3-001(a)	TA-3-39	Less than 90 days storage	6.1.2.1	2, NFA	Regulated storage
3-001(b)	TA-3-39	Satellite accumulation area	6.1.2.1	2, NFA	Regulated storage
3-001(c)	TA-3-102	Less than 90 days storage	6.1.2.1	2, NFA	Regulated storage
3-001(k)	TA-3-16	Decommissioned drum storage	6.1.4.1.3.2	4, NFA	No threat
3-001(m)	TA-3-41	Satellite accumulation area	6.1.2.1	2, NFA	Regulated storage
3-001(p)	TA-3-37	Satellite accumulation area	6.1.2.1	2, NFA	Regulated storage
3-001(r)	TA-3-409	Satellite accumulation area	6.1.2.1	2, NFA	Regulated storage
3-002(b)	TA-3-1966	Inactive satellite storage	6.1.2.1	2, NFA	Regulated storage
3-003(c)	TA-3-287	Storage	6.1.4.1.3.2	4, VCA	No threat
3-009(a)	TA-3-73	Surface disposal	6.1.4.1.2	4, NFA	No threat
3-009(b)	TA-3-41	Surface disposal	6.1.4.1.2	4, NFA	No threat
3-009(c)	South of TA-3-66	Abandoned cement fence post bases	6.1.4.1.2	4, NFA	No threat
3-009(d)	South of TA-3-40	Asphalt and metal disposal	6.1.4.1.2	4, NFA	No threat
3-009(e)	Southeast of TA-3-29 into Mortandad Canyon	Canyon fill	6.1.4.1.2	4, NFA	No threat
3-009(f)	North of TA-3-16	Road construction	6.1.4.1.2	4, NFA	No threat
3-009(g)	South of Twomile Bridge	Borrow pit	6.1.4.1.2	4, NFA	No threat
3-009(h)	Northeast corner of Diamond Dr. and Pajarito Rd.	Road construction debris	6.1.4.1.2	4, NFA	No threat
3-010(a)	TA-3-30	Mercury surface disposal	6.1.3.2	3, DA	VCA
3-010(b)	North side of wing 5, TA-3-29	Vacuum pump oil	6.1.4.1.3.1	4, NFA	No threat
3-010(c)	North of TA-3-216	Vacuum pump oil	6.1.4.1.3.1	4, NFA	No threat
3-010(d)	East of TA-3-141	Vacuum pump oil	6.1.4.1.3.1	4, NFA	No threat
3-012(a)	Southeast of TA-3-66	Bifluoride release	6.1.4.1.3.2	4, NFA	No threat
3-013(c)	West of TA-3-38	Cable cleaning	6.1.4.1.3.2	4, NFA	No threat
3-013(d)	West of TA-3-38	Hydraulic bender	6.1.4.1.3.2	4, NFA	No threat
3-013(e)	TA-3-36	Antifreeze spill	6.1.4.1.3.2	4, NFA	No threat
3-013(f)	East side of TA-3-66	Tar melting	6.1.4.1.3.2	4, NFA	No threat
3-013(g)	Northeast of TA-3-316	Dumpster site	6.1.4.1.3.2	4, NFA	No threat
3-013(h)	South of TA-3-39	Storage	6.1.4.1.3.2	4, NFA	No threat
3-018	TA-3-16	Cesspool	6.1.4.1.3.6	4, NFA	No threat
3-020(a)	North of TA-3-287	Pit	6.1.4.1.3.3	4, NFA	No threat
3-020(b)	Southeast of TA-3-70	Pit	6.1.4.1.3.3	4, NFA	No threat
3-026(d)	TA-3-16	Sump/lift station	6.2.3.1	3, DA	Active, no pathway
3-028	TA-3-73	Surface impoundment	6.1.3.1.4	3, DA	Active, no pathway
3-029(b)	South of TA-3-271	Asphalt for fill	6.1.3.2	3, DA	VCA
3-035(a)	TA-3-36 service station	Underground storage tank	6.1.1.1	1, NFA	Undergone closure
3-035(b)	Southwest of TA-3-440	Underground storage tank	6.1.3.1.3	3, DA	Active, no pathway
3-036(a)	TA-3-70	Asphalt storage	6.1.4.1.3.4	4, NFA	No threat
3-036(c)	TA-3-70	Asphalt storage	6.1.4.1.3.4	4, NFA	No threat
3-036(d)	TA-3-70	Asphalt storage	6.1.4.1.3.4	4, NFA	No threat
3-036(e)	TA-3-70	Asphalt storage	6.1.4.1.3.4	4, NFA	No threat

TABLE 4-2 (continued)

PRSs PROPOSED FOR NO FURTHER ACTION OR DEFERRED ACTION

SWMU ID	LOCATION	DESCRIPTION	SUBSECTION	STEP	RATIONALE
3-037	TA-3-66	Holding tank	6.1.3.1.3	3, DA	Active, no pathway
3-038(a)	TA-3-700	Acid neutralizing and pumping building	6.1.4.1.3.5	4, NFA	No threat
3-038(b)	TA-3-738	Acid retention tank (waste)	6.1.4.1.3.5	4, NFA	No threat
3-039(a)	TA-3-43	Silver recovery unit	6.1.4.1.1	4, NFA	Inactive, disrupts active
3-039(b)	TA-3-28	Silver recovery unit	6.1.4.1.1	4, NFA	Active, no pathway
3-039(c)	TA-3-40	Silver recovery unit	6.1.4.1.1	4, NFA	Inactive, disrupts active
3-039(d)	TA-3-32	Silver recovery unit	6.1.4.1.1	4, NFA	Active, no pathway
3-039(e)	TA-3-409	X-ray processing unit	6.1.4.1.1	4, NFA	Active, no pathway
3-043(e)	TA-3-36	Underground storage tank	6.2.1.1	1, NFA	Closure
3-044(a)	TA-3-70	Decommissioned drum storage	6.1.3.1.1	3, DA	Active, no pathway
3-044(b)	TA-3-102	Decommissioned storage	6.1.2.1	2, NFA	Approved storage
3-055(b)	West of TA-3-30	Outfall	6.2.4.1.1	4, NFA	No threat
3-056(a)	TA-3-271	Oil storage	6.2.3.1	3, DA	Active
3-056(b)	TA-3-70	Decommissioned drum storage	6.1.3.1.1	3, DA	Active, no pathway
30-001	North of TA-3-142	Electronics site	6.2.4.1.1	4, NFA	No threat
59-001	TA-59-1	Septic system	6.1.4.1.3.6	4, NFA	No threat
59-002	TA-59-1	Drum storage	6.2.4.1.1	4, NFA	No threat
59-003	TA-59-1	Sumps	6.2.4.1.1	4, NFA	No threat
60-001(a)	TA-60-1	Active container storage	6.1.2.1	2, NFA	Approved storage
60-001(b)	TA-60-2	Storage area	6.2.4.1.1	4, NFA	No threat
60-001(c)	TA-60-17	Satellite accumulation area	6.2.2.1	2, NFA	Regulated storage
60-001(d)	TA-60-29	Pesticide shed	6.2.4.1.1	4, NFA	No threat
60-002	Sigma Mesa	Storage	6.1.4.1.2	4, NFA	No threat
60-003	TA-60-1	Oil-water separator	6.2.4.1.1	4, NFA	No threat
60-004(a)	Sigma Mesa	Material storage	6.2.4.1.1	4, NFA	No threat
60-005(b)	Sigma Mesa	Drilling operations	6.2.4.1.1	4, NFA	No threat
60-006(b)	Sigma Mesa	Septic system	6.2.4.1.2	4, NFA	No threat
60-006(c)	TA-60	Septic system	6.2.1.2	1, NFA	Duplicate
61-002	TA-61-23	PCB storage area	6.1.1.2	1, NFA	Duplicate SWMU
61-003	E. Jemez Rd.	Alleged burn pit	6.2.1.2	1, NFA	Nonexistent
61-004(a)	TA-61-23	Septic system	6.2.4.1.2	4, NFA	No threat
61-004(b)	0.8 mi east of E. Jemez Rd. and Diamond Dr.	Septic system	6.2.4.1.2	4, NFA	No threat
61-004(c)	TA-61 Landfill	Septic system	6.2.4.1.2	4, NFA	No threat
61-005	TA-61 Landfill	County landfill	6.1.3.1.2	3, DA	Active, no pathway
61-006	TA-61 Landfill	Waste oil	6.1.3.1.2	3, DA	Active, no pathway
61-007	E. Jemez Rd.	PCB oil contamination	6.1.1.1	1, NFA	Undergone closure
64-001	TA-64-1	Satellite accumulation area	6.2.2.1	2, NFA	Regulated storage

4.2 Site Characterization Decision Model

This work plan adheres to the Laboratory's Environmental Restoration (ER) Program technical approach for data collection and evaluation as documented in Chapter 4 of the Installation Work Plan (IWP) (LANL 1992, 0768). This technical approach adopts the philosophy of the observational approach (Appendix G) (LANL 1992, 0768), which bases decisions for action [e.g., collecting additional data vs. moving from the facility investigation to the corrective measures study (CMS)] on definitions for acceptable uncertainties that depend on the current phase of the investigation. Investigations are phased so that decisions remain closely tied to the ultimate goal of selecting an appropriate corrective action and are formulated in consideration of what is already known about the site. The Laboratory's ER Program has adopted a risk-based approach to making corrective action decisions during the RFI process. In this work plan, the data quality objectives (DQO) process (Chapter 4 and Appendix I of the IWP) is used to identify site-specific risk-based decisions or risk-related questions to identify, and in some cases quantify, risk-based decision errors. The DQO process is also used to specify sampling designs to support the risk-based decisions or risk-related questions (LANL 1992, 0768). The approach for evaluating ecological risks is currently under development; therefore, ecological risks will be assessed as part of a later phase of this investigation. Subsection 4.4 presents the status of the ecological assessment.

A goal of this RFI is to confirm the presence or absence of contaminants of concern (COCs). COCs are defined as hazardous constituents or radionuclides whose levels (adjusted for background, if necessary) are above screening action levels (SALs) (LANL 1992, 0768). SALs are media-specific concentration levels for constituents derived using conservative criteria. They are discussed in Subsection 4.2.1.

The first step in the RFI is to evaluate archival information and make field reconnaissance visits to formulate a conceptual model for each site (Fig. 4-1). These data help develop a list of potential contaminants of concern (PCOCs), which are further defined in Subsection 4.3.1.

As shown in Fig. 4-1, NFA or DA may be recommended after the first step of the RFI. Criteria for NFA based on archival information are discussed in

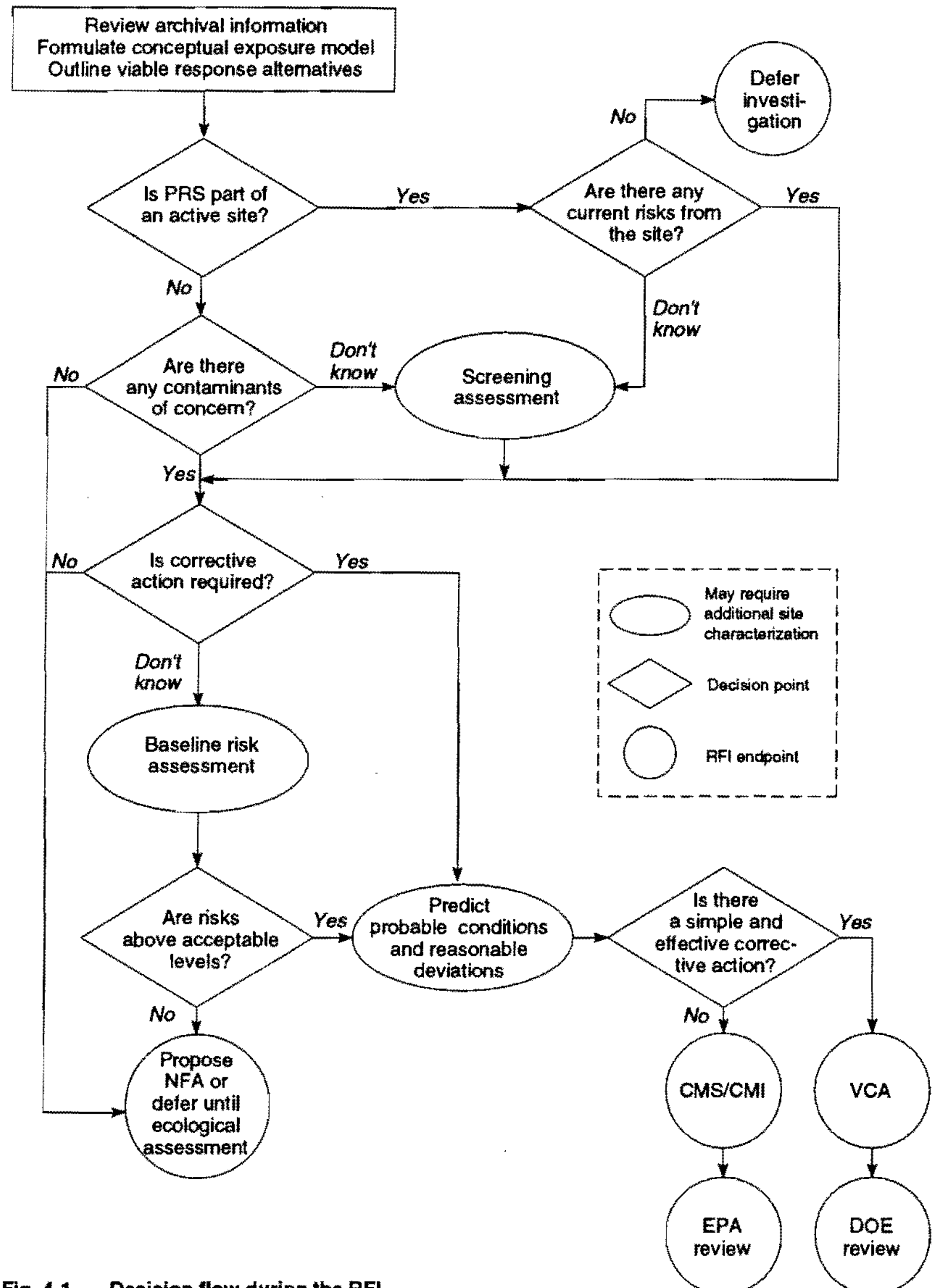

Fig. 4-1. Decision flow during the RFI.

Subsection 4.5.1 of this work plan, and the details are described in Appendix I, Subsection 4.1, of the IWP (LANL 1992, 0768). The PRSs recommended for NFA or DA based on archival information are presented in Chapter 6 of this work plan.

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

For many PRSs in OU 1114, archival information indicates a high probability that there are no COCs at the site, but no confirmatory sampling data exist, and the archival information is not sufficient to recommend NFA. For these sites and sites where virtually no information exists, a Phase I screening assessment will be conducted to determine the presence or absence of COCs. The generic logic flow for screening assessments is shown in Fig. 4-2. Descriptions of sampling strategies for screening assessments are given in Subsection 4.6.

While there are various approaches for collecting data in support of a screening assessment, the primary strategy employed at OU 1114 is reconnaissance sampling. The purpose of reconnaissance sampling is to determine if there are any COCs at a PRS for which little or no historical information exists. As Fig. 4-2 depicts, the process for identifying COCs incorporates a test of whether observed concentrations can be distinguished from known background values; if the answer to this question is yes, then the observed value (adjusted for background if necessary) is compared to SALs (LANL 1992, 0768).

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

In some cases, these actions will need to be preceded or supplemented by additional data collection activities (Phase II sampling). Phase II sampling can have a variety of goals; e.g., supporting a baseline risk assessment,

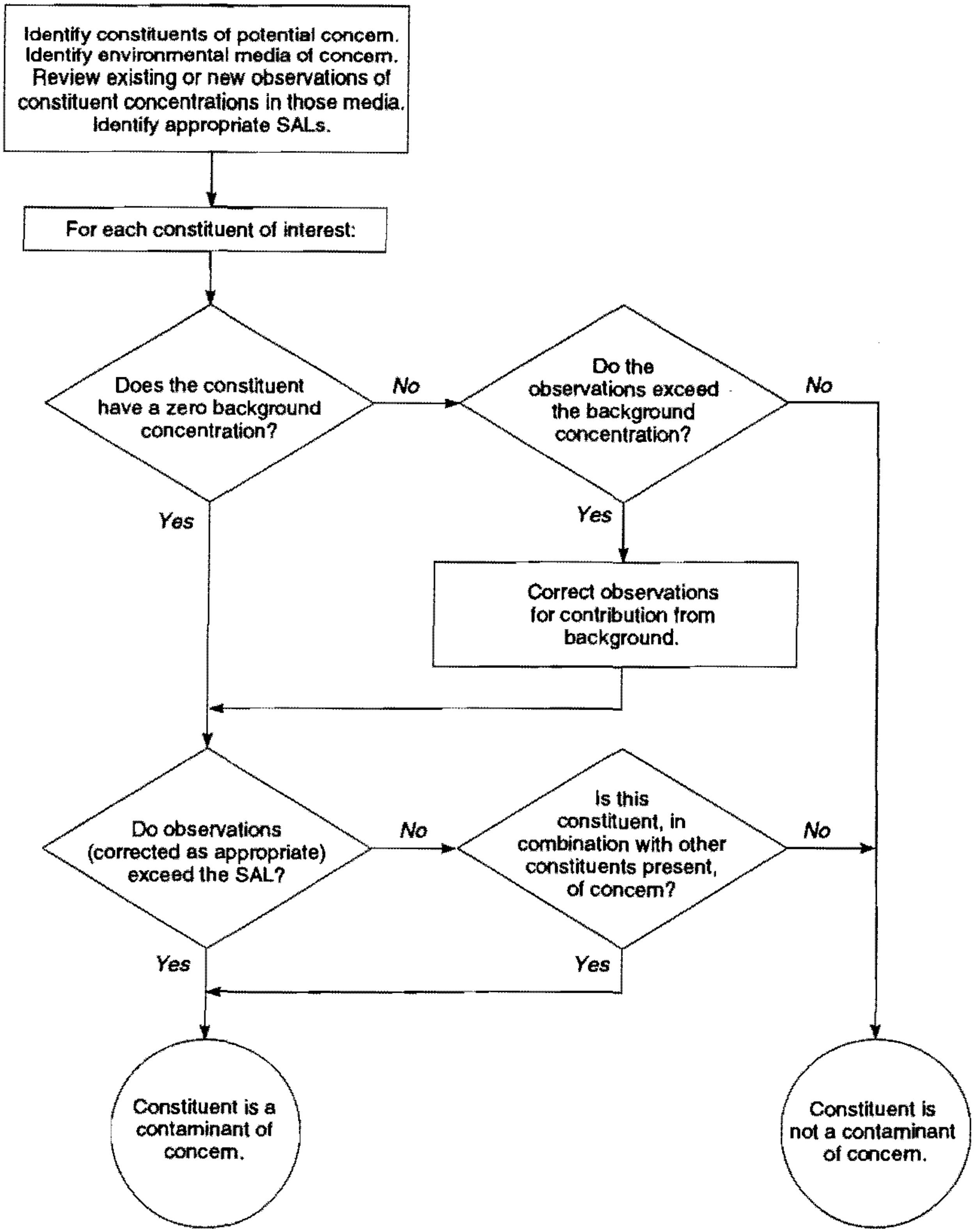

Fig. 4-2. Decision logic for screening assessments.

establishing the nature and extent of contamination, monitoring a VCA. Whenever Phase II sampling is required, it will be proposed in amended versions of this work plan.

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

4.2.1 Screening Action Levels

SALs are media-specific concentration levels for potential contaminants derived using conservative criteria. In most cases, SALs for non-radiological constituents are based on the methodology in Proposed Subpart S of RCRA to calculate action levels (EPA 1990, 0432). Radiological SALs are based on a 10 mrem per year dose using a conservative residential-use exposure scenario. SALs for radionuclides can be derived using the residual radioactive material (RESRAD) code that has been developed for the Department of Energy (DOE) (Gilbert et al. 1989, 0754). However, if a regulatory standard exists and is lower than the value derived by these methods, this lower value will be used for the SAL. The derivation of SALs is discussed in Chapter 4 of the IWP, and the values are given in Appendix J (LANL 1992, 0768). The motivation for developing SALs is to have a tool for effective discrimination between problem and non-problem sites so that resources are used effectively. SALs are not cleanup levels; cleanup levels will be based on site-specific risk evaluations and as low as reasonably achievable (ALARA) criteria. In most cases, cleanup levels will be higher than SALs. For example, if the site will never be used for residential purposes, the site-specific land use scenario (e.g., recreational use) could lead to cleanup levels higher than the SALs derived from a conservative residential-use scenario. SALs for the primary PCOCs at OU 1114 are provided in Table 4-3.

Field screening and laboratory analysis for screening levels proposed for use in the field investigations for OU 1114 PRSs are outlined in detail in Appendix D, Field Investigation Approach and Methods, Sections 4.0 and 6.0.

4.2.2 Voluntary Corrective Actions

During the development of this RFI work plan, VCAs will be undertaken when necessary to protect the health and safety of the public and Laboratory

TABLE 4-3

BACKGROUND AND SCREENING ACTION LEVELS OF REGULATED SUBSTANCES AT OU 1114

POTENTIAL CONTAMINANTS OF CONCERN	CRQL[a] (mg/kg)	BACKGROUND MEAN/n (mg/kg)	BACKGROUND RANGE (mg/kg)	SCREENING ACTION LEVEL IN SOIL (mg/kg)
Metals				
Barium	40	410/40	120-810 [b]	5 600
Beryllium	1 [c]	1.9/37	1.1-3.3[b]	0.16
Cadmium	1	170/36	0.030-0.52 [b]	80
Chromium III	2			80 000
Chromium VI	2			400
Lead	0.6	24/40	8-98[b]	500 [d]
Mercury	0.04	18/39	.007-.029 [b]	24
Nickel	8	8.9/40	1.6-19[b]	1 600
Silver	2	<1.6/74	1.6-7.5[e]	400
Uranium		3.4/75	1.54-6.73 [e]	240
Volatile organic compounds				
Acetone	0.01	0	0	8 000
Benzene	0.01 [c]	0	0	0.67
1,1,1-Trichloroethane	0.01	0	0	1 000
1,1,2-Trichloroethane	0.01	0	0	6.3
Trichloroethene	0.01	0	0	3.2
Semivolatile organic compounds				
Benzo(a)pyrene	0.33 [c]	0	0	0.10
Phenols	0.33	0	0	48 000
Cyanide	2	0		1 600
PCBs		0	0	0.09
Pesticides				
Herbicides				
Radionuclides (pCi/g)				
Cesium-137		0.43 /64[f]	0-1.4 [f]	4[g]
Plutonium-238		0.001/76[f]	0-0.01 [f]	27[g]
Plutonium-239/-240		0.007/76[f]	0-0.05 [f]	24[g]
Tritium		.98/43[f,h]	<0.09-.98[f,h]	15 000 000[g]
Uranium-235		not determined	not determined	18[g]

a Contract-required quantitation limits (CRQLs) for soil [Appendix J of IWP (LANL 1992, 0768)]
b Ferenbaugh et al. 1990, 0099
c The SAL is less than the CRQL; therefore, special analytical services may be required.
d Soil SAL based on EPA OSWER Directive 9355.4-02, "Interim Guidance on Establishing Lead Cleanup Levels at Superfund Site," Office of Solid Waste and Emergency Response, 1989, 17-801.
e Duffy and Longmire 1993, 17-802.
f Purtymun et al. 1987, 0211
g Determined by Laboratory risk assessment committee.
h Assuming 10% soil moisture

personnel, when waste site conditions are such that a VCA is an appropriate response to stop further migration or dispersion of contaminants into the environment, or when cost-effective. When investigating several PRSs, a VCA can be recommended as a proactive measure. In units of limited area where hazardous constituents are known or suspected, corrective action (e.g., removal of soil into 55-gal. drums) will be initiated, guided by field screening to the point where regulatory cleanup is accomplished. After the corrective action is complete, confirmatory samples will be submitted for fixed-laboratory analyses. At OU 1114, VCAs are proposed only for units that will not generate mixed waste. These types of VCAs may be limited until the new mixed waste storage/disposal facility becomes operational in 1996 or 1997. VCAs will be described in technical quarterly reports to the Environmental Protection Agency (EPA), and the public will be informed of VCAs in quarterly public meetings, but the ER Program will not formally solicit EPA approval until final approval of the cleanup is requested.

4.2.3 Active Sites

It is not appropriate to characterize or evaluate corrective actions for active surface PRSs at this time because of continually changing site conditions. Subsurface PRSs present no current health hazard and characterization of these PRSs would seriously disrupt active operations. Therefore, final investigations and permanent corrective actions for active PRSs or PRSs beneath active sites will be addressed when each site is decommissioned. However, it is necessary to ascertain if any off-site migration of contaminants from these PRSs is occurring or is likely to occur. If off-site migration of potential contaminants is occurring, then either a Phase II survey will be conducted or a VCA will be implemented. It is prudent to evaluate subsurface contamination from active septic systems to potentially reduce costs of future remediation efforts. If COCs are detected in an active drain field or outfall area, then either a Phase II survey will be conducted or a VCA will be implemented.

Active sites and those determined to be candidates for DA are among PRSs listed in Table 4-2. The history and rationale for disposition of these PRSs is presented in Chapter 6.

4.3 Conceptual Exposure Models for OU 1114

A conceptual exposure model was developed to identify potential constituent migration pathways and potential human receptors. This model determines the location and magnitude of sampling needed to accurately characterize the PRSs at OU 1114. A conceptual model includes four elements: 1) identification of PCOCs; 2) characterization of the release of COCs; 3) determination of migratory pathways; and, 4) identification of human receptors. Subsection 4.3.1, Potential Contaminants of Concern, presents an overview of the selection of PCOCs at OU 1114. Subsection 4.3.2, Potential Environmental Pathways, discusses the PCOC release mechanisms and migration pathways. Subsection 4.3.3, Potential Human Health Impacts, contains a PRS-specific conceptual model for each PRS aggregate that describes potential current and future receptors and potential exposure to site-related constituents.

4.3.1 Potential Contaminants of Concern

The objectives of the Phase I sampling activity are to accomplish the following:

1. confirm the presence or absence of anticipated PCOCs from known past site activities,

2. use broad spectrum analytical methods that will allow for a reasonable determination that additional PCOCs are not present (e.g., the evaluation of tentatively identified compounds from mass spectral scans),

3. select analytical methods primarily on the basis of sensitivity for anticipated PCOCs at their SALs and secondarily for broad-band-spectrum capability, and,

4. estimate if the concentration of each PCOC is greater than some method threshold.

These data will be used to determine if any site PCOC exceeds some specified, unacceptable concentration. If a site problem is determined, then these data will provide information needed to design a Phase II study that would further define the extent of the unacceptable area or volume of media contaminated and the potential risk to receptors from the site.

Table 4-3 lists the regulated substances that have been identified through archival information as PCOCs for OU 1114. Chemical constituents that are essential human nutrients at low concentrations and toxic at very high levels (e.g., potassium, magnesium) will not be quantified in a baseline risk assessment (EPA 1989, 0305).

The main classes of PCOCs located at OU 1114 are volatile organic compounds, semivolatile organic compounds, metals, and radionuclides. These categories correspond to a method of analysis used to quantify their presence in samples [Section 7.0 of Appendix D, Field Investigation Approach and Methods, lists the standard operating procedures (SOPs) used for these standard suites of chemicals]. Types of volatile organic compounds found at OU 1114 include solvents and chemicals used in laboratory projects. Semivolatile organic compounds include a variety of chemical groups, and some used at OU 1114 include polychlorinated biphenyls (PCBs) used in transformers and polycyclic aromatic hydrocarbons (PAHs) found in waste oils. Pesticides and herbicides are found in specific locations. These substances are specifically analyzed for and are thus considered their own classes.

4.3.2 Potential Environmental Pathways

Chemical or radionuclide PCOCs at OU 1114 may have been released into the environment via drainages, outfalls, or landfill areas, or inadvertently as liquid spills, leaks, or spattering to surface soil from storage areas, storage tanks, or surface impoundments.

After potential contaminants have been released into the environment, they can potentially migrate via: 1) liquid infiltration into near-surface or subsurface soils that may reach groundwater or result in seepage to the surface, 2) volatilization into ambient air, 3) wind entrainment of contaminated dust and deposition onto surface soils, and, 4) surface water overflow and then runoff resulting in the contamination of sediments in drainage channels.

The major migration pathways and relevant environmental media through which human exposure to residual contaminants could occur are summarized in Table 4-4. Pathways that may be complete but are considered less significant include uptake by animals (e.g., cows and elk) from ingestion and inhalation of contaminated media and root uptake by plants from contaminated soils. The contribution of these exposure pathways is likely to be minor in comparison to pathways listed in Table 4-4.

TABLE 4-4

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

MIGRATION PATHWAYS	CONTACT MEDIA	RESULTING POTENTIAL HUMAN EXPOSURE ROUTES
A. Liquid infiltration into near-surface or subsurface soils	1. PCOCs in subsurface soils	1. None (unless erosion, then refer to exposure routes for B and C)
B. Wind entrainment and dispersal of surface soil and atmospheric dispersion of volatiles	1. PCOCs deposited on surface soils and edible plant surfaces 2. PCOCs in air (particulate matter and volatile compounds)	1. Ingestion of soil, dermal contact with soil, and ingestion of plants 2. Inhalation of fugitive dust or volatile compounds
C. Surface water runoff carrying soil/sediment in suspension and in solution	1. PCOCs deposited in drainage sediments 2. PCOCs released to surface waters 3. Contaminated surface water infiltrating surface and subsurface soils	1. Ingestion of sediments and dermal contact with sediments 2. Ingestion of surface water and dermal contact with surface water 3. Ingestion of soil and dermal contact with soil
D. Soil erosion and excavation, exposing subsurface contaminated soil to the surface	1. Feeds wind dispersal (B) and surface water runoff (C)	1. Refer to exposure routes for B and C

Potential migration of PCOCs from PRSs in OU 1114 to the main aquifer is thought to be extremely low; therefore, groundwater is not a plausible pathway for migration of constituents at OU 1114. Refer to Section 3.0 of Chapter 3 for a discussion on the hydrology of the main aquifer beneath OU 1114.

Perched water, however, may be present in OU 1114. Potential contaminant movement into perched water, and through fractures or faults in the subsurface, is possible subsequent to infiltration or leaching into the vadose zone. Currently, there are no groundwater wells on site.

4.3.3 Potential Human Receptors

This subsection discusses how people could potentially be exposed to site-related PCOCs in the absence of site remediation and presents the conceptual site model. Currently, the land within the boundaries of OU 1114 is used for Laboratory operations, two privately-owned cement mixing plants (on land leased from DOE), and the privately-owned Royal Crest Trailer Court (on privately owned land) located approximately 0.25 mile east of the nearest PRS (61-004) within OU 1114. Therefore, current land use consists of on-site workers and residents living at the trailer court. Future land use could encompass recreational users and continued Laboratory operations. Expanded residential use would be unlikely because OU 1114 is located in an area with low population density and projected low growth rate. Land use scenarios are defined in Subsection 4.3.3.2.

4.3.3.1 Conceptual Site Model

The conceptual exposure models (Figs. 4-3 through 4-5) identify historical sources of environmental release, historical migration and conversion, potential current sources of contaminants, potential release mechanisms, contact media, and exposure routes for each PRS. Elements of the conceptual models are presented in Table 4-5.

Fig. 4-3 presents the conceptual exposure model for aggregates that have potential surface soil contamination, including decommissioned storage (pesticide storage shed, leaks/spills), waste oil (leaks/spills), and Sigma Mesa east (leaks/spills). The conceptual exposure model for potential surface and subsurface contamination is presented in Fig. 4-4. The aggregates included are the motor pool (spills/leaks), storm drains (waste disposal/runoff), outfalls (waste disposal/runoff), a septic tank (waste disposal), Sigma Mesa solar pond (waste disposal), and a point/spot spill (overflow). Figure 4-5 presents the conceptual exposure model for the sanitary treatment system aggregate.

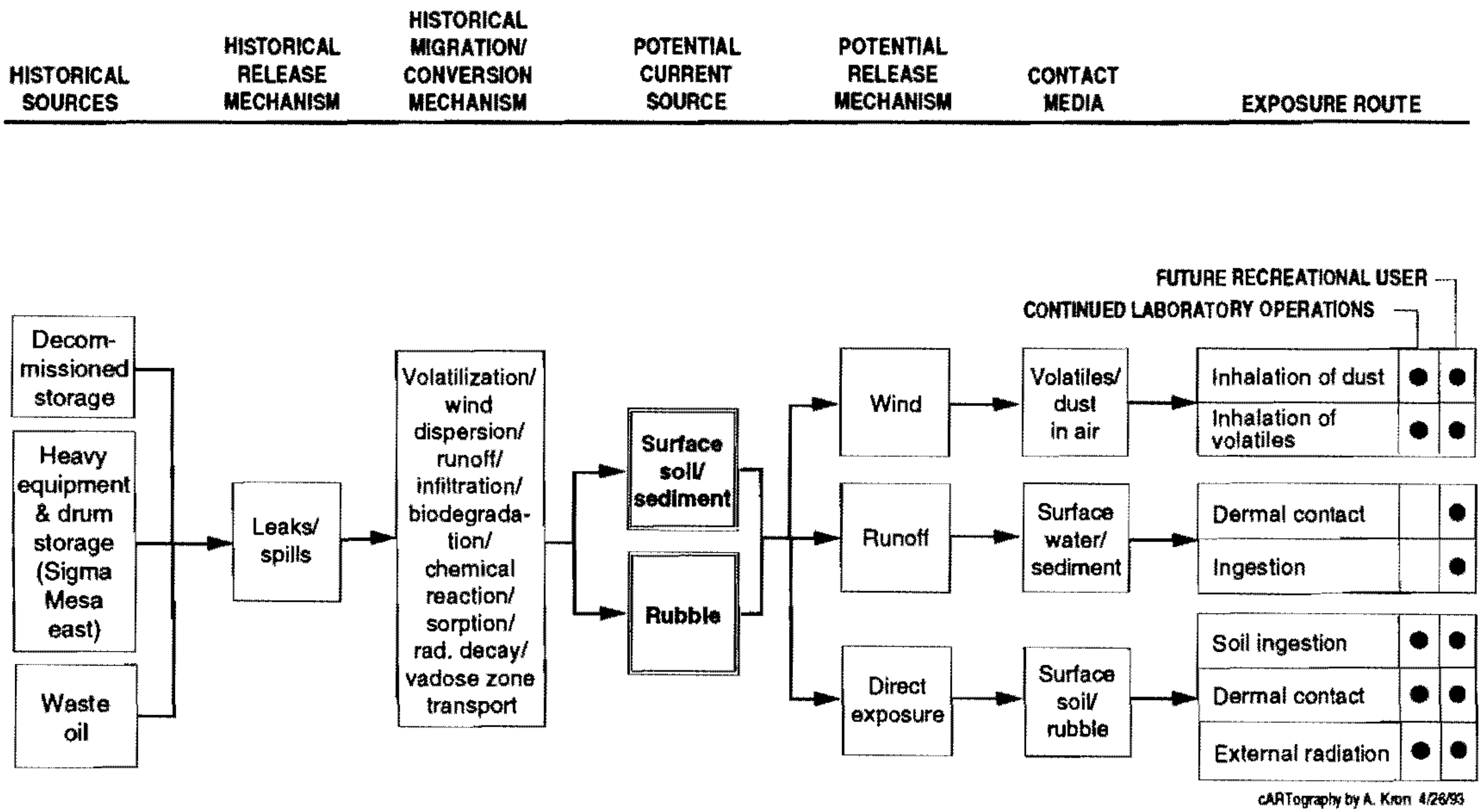

Fig. 4-3. **Conceptual exposure model for potential surface contamination.**

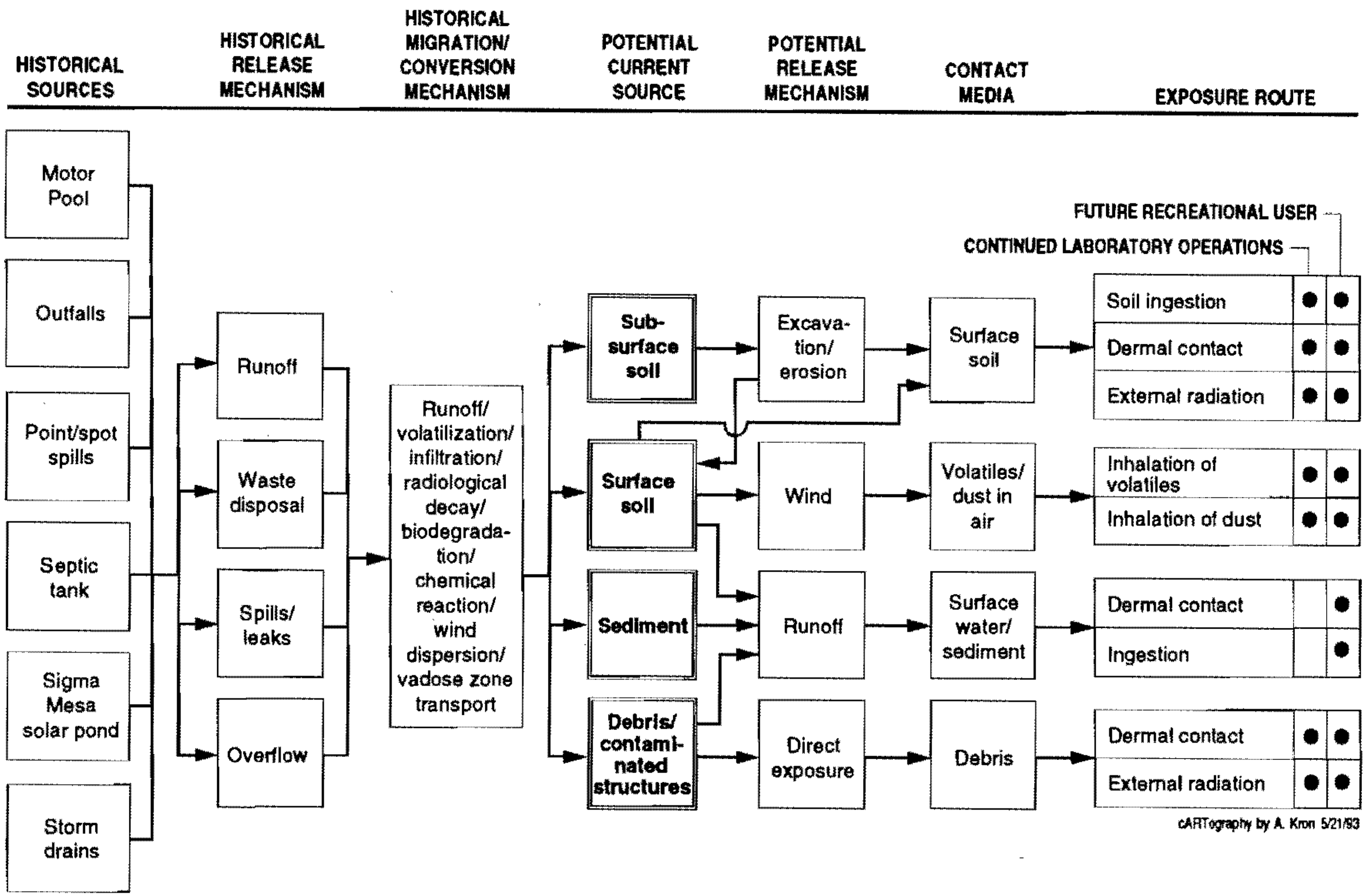

Fig. 4-4. Conceptual exposure model for surface and subsurface contamination.

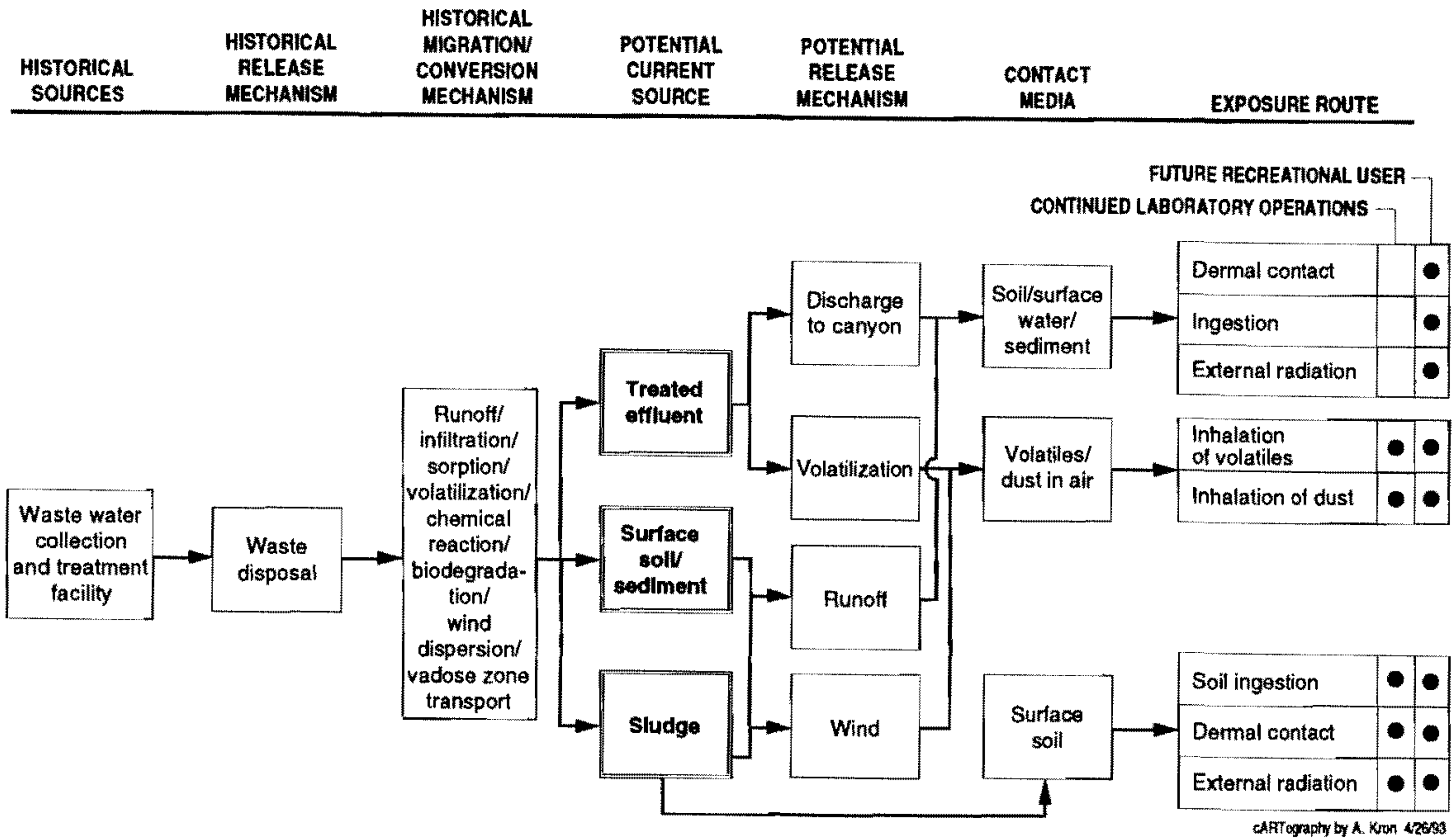

Fig. 4-5. Conceptual exposure model for the sanitary septic system aggregate.

TABLE 4-5

SUMMARY OF CONCEPTUAL MODEL ELEMENTS

PATHWAYS/MECHANISM	CONCEPT/HYPOTHESES
HISTORICAL SOURCES	• Operations/processes that contributed to the creation of the PRS (i.e., storage area, etc.)
PRS RELEASE MECHANISM	• Any spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, leaching, dumping, or disposing into the environment
MIGRATION PATHWAY/ CONVERSION MECHANISM	
Atmospheric dispersion	• Entrainment is limited to chemicals in surface soils
Particulate dispersion	• Entrainment and deposition are controlled by soil properties, surface roughness, vegetative cover and terrain, as well as atmospheric conditions
Volatilization	• Volatilization occurs to volatile organic compounds in surface soils, subsurface soils, and surface water
Surface water runoff *Surface water*	• Surface runoff is directed by natural topographic features or manmade diversions and flows toward the canyons. A topographic low can cause the water to pond on the mesa top, but in most cases the water will flow into the canyon • Chemical transport by surface runoff can occur in solution, sorbed to suspended sediments, or as mass movement of heavier bed sediments • Surface runoff may carry chemicals beyond the OU boundary • Contaminated surface runoff may infiltrate the canyon-bottom alluvium
Sediments	• Surface soil erosion and sediment transport is a function of runoff intensity and soil properties • Chemicals dispersed on the soil surface can be collected by surface water runoff and concentrated in sedimentation areas in drainages • Erosion of drainage channels can extend the area of contaminant dispersal in the drainage
Alluvial aquifers	• *Surface runoff discharged to the canyons may infiltrate* into sediments of channel alluvium
Infiltration	• Infiltration into surface soils depends on the rate of precipitation or snowmelt, antecedent soil water status, depth of soil, and soil hydraulic properties • Infiltration into the tuff depends on the unsaturated flow properties of the tuff • Joints and fractures in the tuff may provide additional pathways for infiltration to enter the subsurface regime
POTENTIAL RELEASE MECHANISM	
Leaching	• Storm water/snowmelt can dissolve chemicals from soil or other solid media, making them available for contact • Water solubility of chemicals and their relative affinity for soil or other solid media affects the ability of leaching to cause a release • Leaching and subsequent resorption can extend the area of contamination
Soil erosion	• The erosion of surface soils is dependent on soil properties, vegetative cover, slope and aspect, exposure to the force of the wind, and precipitation intensity and frequency • Depositional areas as well as erosional areas exist, and erosive loss of soil may not occur in all locations • Storm water runoff can mobilize soils/sediments, making them available for contact • Storm intensity/frequency, physical properties of soils, topography, and ground cover determine the effectiveness of erosion as a release mechanism • Erosion may also enlarge the contaminated area
Mass wasting	• The loss of rock from the canyon walls is a discontinuous, observable process • The rate of the process is extremely slow
Resuspension (wind suspension)	• Wind suspension of contaminated soil/sediment as dust makes chemicals available for contact via *inhalation/ingestion* • Physical properties of soil (e.g., silt content, moisture content), wind speed, and size of exposed ground surface determine effectiveness of wind suspension as a release mechanism • Wind suspension can enlarge the area of contamination and create additional exposure pathways, such as deposition on plants followed by plant consumption by humans/animals

TABLE 4-5 (continued)

SUMMARY OF CONCEPTUAL MODEL ELEMENTS

PATHWAYS/MECHANISM	CONCEPT/HYPOTHESES
Excavation	• Manual or mechanical movement of contaminated soil during construction, remediation, or other activities makes contaminated soil available for dermal contact, ingestion, and inhalation as dust • The method of excavation (i.e., type of equipment), physical properties of soil, weather conditions, and magnitude of excavation activity (i.e., depth and total area of excavation) influence the effectiveness of excavation as a release mechanism • Excavation can increase or decrease the size of the contaminated area, depending on how the excavated material is handled
EXPOSURE ROUTE	
Inhalation	• Vapors, aerosols, and particulates (including dust) can be inhaled and absorbed by the lungs and mucous membranes. • Physical and chemical properties of airborne chemicals influence the degree of retention in the body after being inhaled
Ingestion	• Ingestion of soil, water, food, and dust can lead to chemical intake via absorption in the gastrointestinal tract
Direct contact	• Some hazardous chemical constituents will absorb through the skin when in contact with contaminated surfaces of soil, tuff, or rubble • Physical and chemical properties of chemicals influence the degree of dermal absorption • Factors such as skin moisture and temperature affect the degree of dermal absorption
External penetrating radiation	• External, or whole body radiation, can occur through exposure to gamma-ray-emitting radionuclides that may be present in soil either directly through the soil or re-entrained dusts • Exposure to penetrating radiation can also occur through inhalation or ingestion when radionuclide-contaminated soil or tuff surfaces erode and/or dusts become re-entrained

Formulation of the conceptual exposure models for OU 1114 is based on available PRS information only. Further refinement or development of separate models may be necessary based on data gathered through the RFI.

Site-specific information on PRS aggregates, such as PCOCs and migration pathways, is presented in Chapter 5.

4.3.3.2 Potential Human Exposure

To identify the presence of COCs, sampling plans proposed for OU 1114 will involve comparing analytical data from samples to SALs. SALs are based on a conservative, residential scenario. If measured concentrations exceed SALs, or if several chemicals come close to SALs, then a Phase II study will be initiated even if none of the individual PCOCs exceed SALs. If soil is found to be contaminated (SALs are exceeded) in Phase I or Phase II, the human exposure to these contaminants will be quantified in a baseline risk assessment. Human exposure is estimated through a model of the reasonably-maximum-exposed individual who is defined through assumptions of current and future land use (EPA 1989, 0305;

EPA 1991, 0746; EPA 1992, 17-800). Three land use scenarios may be evaluated in a baseline risk assessment for OU 1114; continued Laboratory operations (current and future), recreational (future), and residential (current). The first two scenarios are discussed in Subsections 4.3.3.2.1 and 4.3.3.2.2. The residential scenario will be confined to the Royal Crest Trailer Court. No PRSs are located within the trailer court and residential use is not likely to expand in the future. The only relevant exposure pathway to residents at the trailer court is through inhalation of ambient air. Air emissions from the PRSs in OU 1114 are minimal because the majority of the site is developed with paved roads and parking lots and landscaped areas. Generation of fugitive dust may occur during site construction in OU 1114.

Currently, no commercial dairy or beef operations are located in the vicinity of OU 1114. In the future, if the land reverts to National Forest, limited cattle grazing may be a possibility. The number of cows that this area would be able to sustain is small because of the semiarid climate. Cattle would have to graze over a large area. Therefore, this exposure scenario will not be evaluated in a baseline human health risk assessment because it is expected to be minor in comparison to scenarios already being evaluated. Refer to Subsection 4.3 of the 1992 IWP for ER programmatic guidance on probable land use scenarios (LANL 1992, 0768).

Depending on site-specific parameters (i.e., types of PCOCs present or migration potential), the worst-case exposure scenario (i.e., the reasonably-maximum-exposed individual) may vary. For PRSs in which two scenarios may be applicable, both exposures will be calculated to determine the worst-case scenario. For any baseline risk assessment, the 95% upper confidence limit on the arithmetic average concentration of COCs over the appropriate exposure area, either surface or subsurface soils, is sufficient to quantify human exposure. It is assumed that contact with soils in all areas of the site is equally probable. Data are averaged over an exposure unit, which is determined by the land use scenario.

Assumptions made for the continued Laboratory operations and recreational scenarios are developed below.

4.3.3.2.1 Continued Laboratory Operations Scenario

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

On-site workers (e.g., maintenance workers, office workers) are expected to be routinely exposed to contaminated media; therefore, this scenario is considered the most conservative exposure scenario for those PRSs in OU 1114 that consist of potential surface contamination (0 to 6 in.) on the mesa top. Surface contamination above SALs will be evaluated for both current and future risks in a baseline risk assessment using the on-site worker scenario. PRS aggregates with potential surface contamination on the mesa top include: decommissioned storage, the motor pool, outfalls, a point/spot spill, a sanitary treatment system, Sigma Mesa east, Sigma Mesa solar pond, storm drains, and waste oil.

The construction worker is expected to be exposed to subsurface contamination during excavation activities. Once subsurface soil is excavated and brought to the surface, on-site workers could also be exposed. Therefore, PRSs in OU 1114 that consist of subsurface contamination above SALs will be evaluated in a baseline risk assessment using the construction worker and on-site worker scenarios. PRS aggregates with potential subsurface contamination include the motor pool, outfalls, a point/spot spill, a sanitary treatment system, a septic tank, a solar pond, and waste oil.

Exposure pathways relevant to workers include: 1) inhalation of fugitive dust or volatile compounds; 2) incidental ingestion of contaminated soils; 3) direct dermal contact with contaminated soils; and, 4) external radiation (see Table 4-6).

TABLE 4-6

SUMMARY OF EXPOSURE ROUTES IN THE CONTINUED LABORATORY OPERATIONS SCENARIO

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

4.3.3.2.2 Future Recreational Scenario

The recreational scenario is the most probable future scenario for PRSs consisting of surface contamination (0 to 6 in.) on the canyon wall or canyon bottom. Workers are not expected to come into contact with contaminated media on the canyon wall or bottom because of limited development of these areas. The recreational scenario may include camping, hiking, hunting, and possibly limited construction.

PRSs in OU 1114 that consist of surface contamination above SALs on canyon walls and/or canyon bottoms will be evaluated in a baseline risk assessment using the recreational scenario. PRSs that are located on the canyon wall and/or bottom are primarily outfalls. PRSs that have surface water runoff into a drainage channel or an associated outfall, such as the motor pool, sanitary treatment system, and waste oil, will also be evaluated using the recreational scenario.

Recreational users of the area could come into contact with COCs through ambient air, surface soil, sediments in drainage channels, and pooled surface water.

Exposure pathways associated with recreational activities include: 1) inhalation of fugitive dust; 2) soil ingestion; 3) dermal contact with soil; 4) external radiation; 5) dermal contact with surface water; and, 6) accidental ingestion of surface water (see Table 4-7). Campers are assumed to carry in potable water and food; therefore, exposure through consumption of contaminated edible plants (piñon and berries) is an insignificant pathway

TABLE 4-7

SUMMARY OF EXPOSURE ROUTES IN THE RECREATIONAL SCENARIO

EXPOSURE ROUTE	ASSUMPTIONS
1. Inhalation of ambient air (fugitive dust or volatiles)	• Fugitive dust is generated by the wind and during recreational activities (e.g., dirt biking) • There may be volatile constituents on site that would contribute to the inhalation exposure
2. Incidental ingestion of soil	• Incidental soil ingestion of surface or sediments may occur as a result of recreational activities (standard daily soil ingestion rates for adults and children are used)
3. Dermal contact with soil	• Skin surface area available for contact with soil includes arms, hands, face, legs, upper body, and head (the camping event occurs in warm weather).
4. External radiation	• Irradiation from radionuclides on the ground surface may occur
5. Dermal contact with surface water	• Ephemeral streams may be present as a result of snowmelt and summer rainfall • Rainfall events result in pooled water • Standing water occurs after the rainfall event before it seeps into the ground
6. Accidental ingestion of surface water	• Ephemeral streams may be present as a result of snowmelt and summer rainfall • Rainfall events result in pooled water • Standing water occurs after the rainfall event before it seeps into the ground

in the recreational scenario. No body of water large enough to support a consistent supply of game fish exists; therefore, exposure to contaminants by consuming contaminated fish is not a viable pathway for this site.

4.4 Ecological Risk Assessment

Ecological risk assessment methodology is currently under development and will be available in the next IWP. NFA for individual PRSs will be proposed based on a comparison to human health risk-based SALs or a baseline health risk assessment, but an ecological risk assessment will have to be conducted to identify ecological effects. If unacceptable ecological effects are identified, then the NFA decisions will be revised. The contribution of all PRSs, including those proposed for NFA, to the unacceptable ecological risk will be assessed so that an effective mitigation strategy can be developed.

Certain environmental criteria, as required by the National Environmental Policy Act (NEPA), endangered species act, wetlands executive orders, or historic preservation, are presented in Appendix B, Biological Resource Summary. These regulatory drivers may be important in future ecological risk assessments, and include:

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

4.5 Potential Response Actions and Evaluation Criteria

Remediation alternatives must achieve acceptable risk levels. Choices between alternatives that meet the human health risk requirements will be based on additional factors such as ecological impact, cost, socioeconomic impacts, public/community input, regulatory concerns (in addition to risk), and impact on Laboratory operations (Appendix I, IWP) (LANL 1992, 0768). Note that all actions refer to potential or known surface and subsurface soil problems. There is no indication that other media are contaminated, which might require other technologies (e.g., steam injection for vadose zone contaminants).

4.5.1 Criteria for Recommending No Further Action or Deferred Action

A PRS may be proposed for NFA if: 1) no COCs are known or found to be present based on historical data or Phase I sampling; 2) releases of COCs are judged not to have taken place and are unlikely to take place in the future; or, 3) some other regulatory program takes precedence. NFA designations are possible at any point in the remedial process. Chapter 1, Subsection 1.3, and Chapter 6, Subsections 6.1 and 6.2 briefly present the basis for NFA and DA decisions for PRSs in this work plan. The PRSs addressed by these criteria are listed in Chapter 6, Table 6-12. Appendix I, Subsection 4.1 of the IWP presents a detailed discussion of the rationale for NFA or DA based on archival information (LANL 1992, 0768).

4.5.2 Disposal and Treatment Options

Appropriate remedial technologies such as removal to an off-site, RCRA-permitted treatment, storage, and disposal (TSD) facility; excavation and removal to the Laboratory mixed-waste facility; excavation and incineration; decontamination (burning or treatment by supercritical water); and recycling will be used at OU 1114.

4.5.3 Conditional Remedies

Conditional remedies for OU 1114 include capping and monitoring surface soil, or installation, maintenance, and monitoring sediment catchments. Conditional remedies are most appropriate for active sites that will be the focus of additional remediation in the future.

4.5.4 Access Restrictions

The majority of the PRSs in OU 1114 are in open, non-secured areas so that the only access restriction for each area is the formality of contacting the proper Laboratory operating group. Some PRSs are within secured areas of the Laboratory. Access restrictions to these PRSs will continue for the foreseeable future.

4.6 Sampling Strategies

All RFI Phase I investigations for OU 1114 are designed to support screening assessments to identify COCs, if any, associated with the PRSs. For most

PRSs within OU 1114, existing information is not sufficient for positive identification of any COCs. In a few instances, the historical information is sufficient to narrow the set of potential contaminants to a small number (e.g., primarily PCBs at the waste oil storage areas discussed in Subsection 5.10, or radionuclides at the solar pond discussed in Subsection 5.8), but not to determine whether these constituents are present in environmental media above the levels of concern defined by SALs in Appendix J of the IWP (LANL 1992, 0768) or other regulatory limits (in particular, the Toxic Substances Control Act for PCBs).

Screening assessments will follow the logic proposed in Subsection 4.1.4 of the IWP (LANL 1992, 0768). In particular, a COC can be identified on the basis of a single observation of a constituent above its SAL. For a small number of constituents, such as arsenic, a comparison with and adjustment for natural background concentrations must precede any comparison with SALs. Many of the sampling plans are biased by professional judgment or field screening to maximize the probability of making such an observation. For some sites the effectiveness of the criteria available to bias sampling is limited by lack of knowledge about the mechanisms controlling the release and migration of contaminants or by the lack of sufficiently sensitive field analytical methods.

Failure to observe any of the potential contaminants above levels of concern during Phase I investigations will generally lead to a proposal of NFA (see equation in Subsection 4.1, Appendix H of the IWP) (LANL 1992, 0768). Therefore, it is important to understand the risks of making an incorrect decision. In the context of a screening assessment, the more serious incorrect decision results from failing to detect contamination when it is present above levels of concern in a significant fraction of the environmental media that compose the decision domain for the site.

The statistical probability of making this type of error is controlled by the number of observations made. Sample sizes are determined by two factors: 1) the fraction of the site so that contamination affecting at least such a fraction would be considered significant and, 2) the frequency with which an error could be tolerated, given such a fraction of contamination. Thus, in order to determine an appropriate sample size, the decision maker must specify these two quantities. This specification should depend on several site-specific characteristics of the decision, including the toxicity and likely inventory of the PCOCs and the heterogeneity of the contamination.

- For relatively homogeneous domains such as sludge in a sump or septic tank, bounds on a central quantile (e.g., less than 30% or 50% of the domain contaminated) suffice. For heterogeneous domains, bounds on more extreme percentiles (e.g., 15% or less of the domain affected) are sought. (It should be noted that heterogeneity refers to the scale of variability or "clumpiness" of potential contamination relative to the size of the domain, rather than on an absolute scale.)

- If the potential problem is not severe, either because the potential contaminants are of low toxicity or because (by the nature of the process that generated the site) the total inventory can not be large, then lower confidence levels (e.g., a detection failure probability of 0.2 or 0.25) can be tolerated. In cases of greater potential impact, greater confidence (e.g., a failure probability of 0.10 or less) is needed.

More generally, a decision maker might specify the acceptable error frequency as a function of the contaminated fraction. Figure 4-6 is a representation of Table H-1 in Appendix H of the IWP (LANL 1992, 0768). Table 4-1 gives minimum sample sizes to ensure a given probability of detection (i.e., one minus the probability of error shown in the figure). Whether a single pair or an entire function is specified, Fig. 4-6 can be used to determine the minimum sample size required to provide the desired confidence (i.e., the probability of making an error, plotted on the ordinate axis of Fig. 4-6) across the range of interest for the proportion of the site that is contaminated (plotted on the abscissa, from 0 to 100%). Where sampling has been biased as discussed above, the failure probabilities shown in Fig. 4-6 are overestimates, sometimes very significant overestimates, of the true probabilities of failing to detect a COC.

In OU 1114, which includes the Laboratory's principal administrative and facility maintenance areas but only a relatively small proportion of Laboratory

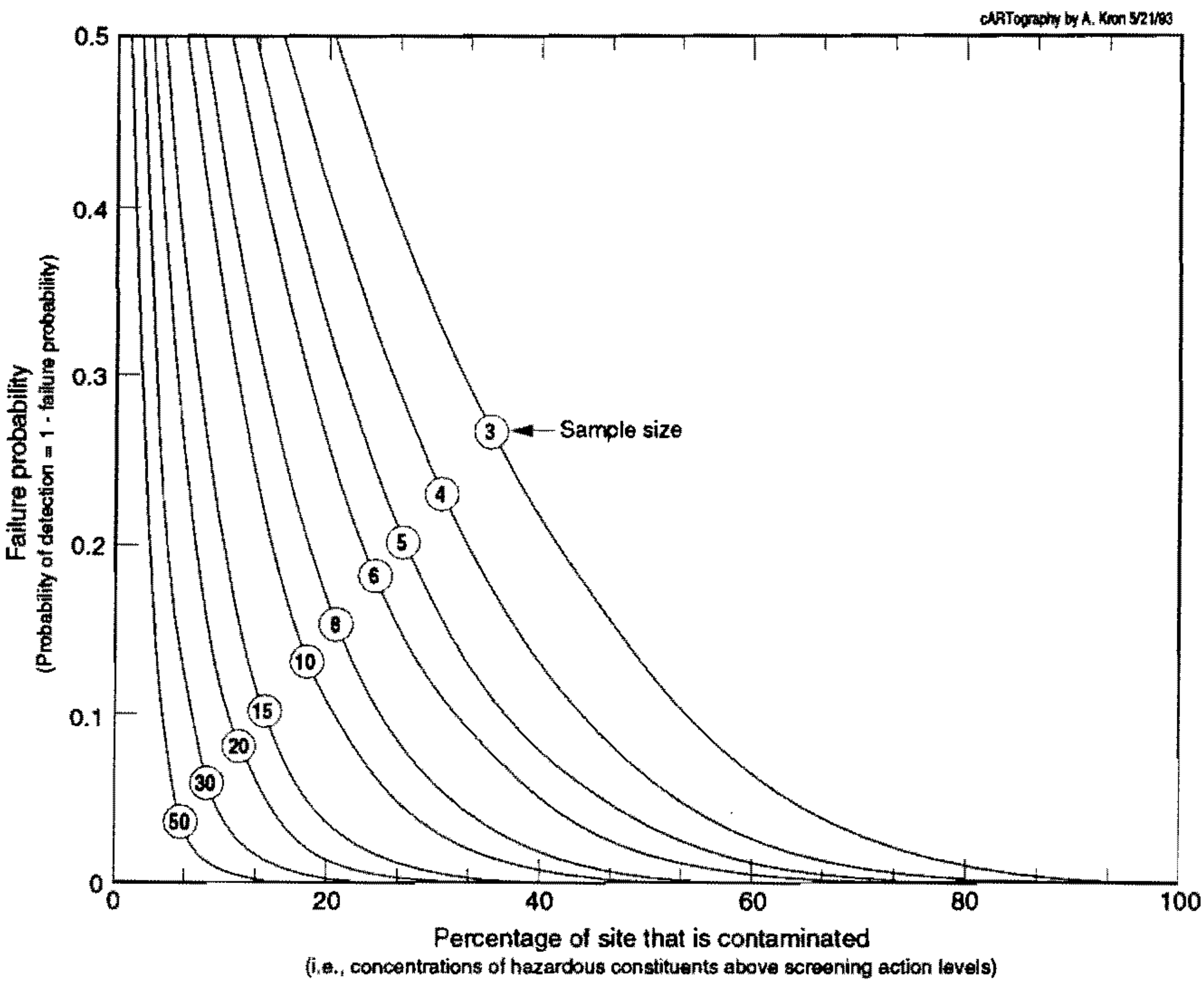

Fig. 4-6. Probability of failing to detect a contaminant of concern (assuming random sampling and independent observations).

activities that entail use of hazardous or radioactive materials, few of the identified PRSs are potentially severe problems, although several are potentially quite heterogeneous. The number of samples for off-site laboratory analysis proposed in Chapter 5 ranges from three to fifteen samples. Heterogeneity can be accommodated in some cases by over-sampling the site and using field analyses (especially field PCB analyses) to select a subset of these samples for more expensive and precise analytical laboratory measurement.

In a few cases, RFI Phase I data may be used as the basis for a baseline risk assessment if the screening assessment identifies one or more COCs. Baseline risk assessments should use unbiased estimates of the mean contamination within exposure units of a size dictated by the appropriate exposure scenario, as discussed in Subsection 4.3. (To be conservative, a statistical upper confidence bound on this mean contamination is often used to calculate the associated exposure and risk.) An average based on data from biased Phase I sampling plans will generally overestimate the mean contamination, and Phase I designs may also fail to provide good estimates of the extent of contamination. Risk assessment based on Phase I data and conservative bounds on extent may overestimate the associated risks by a significant factor. If COCs are identified in Phase I, Phase II investigations will be needed in some cases in order to delineate the extent of contamination more precisely, both to perform a baseline risk assessment and to design a corrective measure if one is necessary. Such Phase II investigations will be tailored to quantify parameters of the appropriate conceptual exposure models as outlined in Subsection 4.3.

Where an obvious and effective corrective action can be identified on the basis of Phase I results, VCA may be undertaken in preference to detailed characterization for formal baseline risk assessment and a CMS. Such actions will be accompanied by field measurements to determine the extent of the area requiring remediation and followed by confirmatory sampling to verify the attainment of cleanup standards.

4.7 Analytical Methods

The analytical methods proposed for use in the field investigations for OU 1114 PRSs are outlined in detail in Appendix D.

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5.0 EVALUATION OF PRS AGGREGATES

The evaluation of each of the potential release site (PRS) aggregates presented herein is submitted in a uniform manner to ensure that all aggregates were addressed against the same presentation format. In many cases, it was determined that no further data were required to satisfy a particular heading or subheading of a section of the evaluation criteria. In those cases, the respective headings were deleted from the text. Table 5-1 lists all PRS aggregates or individual PRSs in Chapter 5, the potential contaminant(s) of concern (PCOCs), physical location, and chapter subsection. Maps showing each PRS within its technical area are in Appendix E. PRS evaluations begin in Subsection 5.1. Sample matrix tables summarize the sample and analysis text for each aggregate using the "best case" scenario. The guidelines used for sample size selection at each PRS aggregate are outlined below, prior to PRS evaluations, to acclimate the reader to the sampling strategies proposed.

5.0.1 Guidelines for Sample Size Selection

Table 5-2 describes the characteristics of OU 1114 PRSs used in determining Phase I sample sizes. Specifically, for the screening assessment sampling strategy described in Subsection 4.6, choice of sample size depends on the decision maker's tolerance for decision error [failure to detect contamination above the screening action level (SAL)] as a function of the fraction of the site that is contaminated. These in turn are affected by prior expectations as to the potential size of the contaminated volume, likely heterogeneity within that domain, and toxicity of the potential contaminants.

The percentage of the site over which contamination should be detected (the abscissa in Fig. 4-6) should be small (5% to 20%) for a potentially heterogeneous site, because for a site of this type, a small fraction of the domain could contain most of the inventory of the contaminant. Conversely, for a relatively homogeneous site, the minimum percentage for which detection is important can be larger (30% to 50%), because no one part of the site is expected to be much worse than any other.

Where the potential contaminants are extremely toxic even in small quantities, or potentially present in very large concentrations (relative to the screening action levels), a low probability of detection failure (5% or 10%) is desirable.

TABLE 5-1

OU 1114 PRS SUBSECTION, AGGREGATION, LOCATION, AND POTENTIAL CONTAMINANT(S) OF CONCERN

SUBSECTION	PRS AGGREGATE/ NUMBER OF PRSs IN AGGREGATE	LOCATION	POTENTIAL CONTAMINANT(s) OF CONCERN
5.1	Decommissioned storage/ 1	100 ft west of TA-3-70	Pesticides, herbicides
5.2	Motor pool/ 2	TA-60-1	Semivolatile organic compounds (SVOCs), PCBs, waste oil
5.3	Outfalls/ 2	TA-3-141, TA-59-1	Depleted uranium, SVOCs, metals, radionuclides
5.4	Point/spot spill/ 1	TA-3-40	Cyanides, metals
5.5	Sanitary treatment system/ 34	East of TA-3-223	Radionuclides, metals, volatile organic compounds (VOCs), SVOCs, pesticides, herbicides
5.6	Septic tank/ 1	TA-60-17	VOCs and SVOCs, metals
5.7	Sigma Mesa east/ 4	TA-60 east end	PCBs, waste oil
5.8	Sigma Mesa solar pond/ 2	TA-60 east end	VOCs and SVOCs, tritium and other low level radionuclides, metals, cyanide, PCBs
5.9	Storm drains/ 2	TA-3-38, TA-3-261	Metals
5.10	Waste oil storage areas/ 4	TA-3-218, TA-3-223, TA-3-253, TA-61-23	VOCs and SVOCs, PCBs, waste oil, metals

In the opposite case of low toxicity or low expected concentrations, higher failure probabilities (up to 25%) are acceptable; the cost of achieving higher confidence in the results is not warranted by the potential problem.

Within OU 1114, the larger sites are also potentially more heterogeneous, so size does not enter as a separate factor here. However, for small sites, decisions are driven primarily by a desire to expedite cleanup, and voluntary corrective action (VCA) is the most likely alternative to no further action (NFA) in most cases. For large sites, final decisions will generally be based on risk assessment, and the screening assessment is a first step designed to identify the contaminants of concern (COCs) for this purpose. If the heterogeneity or severity of contamination in a large site turns out to be greater than expected, more data will probably be collected in a Phase II investigation.

TABLE 5-2

CHARACTERISTICS OF OU 1114 PRSs FOR ESTABLISHING PHASE I SAMPLE SIZES

SUB-SECTION	SWMU OR AOC ID	DESCRIPTION	PCOCS (PROCESSES)	SEVER-ITY	SIZE	VARI-ABILITY	NUMBER OF PROPOSED SAMPLES	SITE-SPECIFIC QA
5.1	3-002(c)	Former pesticide shed	Pesticides (storage)	L	2	M	5 surface samples	1 collocated
5.2	60-007(b)	Drainage ditch north of motor pool	Waste oils, PCBs, metals (vehicle maintenance, transformer storage)	L	3	M/S	7 shallow core samples, 1 confirmatory sample	1 collocated
		Main drainage ditch	Waste oils		3	M/S	5 surface samples, 2 shallow core samples, 1 confirmatory sample	1 collocated
	AOC C-60-005	Two unpaved storage pads	SVOCs, oils	L	2	H/S	8 shallow core samples, 1 confirmatory sample	2 duplicates (1 per pad)
5.3	3-015	Rolling mill outfall	Metals, VOCs (milling, electrochemical)	L	3	M	5 shallow core samples	1 split
	59-004	TA-59-1 outfall	VOCs, SVOCs, radionuclides, photochemicals (analytical laboratories)	L	3	M/S	3 shallow core samples	1 split
5.4	3-033	Plating rinse waste storage	Metals, cyanides (plating operation)	L	1	M	6 shallow core samples	1 collocated
5.5	3-012(b)	Power plant outfall	Metals, radionuclides, VOCs, SVOCs, pesticides, herbicides	L	1	M	2 shallow core samples	
	3-014(c2)	Abandoned outfall	Metals, radionuclides, VOCs, SVOCs, pesticides, herbicides	L	2	M	9 shallow core samples	1 collocated, 1 duplicate
	3-014(b2)	Current outfall	Metals, radionuclides, VOCs, SVOCs, pesticides, herbicides	L	3	M	4 shallow core samples	1 collocated, 1 duplicate
	3-014(a,e)	Area near Imhoff tanks	Metals, radionuclides, VOCs, SVOCs, pesticides, herbicides	L	3	M	5 shallow core samples	1 collocated, 1 duplicate

TABLE 5-2 (continued)

CHARACTERISTICS OF OU 1114 PRSs FOR ESTABLISHING PHASE I SAMPLE SIZES

SUB-SECTION	SWMU OR AOC ID	DESCRIPTION	PCOCs (PROCESSES)	SEVER-ITY	SIZE	VARI-ABILITY	NUMBER OF PROPOSED SAMPLES	SITE-SPECIFIC QA
5.6	60-006(a)	Test rack facility septic tank	VOCs, SVOCs, metals (paint, solvents)	L	1	L	6 samples (2 liquid if present), 2 samples for organic vapor	1 duplicate
5.7	60-004(e)	Transformer storage site	PCBs, waste oils (transformer storage)	L	4	H	Surface samples: 10 remediated area, 2 unremediated area, 2 confirmatory	1 collocated
	60-007(a)	Stained soil and vehicle maintenance area	Waste oils (vehicle maintenance)	L	4	H	Surface samples: 6 remediated, 2 unremediated, 1 confirmatory	1 collocated; 3 split for field QC
	60-004(b), 60-004(d)	Diesel sludge tank storage, underground storage tank	Waste oils (empty fuel tanks)	L	2	M	Surface samples: 3 stained, 4 unstained, 2 confirmatory	1 collocated, 1 split
5.8	60-004(c)	Drum storage area	VOCs, SVOCs, PCBs (temporary storage)	L	2	M	4 shallow core samples	1 collocated, 1 duplicate
	60-005(a)	Solar pond	Radionuclides, metals, cyanides (evaporation experiment using treated effluent)	L	3	M/S	6 shallow core samples (9 analyses: 6 upper layer, 3 lower) in sand/bentonite; 6 mesa top samples	2 splits in sand/bentonite ; 1 collocated
5.9	3-013(a), 3-013(b)	TA-3 storm drain, TA-3-38 floor drains	Metals (storm drains)	L	3	H	5 shallow core samples 1 confirmatory sample	1 duplicate 1 collocated
5.10	3-003(a,b)	PCB equipment storage	PCBs, waste oil, metals (equipment storage)	L	2	M	8 surface samples, 2 chip samples, 4 shallow core samples, 3 confirmatory samples	2 collocated
	3-056(c)	PCB oils, interim action area	PCBs, mercury, VOCs, SVOCs (equipment and drum storage)	L	3	M/S	18 shallow core samples, approximately 9 confirmatory samples	3 splits for field QC, 3 duplicates
	61-001	PCB equipment, remediated area	PCBs (equipment storage)	L	3	M	4 chip samples, 3 sediment samples, 1 confirmatory sample	1 collocated soil

Severity (toxicity and/or potentially high concentrations), heterogeneity, and size of OU 1114 PRSs are categorized as follows in Table 5-2.

5.0.1.1 Severity

L Low for all PRSs by virtue of either low toxicity, expected low levels, or both.

5.0.1.2 Heterogeneity

L Low. Spatial distribution of contamination, if any, should be relatively homogeneous throughout the site.

M Moderate. Spatial variations should be smooth, even if potentially large across the site.

H High. Spatial distribution could be spotty, contamination could be highly localized within the site.

S Stratifiable. Subdomains within which spatial variations should be smaller can be defined based on professional judgment and/or field surveys.

5.0.1.3 Size

1 Very small, less than 0.02 acre.

2 A fraction of a residential exposure unit (EU), 0.02 to 0.1 acre.

3 One to five EUs, 0.1 to 1 acre.

4 Extensive, greater than 1 acre.

5.0.2 Decision Errors

Decision errors can arise from several different sources. These include:

5.0.2.1 **Population variability**, which is of greatest concern when the likely scale of the contamination (determined by release and transport mechanisms) is small compared to the size of the volume to be investigated. This component of error can be controlled by using field screening to improve coverage of the site and by composite sampling where feasible. Its significance can be estimated from collocated samples (defined below).

5.0.2.2 **Sampling error** can be introduced when sampling techniques, sampled media, or constituents of interest are difficult to control (e.g., loss of volatiles during sample collection, constituents that persist despite decontamination of equipment, difficulty of access to the domain of interest). Further problems may arise during packaging and shipping of samples or preparation of aliquots for analysis. Controls are largely procedural. The significance of this error component can be estimated from field splits (defined below) and from QA samples designed to detect sampling bias such as rinsate and trip blanks or field sampling of a prepared matrix.

5.0.2.3 **Analytical error** arises from problems during sample extraction and preparation as well as from instrumental variability. Field methods may be less well calibrated, less stable, or less sensitive than fixed laboratory methods, and may not produce comparable data because of differences in sample preparation. Controls again are largely procedural, including appropriate calibration checks. The significance of this error component can be estimated from blanks and spiked matrix samples (double blind when possible), from laboratory splits (two aliquots from the same sample) and from replicate measurements made on the same aliquot.

5.0.3 QA samples defined

For Phase I sampling at OU 1114, least is known about the component of error due to population variability. Therefore, Table 5-2 also includes suggested sample sizes for field quality assessment (QA) samples of various types. These QA samples are to be prepared on site from the same media as the routine samples. The types suggested in Table 5-2 include collocated samples, field splits (second subsample), field duplicates, and other QA samples defined below.

5.0.3.1 **A collocated sample** is a second sample collected next to the first sample, as close as practicable (usually 1 to 2 ft away), using the same method as the first (both spade or scoop samples, both manual shallow cores, etc.). In general, subsamples for the collocated sample are prepared for each proposed analysis as for the first sample.

5.0.3.2 **A field split** is a second subsample collected in the field from a prepared (e.g., homogenized) sample for a designated type of analysis. This can be appropriate for inorganic, radionuclide, and most semivolatile organic analyses but, in general, is not useful for volatile organic analyses.

5.0.3.3 **A field duplicate** is a second subsample collected for a minimally disturbed field sample (usually a core) for a designated type of analysis. Field duplicates are used in place of field splits for volatile compounds.

5.0.3.4 **Other field QA samples**, such as rinsate blanks, field blanks, and trip blanks, will be included as appropriate. (Guidelines are provided in the generic QAPjP.) In addition, many types of standard laboratory quality control (QC) samples are controlled by the sample coordination facility or individual contract laboratories. These include double-blind samples to the analyst (analyst does not know this is a QA sample), single-blind samples (analyst can tell it is a QA sample but doesn't know "right" answer), samples of standard materials that provide on-line measurements to the analyst (calibration check standard, replicate measurement), and matrix blanks (of same or different matrix from routine samples, but at least single blind).

5.1 SWMU 3-002(c): Decommissioned Storage

5.1.1 Background

5.1.1.1 Description and History

SWMU 3-002(c) is an area directly beneath a dismantled 15 x 19 ft pesticide storage shed, TA-3-1494. The site includes an unbermed 9 ft square concrete pad surrounded by soil on all sides. The cement pad was not a foundation for the larger shed, but was in place before the shed was erected. Visual inspections confirm this pad (and the soil around it) have no sign of staining or damage. This PRS lies approximately 100 ft west of the Johnson Controls administrative office for roads and grounds, TA-3-70. Johnson Controls also manages the pesticide storage facilities.

From the early 1960s through 1984, the wooden shed was used to store drums of liquid and powdered pesticides and possibly herbicides (insecticides and herbicides were once included in the generic term "pesticides"). A 14-year supervisor reports that employees may have brought hand-held equipment into the shed to dispense pesticides and prepare solutions. Spills or leaks would have soaked into the wood floor. There was not a water source inside the shed (L'Esperance 1992, 17-765).

Directly east of the shed site is a 12 x 19 ft cement pad with 6 in. curbing on all sides, used as a secondary containment. The south side of the pad had an asphalt ramp over the curb. Pesticide application vehicles were parked there when not in use. There are no known releases from the vehicles or other equipment that may have been filled inside this containment area. A drain pipe was located in the southwest corner of the pad, through the curbing, to release any accumulated rainwater. The cement pad was asphalted after 1989 to bring the surface grade up to the height of the curbing. Presently nothing is stored there.

From 1984 to 1987 these pesticides were stored in two metal sheds (TA-3-1977, 1978) a few feet north of the former location. In 1987, all pesticides were moved to a new storage facility, TA-60-29, on Sigma Mesa (L'Esperance 1992, 17-765). There are no records that tracked the type and quantities of pesticides stored at the old shed.

In 1989 the original pesticide storage shed was dismantled. The raised wood floor of the shed was permeated with pesticides; therefore, it was cut up, barreled, and disposed of as hazardous waste. No soil samples were taken from the area under the floor at the time of demolition (Weston 1992, 17-582).

5.1.1.2 Conceptual Exposure Model

The conceptual exposure model is presented in Chapter 4, Fig. 4-3. Site-specific information on potential release sources, chemicals of concern, migration pathways, and potential receptors follows.

5.1.1.2.1 Nature and Extent of Contamination

Releases at the pesticide storage shed are unknown because the soil under the structure was never sampled when the shed was decommissioned. PCOCs are pesticides and/or herbicides that may have leaked or spilled onto surface soil beneath the storage shed. In general, pesticides and herbicides are relatively insoluble in water and adhere strongly to soil particles; therefore, potential pesticide/herbicide contamination is not expected to have migrated significantly beyond the PRS boundary.

5.1.1.2.2 Potential Pathways and Exposure Routes

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

TABLE 5-3

EXPOSURE MECHANISMS AND RECEPTORS FOR DECOMMISSIONED STORAGE, SWMU 3-002(c)

POTENTIAL AREA OF CONTAMINATION	RELEASE MECHANISMS	CURRENT POTENTIAL RECEPTORS	FUTURE POTENTIAL RECEPTORS
Surface soil	Erosion resulting in wind dispersion	On-site workers	On-site workers

Off-site surface water runoff is not expected to be a significant route of migration because the area is relatively flat and there are no drainage channels in the immediate vicinity (the closest drainage channel is 100 ft away).

5.1.2 Remediation Decisions and Investigation Objectives

If corrective measures are required at SWMU 3-002(c), they are most likely to consist of removing contaminated soils. The objective of the RFI Phase I investigation of this PRS will be to provide enough information about the levels of hazardous constituents at this site to determine whether there are any COCs, and if so, to perform a baseline risk assessment to determine whether remediation is needed.

No Resource Conservation and Recovery Act (RCRA) facility investigation (RFI) Phase II investigation is anticipated for this PRS, although VCA, if necessary, may include soil and concrete wipe samples to verify the attainment of cleanup standards.

5.1.3 Data Needs and Data Quality Objectives

Environmental data are needed to determine the concentration levels of hazardous constituents, specifically pesticides and/or herbicides, in the soil within SWMU 3-002(c). The domain for potential remedial decisions consists of surface soils in the 15 x 19 ft area that lie beneath the former pesticide storage shed. Phase I data will be used first to identify COCs (that is, pesticides or herbicides present above SALs), based on the maximum concentrations observed. If any contaminants are identified, an upper confidence bound on the mean contamination over the site will be used in a baseline risk assessment for on-site workers (see Chapter 4, Subsection 4.3).

Given the low toxicity and moderate heterogeneity of potential contamination at SWMU 3-002(c), reconnaissance sampling (see Chapter 4, Subsection 4.6) should be sufficient so that COCs will be detected with moderate confidence (80 to 90%) if one-third or more of the small domain is affected. (Five independent observations will provide 85% confidence.) Samples will be distributed around the central concrete pad (9 x 9 ft) near the edge of the pad at points where runoff occurs, if such points can be determined, and near the southwest corner of the 12 x 9 ft cement/asphalt pad.

5.1.4 Sampling and Analysis Plan

5.1.4.1 Field investigation

5.1.4.1.1 Engineering Surveys

SWMU 3-002(c) sampling points will be field surveyed at the time of sample collection. This will consist of site engineering (geodetic) mapping. All sample locations will be recorded on a base map.

5.1.4.1.2 Sampling

Five samples (see Subsection 5.0.1) will be collected, nominally at the points shown in Fig. 5-1. If points of runoff from the concrete pad can be identified by visual inspection at the time of sampling, one or two of these points may be relocated to within one foot of such a point. An additional sample collocated with one of these five samples will also be collected to provide an indication of sampling variability. Additional QA sampling will follow the guidelines of the QAPjP in Annex II of this work plan.

The sample interval to be collected will be 0 to 6 in. in accordance with LANL-ER-SOP-06.11, R0, Stainless Steel Surface Soil Sampler.

5.1.4.1.3 Laboratory Analyses

All samples will be analyzed for organochlorine pesticides that are persistent in the environment and will serve as good indicators of contamination. Two of the five samples will also be analyzed for organophosphorus pesticides and herbicides. See Table 5-4 for a list of laboratory analyses.

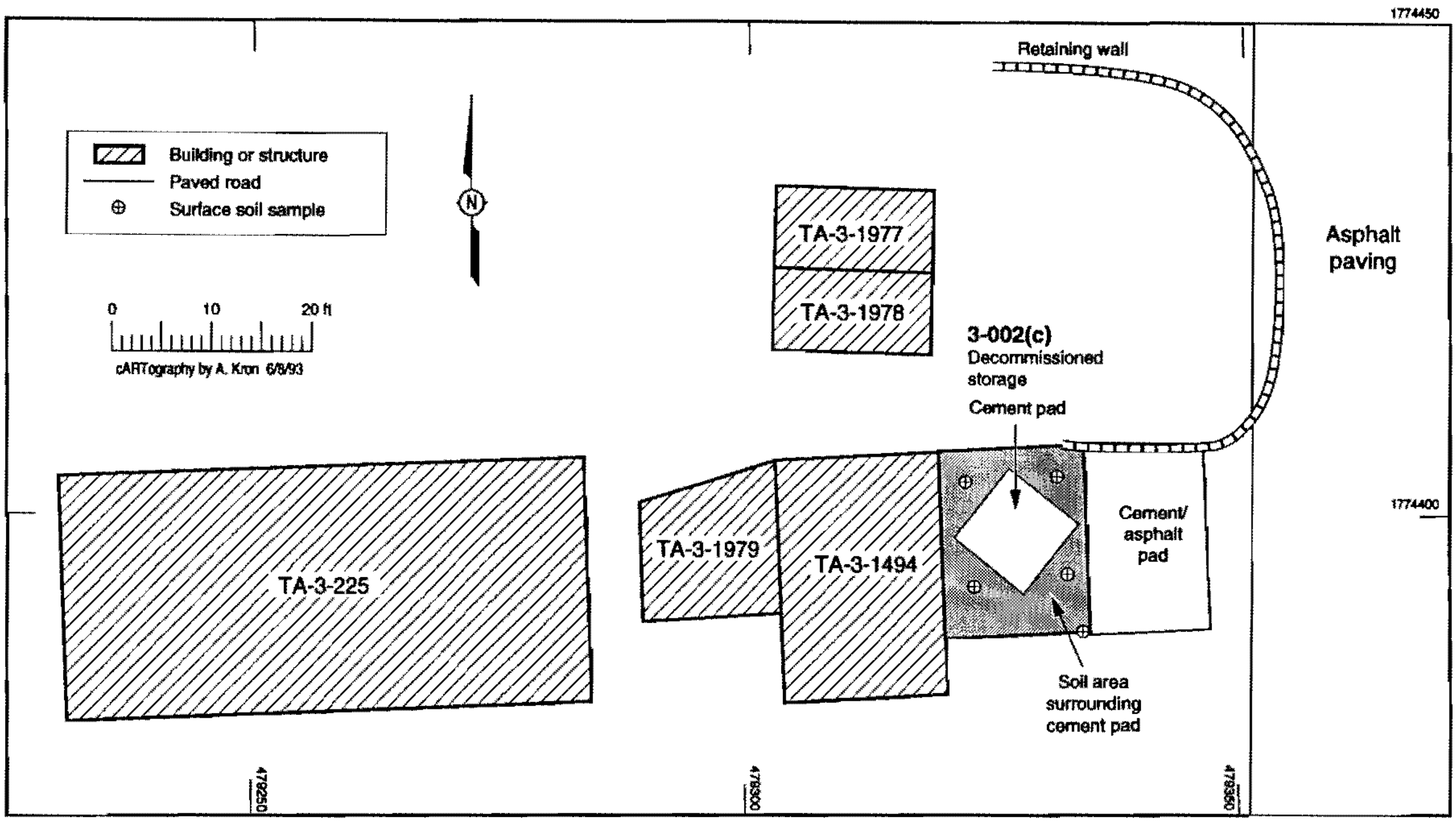

Fig. 5-1. **Sample locations for SWMU 3-002(c), decommissioned storage (also see Fig. E-3, Appendix E).**

TABLE 5-4

SCREENING AND ANALYSIS FOR OU 1114 PHASE I SAMPLING PLAN SUMMARY OF SWMU 3-002(c), DECOMMISSIONED STORAGE

SAMPLING LOCATION/TYPE	SAMPLE LOCATION DESCRIPTION	SAMPLE DESCRIPTION						FIELD SCREENING				FIELD LAB		LABORATORY ANALYSIS															
														Radionuclides					Organics							Metals			Misc
		Sample depth (inches)	Sample I.D. number	Field duplicate	Field split	Collocated sample	Total samples	Gross alpha	Gross beta	Gross gamma	Organic vapor	GC/FID for TPH (SW 8015)	Immunoassay kit for PCBs (SW 4020)	Gross alpha	Gross beta	Gross gamma	Strontium-90	Tritium	Herbicides (SW 8150)	Organochlorine pesticides (SW 8080)	Organophosphorus pesticides (SW 8140)	PCBs (SW 8080)	SVOCs (SW 8270)	TPH (SW 8015)	VOCs (SW 8240)	Mercury (SW 7470, 7471)	OU 1114 metals suite (SW 6010)[1]	OU 1114 Subpart S metals (SW 7000)[2]	Cyanide (SW 9010, 9012)
SWMU 3-002(c)	Former pesticide shed area																												
Surface soil	Northeast of 9' x 9' cement pad	0–6				1	2												2	2	2								
Surface soil	Northwest of 9' x 9' cement pad	0–6					1													1									
Surface soil	Southeast of 9' x 9' cement pad	0–6					1													1									
Surface soil	Southwest of 9' x 9' cement pad	0–6					1													1									
Surface soil	Southwest of 12' x 19' asphalt pad	0–6					1												1	1	1								
TOTAL NUMBER OF SAMPLES							6												3	6	3								

[1]OU 1114 metals suite: beryllium, cadmium, chromium, lead, mercury, nickel, silver
[2]Subpart S metals (TAL list): antimony, arsenic, barium, selenium, thallium, vanadium

s/t = soil/tuff interface
SCB = sediment catchment basin

5.2 Motor Pool Aggregate

5.2.1 Background

5.2.1.1 Description and History

The PRSs in this aggregate are located at the west end of TA-60. The Laboratory's maintenance contractor, Johnson Controls, Inc., conducts its physical support operations as well as activities associated with the Test Fabrication facility at this site. This technical area was created during the 1989 Laboratory redefinition of technical areas when portions of TA-3 were designated as TA-60. It is located adjacent to and east of TA-3.

The motor pool aggregate includes SWMU 60-007(b) and AOC C-60-005 aggregated on the basis of their physical proximity and similarity of potential contaminants. Refer to Subsection 5.2.4 for an illustration of the area.

SWMU 60-007(b), is a storm drainage ditch located north of the Motor Pool Building, TA-60-1. The ditch extends approximately 600 ft from the paved area directly north of TA-60-1 to the bottom of Sandia Canyon. East of TA-60-1 are two tiered parking lots/salvage yards used for vehicle parking, new product required for operations, and equipment storage. The upper lot extends about 200 ft to the east and is bounded by a 6-ft chain link fence. The half of the yard nearest to TA-60-1 is paved; the remainder is a gravel surface. Just east of the fence the land drops sharply to the lower lot. Between the two lots is a drainage ditch running south that carries runoff from the upper lot. This ditch then joins another drainage ditch east of TA-60-1 and TA-60-2 which runs from west to east between the two parking/ storage lots and ultimately drains into Sandia Canyon.

TA-60-1 was built in 1978. It houses offices, the heavy equipment maintenance garage, and the fleet maintenance garage. There were two point sources of environmental release to the ditch. The first was process waste from an outdoor steam-cleaning pad east of TA-60-1 (engines to be overhauled were first steam cleaned to give the mechanics a clean surface to work on). From 1978 to 1986 the waste was discharged across the gravel/soil yard directly into the ditch. In 1986, an oil-water separator was installed to catch effluent from the steam-cleaning operations. The second contaminant source was an underground storage tank (UST) used for storing waste automobile oil. The tank was situated just above this ditch. From 1978 to 1986 oil spills were common during transfer into this tank. In 1986, obvious areas of contamination in the storm drainage ditch were removed to bedrock as a voluntary cleanup effort. Contaminated soils were placed in drums and tested for polychlorinated biphenyls (PCBs) (results were negative), before being removed by the Waste Management Group (HSE-7). New procedures were adopted to minimize transfer spillage (Green 1986, 17-772).

An additional source of contamination could result from the large, asphalt-paved lot several hundred feet northeast of TA-60-1. This area, shown in sampling maps following Subsection 5.2.4.1.2, consisted of equipment storage with capacitors labeled as containing PCBs.

AOC C-60-005, located downslope 30 ft to the southeast of the maintenance warehouse, TA-60-2, consists of two unpaved pads used for new product storage, one 12 x 65 ft, and the other 12 x 40 ft. The storage pads were constructed at the time TA-60-2 was built in 1978 (LANL 1992, 17-683). Both pads held 55-gallon drums of antifreeze, motor oil, grease, transmission fluids, Stoddard solvent (xylene - petroleum naphtha product), and automobile window washer fluid. Materials were dispensed from drums stored on these pads. There have never been any PCB-containing product or waste stored on the pads. The pads were subject to weekly visual inspections. Prior to 1985, neither pad was completely bermed. In 1985, 6-in. asphalt berms with release valves were constructed at the open ends of both pads. These berms mitigated rainwater and snowmelt runoff. However, because of the amount of rain and snowfall received, the slope of the storage yard, and the relatively low height of the end asphalt berms, runoff from the pads continues (LANL 1992, 17-683).

The two soil pads are discolored and have a marked petroleum odor. In 1990, soils from the storage pads were sampled. Volatile organic compounds (VOCs) and semivolatile organic compounds (SVOCs) detected are listed in Subsection 5.2.1.2.1. All drummed liquids were moved to an upgraded bermed cement storage pad in 1990 (LANL 1992, 17-683).

5.2.1.2 Conceptual Exposure Model

The conceptual exposure model is presented in Chapter 4, Fig. 4-4. Site-specific information on potential release sources, chemicals of concern, migration pathways, and potential receptors follows.

5.2.1.2.1 Nature and Extent of Contamination

The contamination constituents detected from the 1990 sample screening at AOC C-60-005 were not characteristic of the products stored on the soil pads. The constituents could have been transported across the storage yard from equipment degreasing (steam cleaning) activities that existed upslope from the soil pads as well as from spills or leaks from other nearby storage pads also transported during periods of rainwater runoff.

Seven samples were collected from pad #2, at depths of 0 to 4 in., and five from pad #3 at depths of 2 to 10 in. All samples were analyzed for VOCs and SVOCs using EPA SW 846 methods 8260 and 8270, respectively. The analytical request specified that results were for screening purposes only.

Trichlorotrifluoroethane, methylene chloride, and carbon disulfide were found at concentrations of less than 0.1 ppm in samples from pad #2. Carbon disulfide was found in similar concentrations in several samples from pad #3. In addition, one sample contained naphthalene at 0.15 ppm and 1,3,5-trimethylbenzene at 12.8 ppm. Tentatively identified hydrocarbons were estimated at 8 to 40 ppm in these two samples. Table 5-5 lists the range of analytical results compared to SALs.

The medium-level screening protocol that was followed for semivolatiles, with detection levels on the order of 20 ppm, resulted in no reportable concentrations apart from one sample with Bis(2-ethylhexyl)phthalate, which also appeared in an associated laboratory reagent blank (Leibman 1990, 17-783).

PCOCs at SWMU 60-007(b) include petroleum compounds and PCBs. Waste motor oil may contain very low concentrations of hazardous metal contaminants, principally copper, chromium, and possibly lead, because of corrosion of engine parts. Since concentrations would only be present far below SALs, metals are not considered PCOCs at this PRS. Current contaminant concentrations, and the extent and spread of contamination is unknown.

TABLE 5-5

RANGE OF VOC ANALYTICAL RESULTS AT AOC C-60-005 (1990 FIELD SCREENING)

ANALYTE	TRICHLORO-TRIFLUOROETHANE	CARBON DISULFIDE	METHYLENE CHLORIDE	1,3,5-TRIMETHYL-BENZENE
Limit of Quantitation (ppm)	0.005	0.005	0.005	0.500
SAL (ppm)	NR	7.400	5.600	NR
PAD # 2 (Sample Concentrations)				
Sample # 196		0.061		
Sample # 199	0.012			
Sample # 200	0.062	106.000	0.044	
Sample # 202		0.043		
PAD # 3 (Sample Concentrations)				
Sample # 204		0.059		
Sample # 205		0.035		
Sample # 206				12.800
Sample # 207		0.021		

NR = not regulated

5.2.1.2.2 Potential Pathways and Exposure Routes

A summary of exposure mechanisms and human receptors is presented in Table 5-6.

VOCs at the atmosphere/soil interface have evaporated; however, SVOCs may be present in near-surface soils due to infiltration.

5.2.2 Remediation Decisions and Investigation Objectives

On-site corrective measures are proposed for SWMU 60-007(b) and AOC C-60-005. Field analysis for total petroleum hydrocarbons (TPH) will be performed on the samples collected. Any sample found above cleanup levels (100 ppm) will undergo a VCA in which all soil will be removed until further field analysis indicates that surrounding soil concentrations are below cleanup standards. Samples from each cleaned area will then be sent

TABLE 5-6

EXPOSURE MECHANISMS AND RECEPTORS FOR MOTOR POOL AGGREGATE

POTENTIAL AREA OF CONTAMINATION	RELEASE MECHANISMS	CURRENT POTENTIAL RECEPTORS	FUTURE POTENTIAL RECEPTORS
Surface soil within PRS boundaries	Erosion resulting in wind dispersion Surface water runoff and infiltration Volatilization	On-site workers	Recreational users [60-007(b)] On-site workers (C-60-005)
Sediment in drainage ditch	Wind dispersion Runoff	On-site workers	Recreational users
Subsurface soil	Excavation or erosion resulting in surface release mechanisms	None	Construction workers On-site workers

for off-site confirmatory analyses. If TPH is not detected above cleanup levels, then at least one confirmatory sample will be collected from each representative sample area.

PCB-suspect areas will undergo soil and sediment screening using immunoassay techniques with detection limits of 5 ppm, following the draft SW 846 Method 4020. Areas exceeding the Toxic Substances Control Act (TSCA) cleanup standard of 10 ppm for unrestricted industrial use will be considered for cleanup to that level. However, sites that are more difficult to clean up may require an evaluation from the regional EPA to determine the cleanup level (EPA 1991, 17-852). Confirmatory samples will be collected for fixed-laboratory PCB analyses. If no areas are found to exceed 10 ppm, at least one confirmatory sample will be sent for laboratory analyses.

Additional investigation will be conducted to help determine the source of any contamination; i.e., the ditch in SWMU 60-007(b) drains areas to the west as well as the motor pool itself and storage areas to the north. The series of ditches draining AOC C-60-005 also serve operational and equipment storage areas east of TA-60-1.

If no COCs are identified during field or confirmation analyses at SWMU 60-007(b), AOC C-60-005, and the associated drainages, no further action will be proposed for the motor pool aggregate.

5.2.3 Data Needs and Data Quality Objectives

Environmental data are needed to determine the concentration levels of hazardous constituents in environmental media associated with the Motor Pool aggregate. The domain for potential remedial decisions, and the corresponding populations to be sampled, are described as follows:

The domain of interest for SWMU 60-007(b) is bounded on the west by the beginning of the asphalt pavement lining the ditch, to the north and south by the edges of the ditch itself, and on the east by the rim of Sandia Canyon (Fig. 5-2). Professional judgment will be used to determine locations in this channel that are most likely to retain petroleum products and other hazardous constituents during runoff events (see Appendix D, Subsection 4.1.4). Sampling will include surface media (0 to 6 in.) and shallow core samples (0 to 18 in.) at these locations.

The domain for decisions about AOC C-60-005 consists of the two unpaved pads that constitute this PRS, together with the series of ditches draining the area. Soil samples for screening will be collected to a depth of 18 in. from these pads, and both the location of sample points and depths of sampling may be biased by staining or other visual evidence of contamination. Sampling of sediments and tuff in the drainages will be biased, as above, by judgment as to locations most likely to retain material during runoff events.

All samples will be analyzed for TPH in the field, for comparison with a cleanup level of 100 ppm. PCBs are of interest in SWMU 60-007(b), for comparison with TSCA cleanup levels of 1 to 10 ppm for unrestricted industrial use. Semivolatile organic analysis will be conducted for confirmatory samples from the AOC C-60-005 pads and from locations in the associated drainages where they might be retained (i.e., sediment catchments of depths greater than 6 in.). Results for confirmatory samples will be compared with SALs for hazardous organic compounds associated with materials formerly stored at this site.

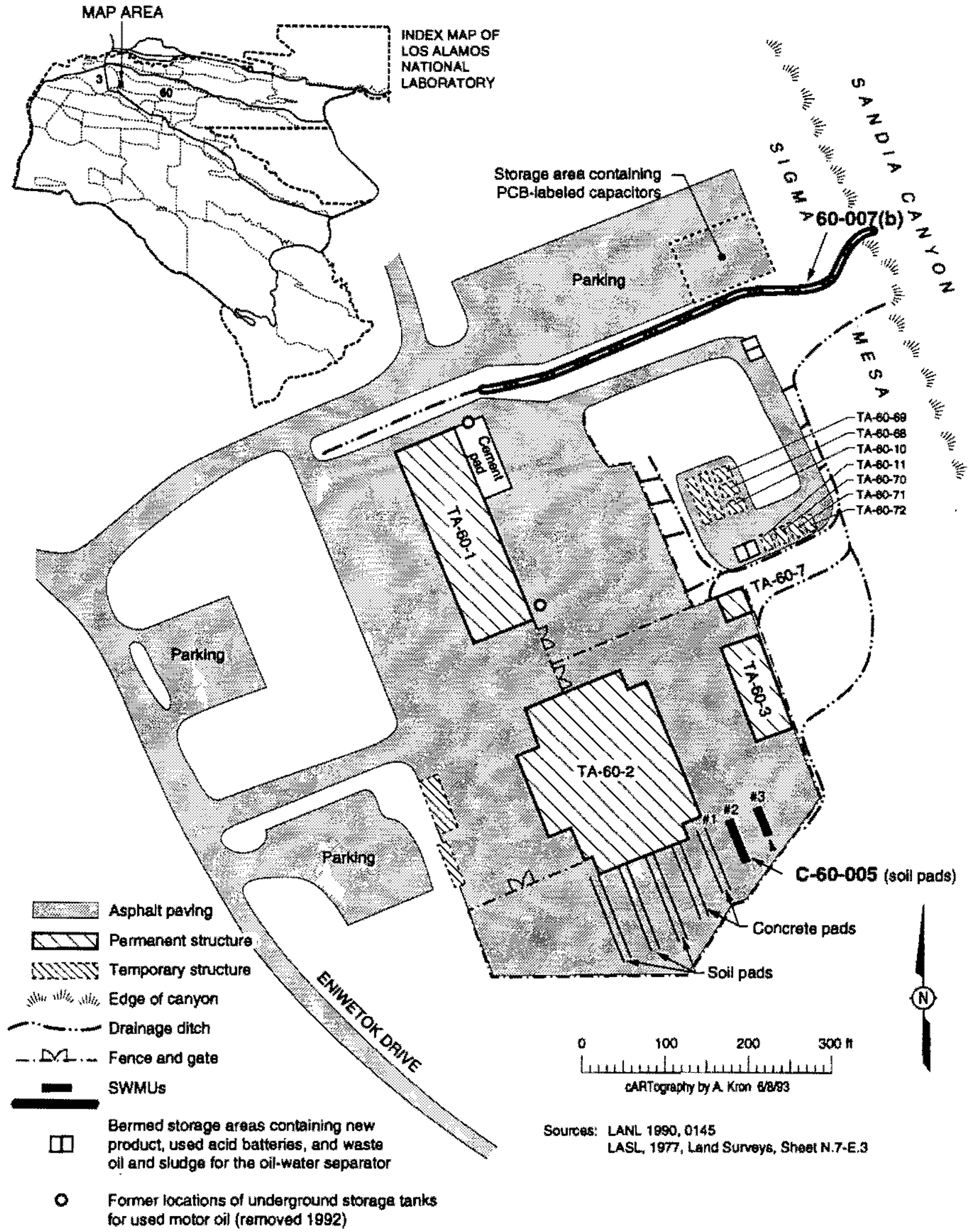

Fig. 5-2. Location of motor pool aggregate, SWMU 60-007(b) and AOC C-60-005 (also see Fig. E-5, Appendix E).

The principal use of the screening data will be to identify COCs by comparison of the maximum observed soil concentrations with these levels. The toxicity of the PCOCs is generally low, but the decision domains are quite heterogeneous. Sample sizes should be selected to provide moderate confidence for this screening assessment. Guiding the selection of samples by visual evidence and professional judgment should partially offset the effects of the heterogeneity on the ability to locate contamination, if present. Thus, although four samples can nominally provide 80% confidence of detection only if at least one-third of the domain is affected, biased screening should permit detection of contamination affecting a much smaller fraction of the domains of interest here.

5.2.4 Sampling and Analysis Plan

5.2.4.1 Field Investigation

5.2.4.1.1 Engineering Surveys

All sampling points presented in Figs. 5-3, 5-4, and 5-5 will be field surveyed at the time of sample collection. If additional samples are required as a result of field activities, the sample locations will be marked with pin flags and surveyed as soon as possible. Field surveying will consist of site engineering (geodetic) mapping. Data will be recorded on a base map.

5.2.4.1.2 Sampling

SWMU 60-007(b). Seven sample locations (see Subsection 5.0.1) from SWMU 60-007(b) are shown on the sampling map (Fig. 5-3). The seven 0 to 18 in. (or soil/tuff interface) samples will be collected from logical areas of PCOC concentrations, such as deposits in sediment catchment basins and turns or bends in the ditch, in accordance with LANL-ER-SOP-06.10, R0, Hand Auger and Thin-Wall Tube Sampler. One collocated sample and at least one confirmatory sample will be added to these surface samples. Additional field analysis and/or confirmatory samples may need to be collected if contamination is detected.

Seven sample locations (see Subsection 5.0.1) have been selected from the main drainage ditch (Fig. 5-4) collecting runoff from TA-60-2. For the two locations with the deepest sediment catchment basins, manual shallow core

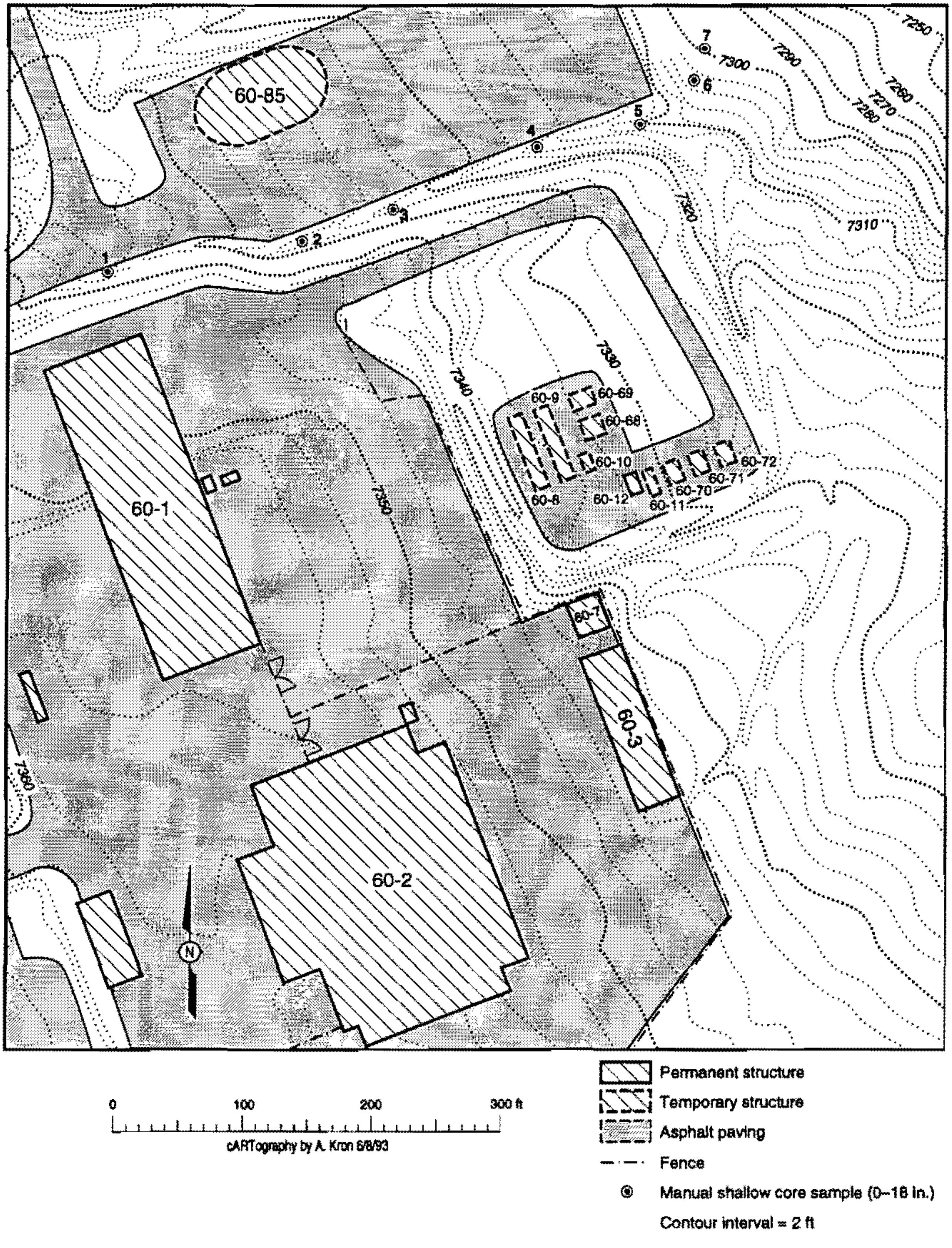

Fig. 5-3. Sampling locations for SWMU 60-007(b), motor pool drainage.

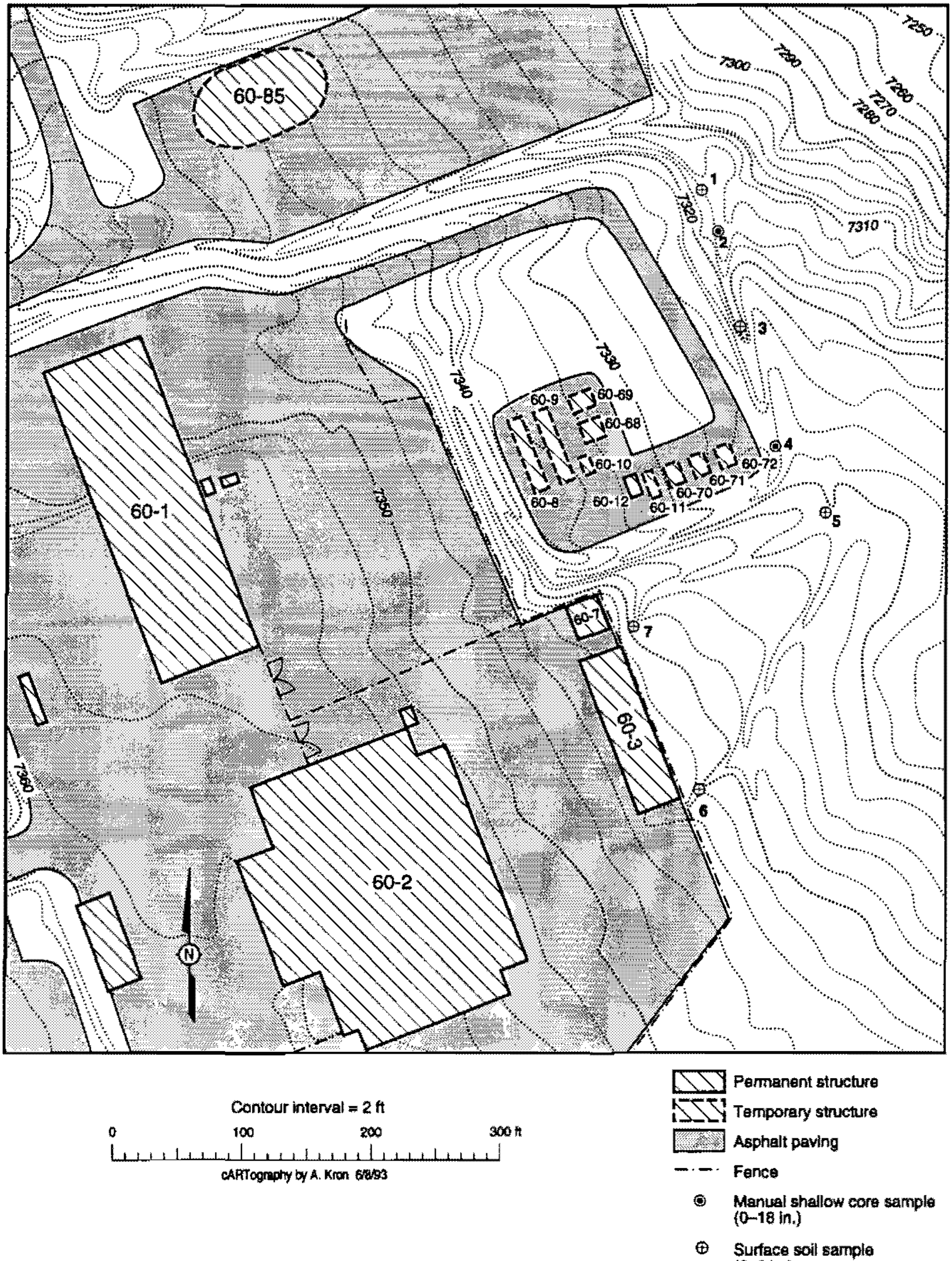

Fig. 5-4. Sampling locations for main drainage ditch from TA-60-2.

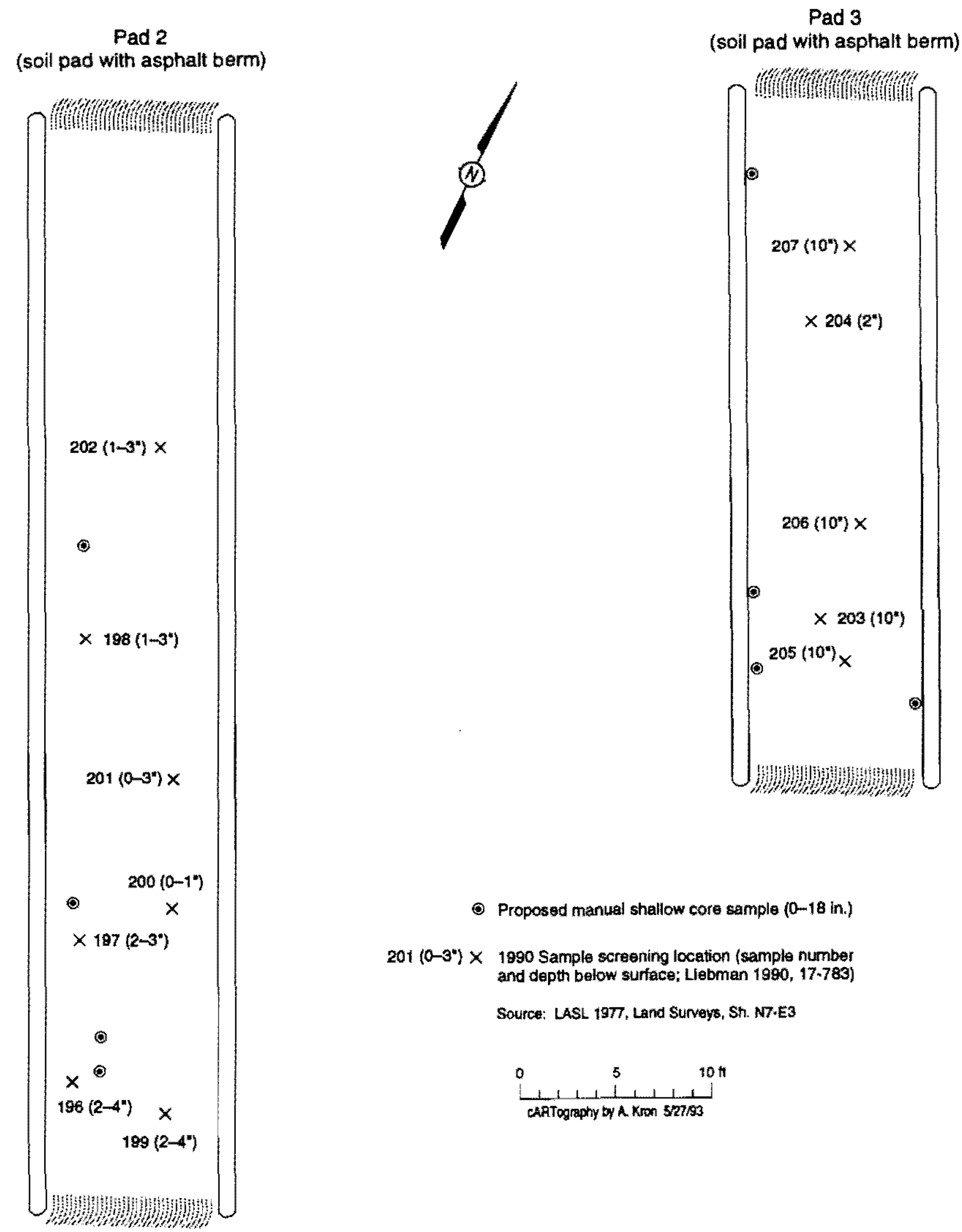

Fig. 5-5. Sampling locations for AOC C-60-005, motor pool storage pads.

samples (0 to 18 in. or soil/tuff interface) will be collected using a hollow stem auger and continuous tube sampler (LANL-ER-SOP-06.10, R0, Hand Auger and Thin-Wall Tube Sampler). Surface samples (0 to 6 in.) will be collected from the remaining locations in accordance with LANL-ER-SOP-06.09, R0, Spade and Scoop Method for Collection of Soil Samples. Additional field analysis and confirmatory samples may be required if contamination is detected.

AOC C-60-005. The four 0 to 18 in. sample points have been selected based on soil staining and/or prior field screening results at each of the two pads that make up AOC C-60-005 (see Fig. 5-5). Each location will be sampled in accordance with the manual shallow core technique, LANL-ER-SOP-06.10, R0. Samples for semivolatile and TPH analyses may be selected at any part of this interval, based again on visual staining if it is present. At least one confirmatory sample will be collected from each pad for TPH and SVOC analysis. Additional field analysis and confirmatory samples may be required if contamination is detected. Duplicate samples for semivolatile analysis will be selected from one core in each pad.

In addition to the duplicate and collocated samples mentioned above, QA sampling will follow the guidelines of the QAPjP in Annex II of this work plan.

5.2.4.1.3 Laboratory Analyses

TPH field analysis using gas chromatography (GC)/flame ionization detector (FID) will be performed on samples from both PRSs. Samples collected from SWMU 60-007(b) will be analyzed in the field for PCBs using immunoassay techniques following the draft SW 846 Method 4020. Confirmatory samples from SWMU 60-007(b) will be analyzed for TPH and PCBs at a fixed laboratory. Confirmatory samples from the pads in AOC C-60-005 will be analyzed for SVOCs and TPH at a fixed laboratory, as will confirmatory samples from the cored locations in the main drainage ditch. Areas identified as having contaminants above cleanup levels will undergo VCA. Soil will be removed and drummed until further field analyses indicate that contaminants in the remaining soil are below cleanup levels. Confirmatory samples will be collected for fixed laboratory analyses after any VCA. Field and/or fixed laboratory analyses will be performed as listed in Table 5-7.

TABLE 5-7

SCREENING AND ANALYSIS FOR OU 1114 PHASE I SAMPLING PLAN SUMMARY OF MOTOR POOL AGGREGATE

SAMPLING LOCATION/TYPE	SAMPLE LOCATION DESCRIPTION	SAMPLE DESCRIPTION						FIELD SCREENING				FIELD LAB		LABORATORY ANALYSIS															
														Radionuclides					Organics							Metals			Misc
		Sample depth (inches)	Sample I.D. number	Field duplicate	Field split	Collocated sample	Total samples	Gross alpha	Gross beta	Gross gamma	Organic vapor	GC/FID for TPH (SW 8015)	Immunoassay kit for PCBs (SW 4020)	Gross alpha	Gross beta	Gross gamma	Strontium-90	Tritium	Herbicides (SW 8150)	Organochlorine pesticides (SW 8080)	Organophosphorus pesticides (SW 8140)	PCBs (SW 8080)	SVOCs (SW 8270)	TPH (SW 8015)	VOCs (SW 8240)	Mercury (SW 7470, 7471)	OU 1114 metals suite (SW 6010)[1]	OU 1114 Subpart S metals (SW 7000)[2]	Cyanide (SW 9010, 9012)
SWMU 60-007(b)	Motor pool drainage																												
Manual shallow core	Drainage/SCB (pt. 1)	0–18 s/t					1					1	1																
Manual shallow core	Drainage/SCB (pt. 2)	0–18 s/t					1					1	1																
Manual shallow core	Drainage/SCB (pt. 3)	0–18 s/t					1					1	1																
Manual shallow core	Drainage/SCB (pt. 4)	0–18 s/t					1					1	1																
Manual shallow core	Drainage/SCB (pt. 5)	0–18 s/t				1	2					2	2																
Manual shallow core	Drainage/SCB (pt. 6)	0–18 s/t					1					1	1																
Manual shallow core	Drainage/SCB (pt. 7)	0–18 s/t					1					1	1																
Confirmatory	Drainage SCB (pt. 2)	0–18 s/t					1															1		1					
Main drainage ditch	Ditch																												
Surface soil	Main drainage (pt. 1)	0–6					1					1																	
Manual shallow core	Main drainage/SCB (pt. 2)	0–18 s/t				1	2					2																	
Surface soil	Main drainage (pt. 3)	0–6					1					1																	
Manual shallow core	Main drainage/SCB (pt. 4)	0–18 s/t					1					1																	
Surface soil	Main drainage (pt. 5)	0–6					1					1																	
Surface soil	Main drainage (pt. 6)	0–6					1					1																	
Surface soil	Main drainage (pt. 7)	0–6					1					1																	
Confirmatory	Main drainage	0–18 s/t					1																1	1					
TOTAL NUMBER OF SAMPLES						2	18					16	8									1	1	2					

[1]OU 1114 metals suite: beryllium, cadmium, chromium, lead, mercury, nickel, silver
[2]Subpart S metals (TAL list): antimony, arsenic, barium, selenium, thallium, vanadium

s/t = soil/tuff interface
SCB = sediment catchment basin

TABLE 5-7 (continued)

SCREENING AND ANALYSIS FOR OU 1114 PHASE I SAMPLING PLAN SUMMARY OF MOTOR POOL AGGREGATE

SAMPLING LOCATION/TYPE	SAMPLE LOCATION DESCRIPTION	SAMPLE DESCRIPTION: Sample depth (inches)	Sample I.D. number	Field duplicate	Field split	Collocated sample	Total samples	FIELD SCREENING: Gross alpha	Gross beta	Gross gamma	Organic vapor	FIELD LAB: GC/FID for TPH (SW 8015)	Immunoassay kit for PCBs (SW 4020)	LABORATORY ANALYSIS – Radionuclides: Gross alpha	Gross beta	Gross gamma	Strontium-90	Tritium	Organics: Herbicides (SW 8150)	Organochlorine pesticides (SW 8080)	Organophosphorus pesticides (SW 8140)	PCBs (SW 8080)	SVOCs (SW 8270)	TPH (SW 8015)	VOCs (SW 8240)	Metals: Mercury (SW 7470, 7471)	OU 1114 metals suite (SW 6010)[1]	OU 1114 Subpart S metals (SW 7000)[2]	Misc: Cyanide (SW 9010, 9012)
AOC C-60-005	Storage pads																												
Manual shallow core	Storage pad #2 (pt. 1)	0–18					1					1																	
Manual shallow core	Storage pad #2 (pt. 2)	0–18					1					1																	
Manual shallow core	Storage pad #2 (pt. 3)	0–18					1					1																	
Manual shallow core	Storage pad #2 (pt. 4)	0–18					1					1																	
Confirmatory	Storage pad #2 (pt. 4)	0–18		1			2																2	1					
Manual shallow core	Storage pad #3 (pt. 1)	0–18					1					1																	
Manual shallow core	Storage pad #3 (pt. 2)	0–18					1					1																	
Manual shallow core	Storage pad #3 (pt. 3)	0–18					1					1																	
Manual shallow core	Storage pad #3 (pt. 4)	0–18					1					1																	
Confirmatory	Storage pad #3 (pt. 3)	0–18		1			2																2	1					
TOTAL NUMBER OF SAMPLES				2			12					8											4	2					

[1]OU 1114 metals suite: beryllium, cadmium, chromium, lead, mercury, nickel, silver
[2]Subpart S metals (TAL list): antimony, arsenic, barium, selenium, thallium, vanadium

s/t = soil/tuff interface
SCB = sediment catchment basin

5.3 Outfalls Aggregate

5.3.1 Background

5.3.1.1 Description and History

The two PRSs included in this aggregate are SWMU 3-015 and SWMU 59-004. These PRSs are aggregated on the basis of similar geomorphology, function, sampling strategies, and risk assessment conceptual models.

SWMU 3-015 is located at the exit of National Pollutant Discharge System (NPDES) outfall number EPA 04A140 located between the pavement and the security fence northeast of the rolling mill building, TA-3-141. The outfall area is level and covered with grasses. Effluent from the outfall has formed a narrow channel which drains northeast. Engineering drawing ENG-C 27347 indicates that the outfall received effluent from janitor sinks plus floor and roof drains. The lines draining to the outfall are were decommissioned in early 1993. One water sample was collected from the outfall area at the time of decommissioning, February 11, 1993. Laboratory analysis of alpha (plutonium and uranium) and beta resulted in less than detectable counts. The lower limit of detection (LLD) is 14 to 16 counts per minute (cpm). If counts are less than 14 cpm, it is reported as non-detectable activity (NDA) (LANL 1993, 17-811). Roof drains have been connected to an existing outfall in Mortandad Canyon. The floor drains have been rerouted into the TA-50 radioactive liquid waste line. Engineering drawing ENG-C 46297 identifies these changes.

From 1962 to 1990, TA-3-141 housed electrochemical and depleted uranium processing facilities (Keenan 1977, 17-199). Currently powder characterization, plasma flame spray processing, beryllium processing, and depleted uranium processing are ongoing operations.

SWMU 59-004 is located at the exit of an outfall located south of the occupational health laboratory, TA-59-1, and of an office trailer, TA-59-2. Effluent from the outfall, NPDES permit number EPA 03A098, empties onto a rock-lined ditch underlain with a cloth-type liner approximately 4 ft wide x 50 ft long, then flows down a narrow channel into Twomile Canyon. The ground directly below the outfall (under the rock-lined ditch) has recently been excavated to lay underground piping for the sanitary waste system consolidation (SWSC) plant. Natural catchments are visible for another 50 ft before the outfall traverses downward into the canyon. The canyon is 160 ft deep at this point and forested with coniferous trees.

TA-59-1 houses laboratories and offices of the industrial hygiene group. Facilities also include a machine shop, storage for radioactive sources, and photographic darkrooms. Laboratories in TA-59-1 perform analyses of radioactive constituents as well as organic and inorganic analyses. Drains in these laboratories have always been connected to the acid waste line. The exhaust hoods in the laboratories were required to add a scrubber unit to the ventilation system. The water from the scrubber was rerouted to the outfall. Other water sources from the outfall include drains located in the basement of TA-59-1 from equipment rooms (once-through cooling water), sinks, fire water, the boiler room (boiler blowdown), and hot and cold water pumps. (LANL 1992, 17-810). The outfall also receives cooling tower blowdown as shown in Engineering drawings ENG-C 35288, ENG-C 35289, and ENG-C 35292.

5.3.1.2 Conceptual Exposure Model

The conceptual exposure model is presented in Chapter 4, Fig. 4-4. Site-specific information on potential release sources, chemicals of concern, migration pathways, and potential receptors follows.

5.3.1.2.1 Nature and Extent of Contamination

The outfalls that make up these PRSs are categorized by the NPDES permit as industrial. The prefix 03A includes outfalls that receive waters from non-contact cooling water, non-destructive testing discharge, and water production facilities. Those with the prefix 04A include waters from cooling tower blowdown, evaporative coolers, condensers, and air washer blowdown. All 03A and 04A outfalls throughout the Lab are sampled weekly on a sequential rotating basis. The monitoring parameters for 03A include flow rate, total suspended solids, chlorine, pH, and total phosphorus. Outfalls designated 04A, monitor only flow rate and pH. None of the parameters mentioned above are of interest to the ER program. The application for NPDES permits began in the mid 1970s. Every five years, reapplication for the NPDES permit requires analyses of over 120 analytes including some RCRA-regulated constituents. Analytical reports from these water analyses are not included in this RFI, which is concerned with PCOCs that may have accumulated in the soil since the early 1960s for TA-3-141 and late 1960s for TA-59-1.

It is probable that prior to the installation of the NPDES permit program, the soils in the outfall area of SWMU 3-015 received depleted uranium. Other possible floor drain wastes may be mercury, beryllium, and VOCs.

Potential contaminants at SWMU 59-004 include VOCs and possibly radionuclides from laboratory activities; however, drains from the laboratories go directly to the acid waste line.

Metals were used in greater amounts than VOCs or SVOCs at these SWMUs and are more persistent in the environment. If metals are not present above SALs at these sampling locations, it is very unlikely that contamination by VOCs or SVOCs would be present above SALs. Therefore, metals have been selected as indicator parameters for potential contamination. If any of the metals are detected above SALs, then additional sampling may be necessary to determine whether VOCs and SVOCs are present above SALs.

5.3.1.2.2 Potential Pathways and Exposure Routes

A summary of exposure mechanisms and human receptors is presented in Table 5-8.

There are sedimentation catchment areas in the drainage channels where contaminants would have been expected to accumulate. VOCs at the atmosphere/soil interface would have evaporated.

5.3.2 Remediation Decisions and Investigation Objectives

If corrective measures are required at either of the outfalls in this PRS aggregate, they will most likely consist of removing contaminated sediments and tuff from the outfall areas. RFI Phase I investigations will provide data for screening assessments to determine whether any hazardous constituents are present above SALs. If any COCs are identified in Phase I samples, RFI Phase II investigations may be required to determine the extent of contamination for baseline risk assessment and the design of corrective measures.

TABLE 5-8

EXPOSURE MECHANISMS AND RECEPTORS FOR OUTFALLS AGGREGATE

POTENTIAL AREA OF CONTAMINATION	RELEASE MECHANISMS	CURRENT POTENTIAL RECEPTORS	FUTURE POTENTIAL RECEPTORS
Surface soil below outfall	Wind dispersion Surface water runoff and infiltration Volatilization	On-site workers	Recreational users
Sediment and tuff in drainage channels	Wind dispersion Runoff	None	Recreational users
Surface water in drainage channels	Runoff Evaporation resulting in surface release mechanisms	None	Recreational users
Subsurface soil	Excavation or erosion resulting in surface release mechanisms	None	Construction workers On-site workers

5.3.3 Data Needs and Data Quality Objectives

Environmental data are needed to determine the concentration levels of hazardous constituents in soils, sediments, and tuffs below the outfalls. RFI Phase I investigations will concentrate on environmental media (soil and sediments) relatively near the outfall points, where any contamination that is found is most likely to be associated with the outfalls in question. Specifically, the domain for Phase I decisions about SWMU 3-015 is the grassy area adjacent to the outfall just east of the security fence and the ditch between that fence and the road, northward toward the culvert under the road that carries runoff to Sandia Canyon. The decision domain for SWMU 59-004 is the 50 ft of undisturbed channel below the outfall, which descends into Twomile Canyon. Both outfalls have stable, well-established drainage patterns within these domains.

Professional judgment will be used to the extent possible to determine locations in these domains that are most likely to retain hazardous constituents; i.e., sediment catchment basins, particularly leading into Twomile Canyon. Shallow cores will be sited within these locations, and field screening (for radioactivity and volatile organics) may be used to select samples for analysis from these cores.

The principal use of the Phase I data will be to identify COCs by comparing the maximum observed soil concentrations of the constituents of potential concern with SALs for soil. (See Subsection 5.3.1.2.1 for the PCOCs for each PRS.) The toxicity of the PCOCs is generally low, but the decision domains are quite heterogeneous. Sample sizes should be selected to provide moderate confidence for this screening assessment.

5.3.4 *Sampling and Analysis Plan*

5.3.4.1 Field investigation

5.3.4.1.1 Engineering Surveys

Sampling points will be field surveyed before sample collection to provide a grid for radiological field screening. This will consist of site engineering (geodetic) mapping. Data will be recorded on a base map.

The geomorphologic survey will consist of mapping of the first-order drainage channels downslope of the two drain outfalls. Sample site selection will be guided by surface drainage mapping of sediment catchment sites from the outfall streams.

5.3.4.1.2 Sampling

Five manual shallow-core samples (see Subsection 5.0.1) will be collected from the erosion channel leading from the outfall (SWMU 3-015) using a hollow stem auger and continuous tube sampler (LANL-ER-SOP-06.10, R0, Hand Auger and Thin-Wall Tube Sampler) to a depth of 18 in. or the soil/tuff interface (whichever is more shallow). Four of the five samples will be located within 50 ft of the outfall drain line. The remaining sample will be collected within 20 ft of the entrance to the culvert that passes below the road located approximately 200 ft to the north-northwest of the outfall. Refer to Fig. 5-6 for sample locations.

Three soil samples will be collected at three distinct areas below the rock-lined ditch at SWMU 59-004. Manual shallow core samples will be collected using a hollow stem auger and continuous tube sampler (LANL-ER-SOP-06.10, R0, Hand Auger and Thin-Wall Tube Sampler) to a depth of 18 in. or the soil/tuff interface. The three core samples will be collected at catchments on the mesa top before the drainage transitions down the steep walls of Twomile Canyon. See Fig. 5-7 for sample locations.

5.3.4.1.3 Laboratory Analyses

All samples for SWMU 3-015 and SWMU 59-004 will be field screened for organic vapor and gross alpha and beta/gamma radiation. If radioactivity is detected during the screening at levels above 1 000 cpm the samples will be sent to a field screening trailer for gross alpha, gross beta, gamma spectroscopy, and tritium analyses (tritium for SWMU 59-004 only). If radioactivity is not detected, or detected at levels below 1 000 cpm, those samples will be sent to a fixed laboratory for confirmatory gross alpha, gross beta, gross gamma, and tritium analyses.

In addition, all samples for SWMU 3-015 and SWMU 59-004 will be analyzed for metals listed in the OU 1114 metals suite as discussed in Appendix D, Section 7.0. This analyte list includes beryllium, cadmium, chromium, lead, mercury, nickel, and silver (see Table 5-9 and Appendix D for specific EPA methods).

Samples to be analyzed for metals and radionuclides will be collected from the 0 to 12 in. interval of each core. One field split sample for each of these types of analyses will be provided from each set of core samples. Additional QA sampling will follow the guidelines of the QAPjP in Annex II of this work plan.

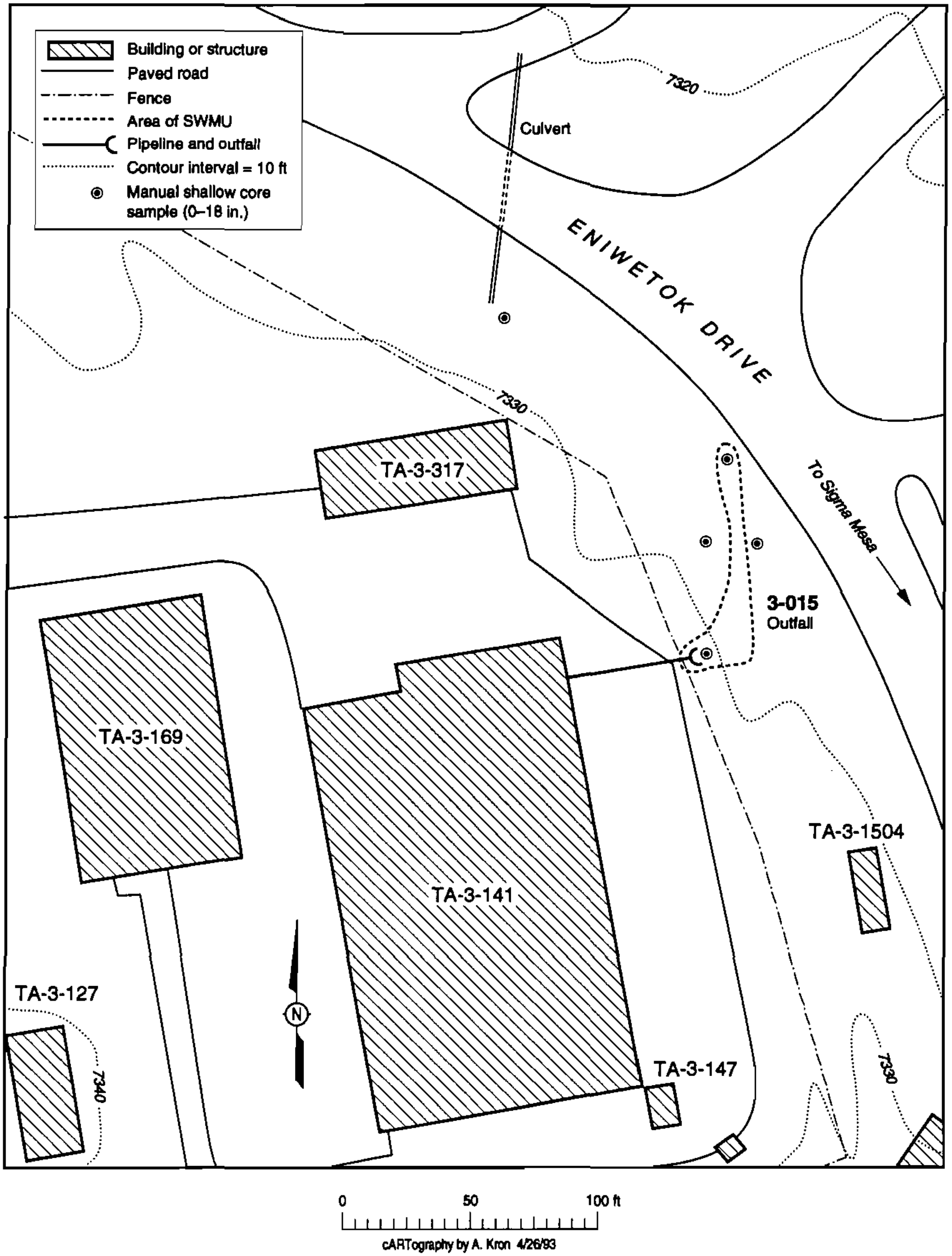

Fig. 5-6. Sample locations for SWMU 3-015, outfall (also see Fig. E-5, Appendix E).

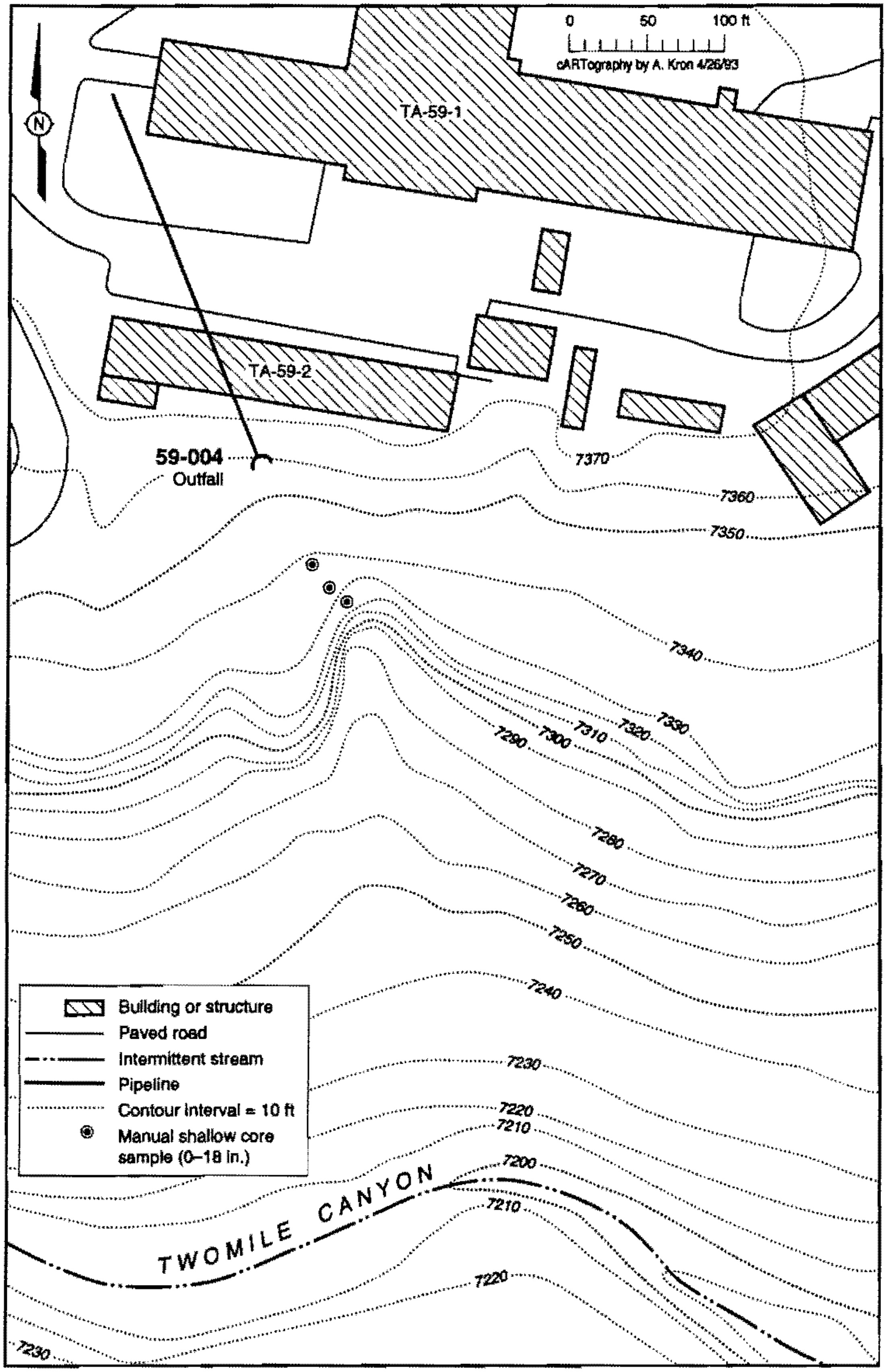

Fig. 5-7. Sample locations for SWMU 59-004, outfall (also see Fig. E-8, Appendix E).

TABLE 5-9

SCREENING AND ANALYSIS FOR OU 1114 PHASE I SAMPLING PLAN SUMMARY OF OUTFALLS AGGREGATE

		SAMPLE DESCRIPTION						FIELD SCREENING				FIELD LAB		LABORATORY ANALYSIS															
														Radionuclides					Organics							Metals			Misc
SAMPLING LOCATION/TYPE	SAMPLE LOCATION DESCRIPTION	Sample depth (inches)	Sample I.D. number	Field duplicate	Field split	Collocated sample	Total samples	Gross alpha	Gross beta	Gross gamma	Organic vapor	GC/FID for TPH (SW 8015)	Immunoassay kit for PCBs (SW 4020)	Gross alpha	Gross beta	Gross gamma	Strontium-90	Tritium	Herbicides (SW 8150)	Organochlorine pesticides (SW 8080)	Organophosphorous pesticides (SW 8140)	PCBs (SW 8080)	SVOCs (SW 8270)	TPH (SW 8015)	VOCs (SW 8240)	Mercury (SW 7470, 7471)	OU 1114 metals suite (SW 6010)[1]	OU 1114 Subpart S metals (SW 7000)[2]	Cyanide (SW 9010, 9012)
SWMU 3-015	Outfall																												
Manual shallow core	Erosion channel	0–18					1	1	1	1	1			1	1	1											1		
Manual shallow core	Erosion channel	0–18			1		2	2	2	2	2			2	2	2											2		
Manual shallow core	Erosion channel	0–18					1	1	1	1	1			1	1	1											1		
Manual shallow core	Erosion channel	0–18					1	1	1	1	1			1	1	1											1		
Manual shallow core	Culvert entrance	0–18					1	1	1	1	1			1	1	1											1		
SWMU 59-004	Outfall																												
Manual shallow core	SCB mesa top	0–18 s/t					2	2	2	2	2			2	2	2		2									2		
Manual shallow core	SCB mesa top	0–18 s/t			1		1	1	1	1	1			1	1	1		1									1		
Manual shallow core	SCB mesa top	0–18 s/t					1	1	1	1	1			1	1	1		1									1		
TOTAL NUMBER OF SAMPLES							10	10	10	10	10			10	10	10		4									10		

[1]OU 1114 metals suite: beryllium, cadmium, chromium, lead, mercury, nickel, silver
[2]Subpart S metals (TAL list): antimony, arsenic, barium, selenium, thallium, vanadium

s/t = soil/tuff interface
SCB = sediment catchment basin

5.4 SWMU 3-033: Point/Spot Spill

5.4.1 Background

5.4.1.1 Description and History

SWMU 3-033 consists of a liquid waste collection system from the printed circuit shop housed in the northwest corner of the Physics Building (TA-3-40). The transfer tank and two containment areas are located adjacent to the northwest corner of TA-3-40 (refer to Subsection 5.4.4.1.2 for an illustration of the tank and containment system). The transfer tank's secondary containment, approximately 2 ft from the building, is fabricated from a 6 ft diameter, corrugated metal culvert section, lined with an epoxy coating, and manufactured without a vertical seam. This culvert section was embedded in an upright position in a gravel base (upgraded to a concrete base in 1986) 8 ft below ground level to form a "vault" for the 200-gal. transfer tank as well as electronic pumps, an outlet, and associated lines. The containment has a solid steel lid with a padlocked access way. There are no visible structural deficiencies. The other secondary containment basin (sump) is a 6 x 8 x 2 ft deep concrete box covered with a steel grate, over which containers were sited to collect the liquid waste from the transfer tank. It abuts the north edge of the parking lot, approximately 20 ft west of the first containment. The sump has a transfer line from the 200-gal. transfer tank, located in the bottom of the steel culvert described above, which rises vertically on the north side of the sump, then extends out over the center of the sump. The sump contained a layer of sand/absorb-all to retain any liquids that leaked or spilled from the tanks or drums.

The printed circuit shop at TA-3-40 operated from the mid 1970s to January of 1991. Plating rinses from the shop were discharged to the sewer system. Plating baths were barreled and disposed of. In 1983 the system was upgraded to collect all wastes in the transfer tank. Rinsates had to be segregated after a time because of the difficulty analyzing the contents for disposal. The primary rinsates going to the transfer tank were ammonia etching rinsates, concentrated nitric acid and diluting water (to leach residues from plating baths), and residues. In 1986 or 1987, because of sludge build-up, the 200-gal. transfer tank was replaced by a new 200-gal. tank. As the transfer tank filled, the contents were pumped to an

800-gal. tank, later replaced by both 55-gal. lined drums and 320-gal. or 220-gal. "tuff tanks" regularly collected by HSE-7 for disposal.

For one year, workers from the printed circuit shop inspected the containment areas weekly, then a change in policy dictated inspections be performed daily. If rainwater or snowmelt accumulated in the secondary containments, it would be pumped into the transfer tank. In June of 1988, approximately one gallon of liquid overflowed the "vault" as a result of heavy rains. A spill also occurred at the "sump" when 55-gal. barrels were being filled by shop employees. A few gallons of liquid were released into the secondary containment. The spilled liquid was pumped out of the containment and barreled for disposal (Sobojinski 1993, 17-822).

The printed circuit shop is no longer in operation. The 200-gal. transfer tank and associated pumps were removed in October 1992 (Martinez 1992, 17-769). Samples were taken from the liquid inside the transfer tank, results are listed in Subsection 5.4.1.2.1. Since their use has been discontinued both containment areas have been covered with a tarp to prevent rain or snowmelt from entering and the sand/absorb-all has been removed from the sump.

5.4.1.2 Conceptual Exposure Model

The conceptual exposure model is presented in Chapter 4, Fig. 4-4. Site-specific information on potential release sources, chemicals of concern, migration pathways, and potential receptors follows.

5.4.1.2.1 Nature and Extent of Contamination

The printed circuit shop tanks received plating rinse wastes that contained trace amounts of nickel, copper, lead, silver, gold, and tin as well as cyanides, ferric chloride, pyrophosphate solutions, fluoroborates, and hydrochloric acid (LANL 1990, 0145). Table 5-10 lists the analytical results of samples collected from the contents of the transfer tank. PCOCs may have leached into surrounding surface soils on two occasions if the transfer tank had an undocumented leak; at the time that the containment had a gravel base, and at the time rainwater overflowed the containment.

TABLE 5-10

ANALYTICAL RESULTS AT SWMU 3-033

CONTAMINANTS OF CONCERN	RESULT[a]	LOCAL BACKGROUND	SCREENING ACTION LEVEL
Water in poly tank	**(mg/L)**	**(mg/L)[b]**	**(mg/L)**
Arsenic	0.002	NA	0.00002
Mercury	0.00005	NA	0.011
Mercury (sludge)	0.00002		0.011
Lead	0.012	NA	0.050
Cyanide	1 – 16	NA	0.7
Acetone	0.055	NA	3.5
Methylene chloride	0.013	NA	0.005
Benzyl alcohol	0.029	NA	
Bis(2-ethylhexyl)phthalate	0.35	0.46 – 0.56 [b]	0.7
Soil	**(mg/kg)**	**(mg/kg)**	**(mg/kg)**
Di-n-butylphthalate	0.87	NA	8 000
Bis(2-ethylhexyl)phthalate	6.4	NA	1 600

a LANL 1992, 17-819
b Purtymun et al. 1988, 0213

A 1988 field survey observed liquid in the sump (secondary containment basin). Any spills around the sump would be absorbed in the surface soils that surround it on the west, north, and east sides, or run off downslope on the southeast side. No stains are evident on the soil or pavement surrounding the sump. If acids leaked into the surrounding soil, they would have been neutralized.

5.4.1.2.2 Potential Pathways and Exposure Routes

A summary of exposure mechanisms and human receptors is presented in Table 5-11.

Leaks from piping above the surface or from spills from filling and transfer operations could deposit constituents in surface soils.

TABLE 5-11

EXPOSURE MECHANISMS AND RECEPTORS FOR POINT/SPOT SPILL (SWMU 3-033)

POTENTIAL AREA OF CONTAMINATION	RELEASE MECHANISMS	CURRENT POTENTIAL RECEPTORS	FUTURE POTENTIAL RECEPTORS
Surface soil	Erosion resulting in wind dispersion Surface water runoff and infiltration Volatilization	On-site workers	On-site workers
Sump	Leak to subsurface soil with subsequent excavation or erosion resulting in surface release mechanisms	None	Construction workers On-site workers
Subsurface soil	Excavation or erosion resulting in surface release mechanisms	None	Construction workers On-site workers

5.4.2 Remediation Decisions and Investigation Objectives

If corrective measures are required at SWMU 3-033, the most likely remedial alternatives are excavation and treatment of surface and subsurface soils. RFI Phase I investigations will provide data for a screening assessment to determine whether any hazardous constituents are present above SALs. If any COCs are identified in Phase I samples, RFI Phase II investigations may be required to determine the extent of contamination for the purposes of baseline risk assessment or remediation.

5.4.3 Data Needs and Data Quality Objectives

Environmental data are required to determine if there are hazardous constituents in surface and near-surface soil adjacent to the two containment areas at SWMU 3-033. The decision domain includes both a volume downslope of the culvert section that contained a 200-gal. tank, pump, and connecting lines and the surface material adjacent to the sump. Within these domains, contamination is most likely to be found downslope of the culvert section, and the lowest grade around the sump, the southeast corner.

The principal use of the Phase I data will be to identify COCs by comparing the maximum observed soil concentrations of the constituents of potential concern with SALs for soil. (See Subsection 5.4.1.2.1 for a list of the PCOCs.) The toxicity of the PCOCs is generally low, but the decision domains, although small, could be moderately heterogeneous. Sample sizes should be selected to provide moderate confidence for this screening assessment.

5.4.4 Sampling and Analysis Plan

5.4.4.1 Field Investigation

5.4.4.1.1 Engineering Surveys

Sampling points will be field surveyed at the time of sample collection. This will consist of site engineering (geodetic) mapping. All sample locations will be recorded on a base map.

5.4.4.1.2 Sampling

The sampling plan for SWMU 3-033 specifies the collection of six samples (see Subsection 5.0.1) at locations shown in Fig. 5-8.

Two samples will be collected from the soil downslope of the cylindrical vault. Both samples will be manual shallow core, 0 to 18 in. Four manual shallow core samples (0 to 18 in.) will be collected adjacent to the sump. One will be located along the north edge of the sump near the waste discharge line (riser). One sample will be taken from the west side of the sump, and two samples will be collected along the southeast corner of the sump from soil areas (see Fig. 5-8). Manual shallow core samples will be collected in accordance with LANL-ER-SOP-06.10, R0, Hand Auger and Thin-wall Tube Sampler.

One collocated sample is specified, to be collected with one of the manual shallow core soil samples adjacent to the sump. Additional QA sampling will follow the guidelines of the QAPjP in Annex II of this work plan. Aliquots for cyanide must be collected from each core at depths greater than 12 in.

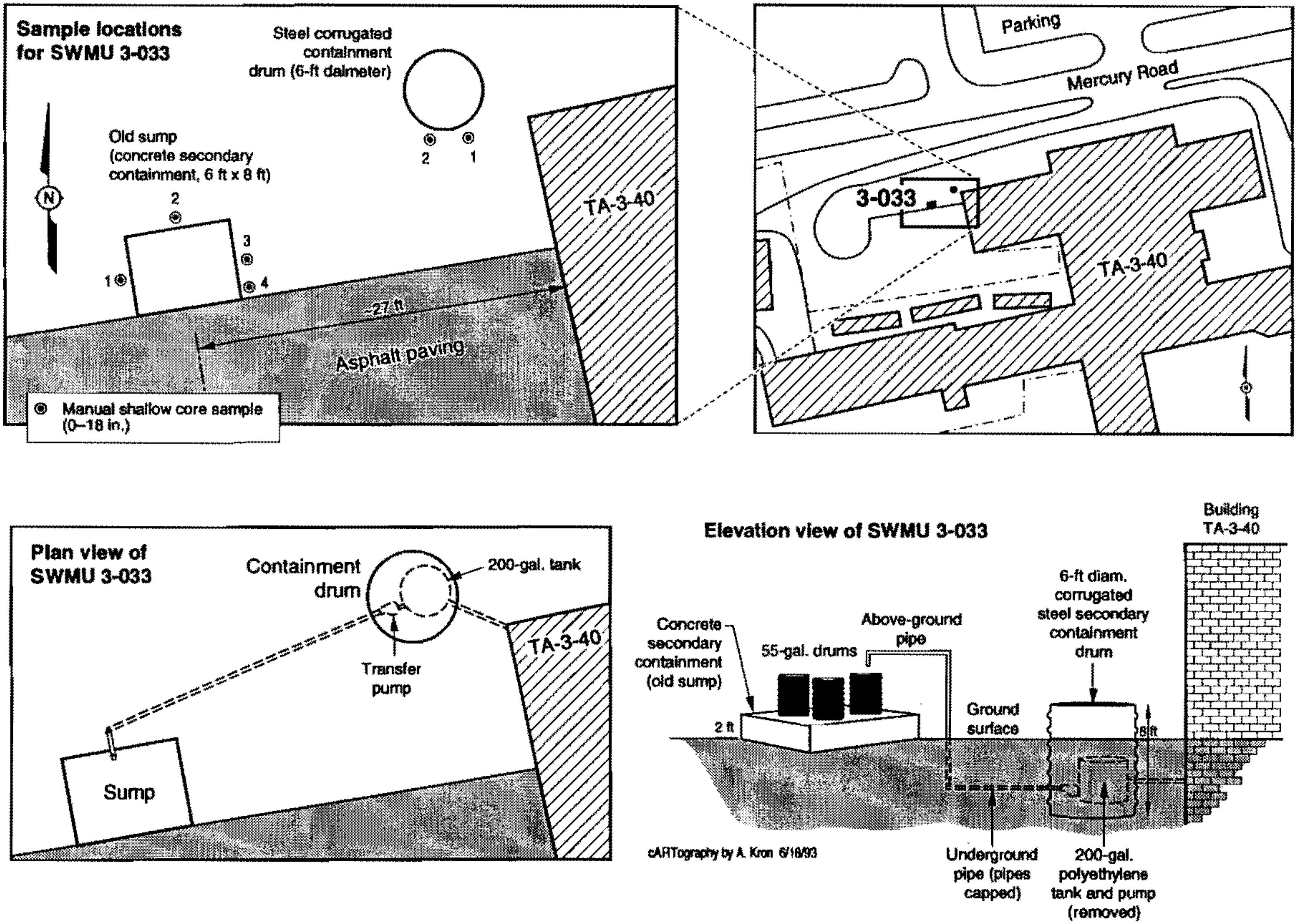

Fig. 5-8. Detailed views and sample locations for SWMU 3-033, point/spot spill (also see Fig. E-4, Appendix E).

5.4.4.1.3 Laboratory Analyses

Samples will be analyzed for metals listed in the OU 1114 metals suite: beryllium, cadmium, chromium, lead, mercury, nickel, and silver. In addition, the samples will be analyzed for cyanide (see Table 5-12 and Appendix D for specific EPA methods).

TABLE 5-12

SCREENING AND ANALYSIS FOR OU 1114 PHASE I SAMPLING PLAN SUMMARY OF SWMU 3-033, POINT/SPOT SPILL

SAMPLING LOCATION/TYPE	SAMPLE LOCATION DESCRIPTION	SAMPLE DESCRIPTION						FIELD SCREENING				FIELD LAB		LABORATORY ANALYSIS: Radionuclides					LABORATORY ANALYSIS: Organics							LABORATORY ANALYSIS: Metals			LABORATORY ANALYSIS: Misc
		Sample depth (inches)	Sample I.D. number	Field duplicate	Field split	Collocated sample	Total samples	Gross alpha	Gross beta	Gross gamma	Organic vapor	GC/FID for TPH (SW 8015)	Immunoassay kit for PCBs (SW 4020)	Gross alpha	Gross beta	Gross gamma	Strontium-90	Tritium	Herbicides (SW 8150)	Organochlorine pesticides (SW 8080)	Organophosphorus pesticides (SW 8140)	PCBs (SW 8080)	SVOCs (SW 8270)	TPH (SW 8015)	VOCs (SW 8240)	Mercury (SW 7470, 7471)	OU 1114 metals suite (SW 6010)[1]	OU 1114 Subpart S metals (SW 7000)[2]	Cyanide (SW 9010, 9012)
SWMU 3-033	Point/spot spill																												
Manual shallow core	Soil around vault (pt. 1)	0–12					1																				1		
		12–18					1																						1
Manual shallow core	Soil around vault (pt. 2)	0–12					1																				1		
		12–18					1																						1
Manual shallow core	Soil west of sump (pt. 1)	0–12					1																				1		
		12–18					1																						1
Manual shallow core	Soil north of sump (pt. 2)	0–12					1																				1		
		12–18					1																						1
Manual shallow core	Soil southeast of sump (pt. 3)	0–12					1																				1		
		12–18					1																						1
Manual shallow core	Soil southeast of sump (pt. 4)	0–12				1	2																				2		
		12–18				1	2																						2
TOTAL NUMBER OF SAMPLES							14																				7		7

[1]OU 1114 metals suite: beryllium, cadmium, chromium, lead, mercury, nickel, silver
[2]Subpart S metals (TAL list): antimony, arsenic, barium, selenium, thallium, vanadium

s/t = soil/tuff interface
SCB = sediment catchment basin

5.5 Sanitary Treatment System Aggregate

5.5.1 Background

5.5.1.1 Description and History

PRS aggregate 3-014 consists of the entire sanitary treatment system for TA-3. Components of this system include floor drains, lift stations, associated outfalls, and the waste water treatment plant. The aggregate also contains SWMU 3-012(b), an outfall that empties into the same area as the aggregate 3-014 system. A map of this aggregate with PRS locations is in Appendix E, Figs. E-3, E-4, and E-6, in addition to Subsection 5.5.4.1.2.

Components of the sanitary treatment system are listed in Table 5-13.

5.5.1.1.1 Waste Water Treatment Plant Overview

This plant is located adjacent to and east of the mechanical utilities shop, TA-3-223, on the southern rim near the head of Sandia Canyon. The waste water treatment plant (WWTP) at TA-3 serves the sanitary sewer system at the site and includes TA-59, TA-60, TA-43, the trailer park on West Jemez Road, and the holding tanks and septic system wastes throughout the Lab. In addition, the TA-3 WWTP started treating wastes from TA-2 and TA-41 three years ago, and has treated wastes from TA-21 since 1992 (Sobojinski 1992, 17-635).

The waste water treatment plant was taken off-line when the Laboratory's Sanitary Waste System Consolidation plant came on-line in 1992.

5.5.1.1.2 Waste Water Treatment Plant Processes

The waste water treatment facility consists of two parallel systems, each with an entrance works, an Imhoff tank, dosing siphon, trickling filter, and final clarifying tank. The north plant (Plant #1) was built in 1951, the south plant (Plant #2) in 1964. The two plants are different only in some physical dimensions and function essentially the same. Overall design capacity for the TA-3 facility is 750 000 gal./day (JCI 1991, 17-639).

Upon entering each plant, raw sewage is first metered at a splitter box [SWMU 3-014(i)] where the flow is diverted/divided to either Plant 1 or Plant 2. The water flow then passes through a comminutor to shred any rags

TABLE 5-13

COMPONENTS OF THE SANITARY TREATMENT SYSTEM

SWMU	STRUCTURE	YEAR BUILT	DESCRIPTION	FUNCTION
3-014(a)	TA-3-49	1951	Imhoff tank	Settling/digestion
3-014(e)	TA-3-192	1965	Imhoff tank	Settling/digestion
3-014(b)	TA-3-48	1951	Dosing siphon	Holding/dispersing
3-014(f)	TA-3-193	1965	Dosing siphon	Holding/dispersing
3-014(c)	TA-3-47	1951	Trickling filter	Microbial digestion
3-014(g)	TA-3-194	1965	Trickling filter	Microbial digestion
3-014(d)	TA-3-46	1951	Secondary clarifier	Settling/clarifying
3-014(h)	TA-3-195	1965	Secondary clarifier	Settling/clarifying
3-014(i)	TA-3-677	1951	Splitter box	Divert flow
3-014(i)	TA-3-677	1951	Comminutor	Cutter/shredder
3-014(i)	TA-3-677	1951	Bar rack	Filters large debris
3-014(j)	TA-3-166	1957	Effluent pump pit	Final effluent pump
3-014(j)	TA-3-166	1957	Chlorinator	Chlorine injector pump
3-014(j)	TA-3-166	1985	Contact chamber	Chlorine contact basin
3-014(k)	TA-3-196	1965	Drying bed	Sludge drying
3-014(l)	TA-3-197	1965	Drying bed	Sludge drying
3-014(m)	TA-3-198	1965	Drying bed	Sludge drying
3-014(n)	TA-3-199	1965	Drying bed	Skimmer bed
3-014(o)	TA-3-1871	1987	Drying beds (3)	Sludge drying
3-014(p)	TA-3-265	1966	Sewage lift station	Pump sewage
3-014(q)	TA-3-336	1967	Effluent tank	Holding tank for cooling tower
3-014(r)	TA-3-693	1970s	Sewage pump station	Pump sewage
3-014(s)	TA-3-1693	1970s	Sewage lift station	Pump sewage
3-014(t)	TA-3-1869	1987	Sewage lift station	Pump sewage
3-014(u)	TA-3-1901	1988	Holding tank	Temporary storage
3-014(v)	TA-3-36	1953	Floor drain	Drain to sewer
3-014(w)	TA-3-29	1953	Floor drain	Inactive drain (1991)
3-014(x)	TA-3-66	1959	Floor drain	Drain to sewer
3-014(y)	TA-3-35	1954	Floor drain	Inactive drain (1981)
3-014(z)	TA-3-40	1950s	Floor drain	Inactive drain (1989)
3-014(a2)	TA-3-316	1969	Floor drain	Drain to sewer
3-014(b2)	TA-3-166	1988	Permitted outfall	Sanitary outfall
3-014(c2)	TA-3-166	1985	Abandoned outfall	Sanitary outfall
3-012(b)	TA-3-22	1989	Permitted outfall	Power plant outfall*

* WWTP effluents diverted to the power plant's cooling tower and outfall.

or other large solid material. Manually-cleaned bar racks are also available for both plants if the comminutors are down for repair. Effluent flow (gravity type) through each plant is about 150 000-gal./day.

Water passes from the entrance works directly to the Imhoff tanks [SWMU 3-014(a) and 3-014(e)] which function as settling/digesting tanks. Effluent water flows from each Imhoff tank to a dosing siphon [SWMU 3-014(b) and 3-014(f)] that disperses, in cycles, accumulated effluent water in an amount sufficient to run the trickling filter rotary arms (JCI 1991, 17-639). The dosing siphon maintains the moisture throughout the trickling filter's rock media beds.

The trickling filters, SWMUs 3-014(c) and 3-014(g), digest organic waste biologically through bacterial growth on the rock media. Each filter bed is 72 ft in diameter by 6 ft deep with a design capacity of 325 000-gal./day. Material sloughed from the tricking filter media settles in the final clarifying tanks. Resulting sludge is re-circulated back to the head of the plant to allow solids to settle out in the Imhoff tanks (JCI 1991, 17-639).

As the sludge collects in the Imhoff tanks, it is siphoned to four 22 x 60 ft, 3 000-gal., sludge drying beds [SWMUs 3-014(k), 3-014(l), 3-014(m), and 3-014(n)] that are located immediately north of the Imhoff tanks. Three of these four beds are used for sludge drying while one is used as a skimmer bed.

Four additional sludge drying beds, SWMU 3-014(o), are located north of and downslope from the first group of beds, west of the chlorine contact chamber. The lower group of beds measure 22 x 60 ft each and accommodates approximately 8 000 gal. of liquid sludge.

Dried sludge has been analyzed quarterly since 1990 for radioactive components. See Subsection 5.5.1.2.1 for analytical results.

Effluent from the sludge beds flows from a subsurface drain system to a holding tank, SWMU 3-014(u). The contents of the holding tank are recirculated (by truck) to the head of the plant for additional treatment (JCI 1991, 17-639). From the late 1950s to the late 1970s dried sludge was added to the soil around the entrance works as a soil amendment.

5.5.1.1.3 Power Plant Outfall

SWMU 3-012(b) is an outfall discharge point (NPDES Permit Number 01A001) onto sand and gravel in a small tributary of Sandia Canyon south of the power plant, TA-3-22.

Between 1951 and 1985 the power plant used treated effluent water available from the WWTP as cooling tower liquids. The effluent was pumped to the power plant's holding tank, SWMU 3-014(q), and treated to adjust the pH and hinder bacteria growth. In the past chromates were used to treat the effluent; currently, chlorine is used. The water is de-chlorinated before being released into Sandia Canyon (LASL 1972, 17-716) (EPA pp. II-9, 1976 17-717).

The cooling tower outfall at the power plant has an NPDES permit number of 01A001.

The power plant and the WWTP have separate outfall locations with different effluent limits and NPDES permit requirements. The power plant's 1986 permit application for discharge water inadvertently omitted sanitary effluent. This oversight was discovered in 1990, at which time the power plant discontinued using the WWTP effluent until permit modifications were obtained in August of 1992 (Sobojinski 1992, 17-659).

In accordance with the NPDES permit, water samples are collected at the outfall and analyzed based on standard parameters for industrial waste water systems, which include total suspended solids, pH, and chlorine (EPA 001, pp. V I - V 9, 1986, 17-719).

5.5.1.1.4 Waste Water Treatment Plant Outfalls

SWMU 3-014(c2) is the abandoned outfall located on the north side of TA-3-166, the pump building. The NPDES number from 1975 to 1985 was NM 0024210. Effluent flowed from TA-3-166 into an erosion channel, which also serves a storm drain, about 50 ft before passing under a gravel road, then drained downslope into the canyon. Frequently, the erosion channel was cleaned out with a backhoe to prevent sediments from clogging the channel. The removed soil was piled uphill onto the channel bank (Sobojinski 1992, 17-659).

This first outfall was abandoned when a chlorination system, SWM 3-014(j), was added to the waste water treatment plant in 1985. The chlorine contact chamber is located about 100 ft downslope and north of TA-3-166. This system treats the effluent that was previously diverted to and treated by the power plant. The effluent was piped underground from TA-3-166 to the contact chamber, creating a new outfall location. From the flow measurement weir north of the contact chamber the final effluent flowed freely downslope into the canyon. This second outfall was abandoned in 1988 or 1989.

Current effluent is routed from the weir through a corrugated metal pipe (approximately 1.5 ft in diameter) 300 ft to an outfall at a rocky outcrop on the canyon's edge. From there the effluent flows down a steep rocky channel to the canyon floor where a wetland has developed (Sobojinski 1992, 17-659).

Effluent at the current outfall point, SWMU 3-014(b2), is monitored three times a month for standard parameters of sanitary waste water systems in compliance with the NPDES Permit Number SSS01S. The monitoring parameters include; biochemical oxygen demand, total suspended solids, pH, and fecal coliform. Total chlorine and radioactive components are additional analyses performed on the effluent for Laboratory information.

All NPDES outfall permits must be renewed every five years. At that time sampling and analyses are performed on approximately 117 additional parameter to include metals, cyanide, total phenols, volatile compounds, acid compounds, basic and neutral compounds, and pesticides (EPA 01S 1986, 17-719). Analytical data indicate that there have not been any radioactive or RCRA analytes over the detection limit (see Subsection 5.5.1.2.1 for a list of PCOCs from sludge analyses).

5.5.1.1.5 Floor Drains: SWMUs 3-014(v), 3-014(x), 3-014(y), 3-014(z), and 3-014(a2)

In some of the technical areas noted in the waste water treatment plant overview, floor and sink drains from industrial processes are connected to the sanitary sewer (Table 5-13) (LANL 1990, 0145).

5.5.1.1.6 Lift Stations: SWMUs 3-014(q), 3-014(r), 3-014(s), and 3-014(t)

The sanitary waste water system consists of thousands of feet of line, as well as numerous manholes and lift stations. All lift stations pump water or effluent up to an elevation that yields gravity flow (Table 5-13).

5.5.1.2 Conceptual Exposure Model

The conceptual exposure model is presented in Chapter 4, Fig. 4-5. Site-specific information on potential release sources, chemicals of concern, migration pathways, and potential receptors follows.

5.5.1.2.1 Nature and Extent of Contamination

The areas of concern within the waste water treatment plant are the immediate areas surrounding each of the following components: the splitter box, bar rack, comminutor(s), Imhoff tank(s), and dosing siphon(s), otherwise known as the "entrance works". These areas could have been associated with possible spills or splashing of the influent onto the soil during the treatment processes. In addition, it has been reported that in the late 1970s and early 1980s, sludge and effluent had been used on the grass around these areas. If PCOCs existed in the sludge, they could remain in the soil around the entrance works. Dried sludge has been analyzed since 1990 for hazardous components. The sludge is field-screened for radioactivity twice, first at the time of collection, then prior to submittal for laboratory analysis. Upon verification that samples are free of radioactive contamination, they are submitted to contract laboratories for toxicity characteristic leaching procedure (TCLP) and total metals, VOCs, SVOCs, herbicides, and pesticides analyses. Samples are taken from sludge beds #1 ,2 ,3, and 6, north and south beds, holding pits #1 and 2, and TA-3 roll offs. Table 5-14 summarizes results of sludge analyses. No pesticides, herbicides, SVOCs or VOCs were found above detection limits during this time. Alpha and beta results were less than 25 pCi/g. Gamma results ranged from 0.24 to 0.89 pCi/g.

The outfall, SWMU 3-014(b2), joins a tributary of Sandia Canyon south of TA-3-22. There is a sand and gravel bed into which the outfall stream discharges. Any potential contaminants present in the water would be expected in the sand and gravel sediment. This rationale also applies to the abandoned outfall, SWMU 3-014(c2).

TABLE 5-14

SUMMARY RESULTS OF SLUDGE ANALYSES: 1990-1992

DATES	PCOC	CONCENTRATION RANGE (ppm)	REG LIMIT[a]	SAL (soil)
12/90;11/91;5/92	Arsenic (TCLP)	0.01-0.10	5	24
	Barium(TCLP)	0.22-1.3	100	5 600
	Cadmium(TCLP)	<0.01-0.12	1	80
	Chromium (TCLP)	0.1-0.16	1	400
	Lead (TCLP)	0.03-0.2	5	ND
	Mercury (TCLP)	<0.0002-<0.005	0.2	24
	Selenium (TCLP)	0.0019-0.03	1	400
	Silver (TCLP)	<0.04-0.05	5	400
11/91, 5/92	Arsenic (total)	2.4-4.0	36	24
	Barium (total)	30-274	N/A	5 600
	Cadmium (total)	2.5-15	360	80
	Chromium (total)	80-930	3 100	400(VI)
	Copper (total)	323-1030	3 300	3 000
	Lead (total)	87-750	1 600	ND
	Mercury	1.2-1.9	30	24
	Nickel (total)	17-26	990	1 600
	Selenium (total)	<0.2-0.6.	64	400
	Silver (total)	68-158	N/A	400
	Zinc (total)	252-1060	8 600	2 400

[a] 40 CFR 261 (TCLP) and 40 CFR 503 (total)

Effluent was received from many different types of facilities at TA-3. Therefore, the range of PCOCs include the following metals: antimony, arsenic, barium, beryllium, cadmium, chromium, lead, mercury, nickel, selenium, silver, thallium, and vanadium, as well as radionuclides, cyanide, volatile and semivolatile organics, pesticides, and herbicides.

5.5.1.2.2 Potential Pathways and Exposure Routes

A summary of exposure mechanisms and human receptors is presented in Table 5-15.

TABLE 5-15

EXPOSURE MECHANISMS AND RECEPTORS FOR SANITARY TREATMENT SYSTEM AGGREGATE

POTENTIAL AREA OF CONTAMINATION	RELEASE MECHANISMS	CURRENT POTENTIAL RECEPTORS	FUTURE POTENTIAL RECEPTORS
Surface soil	Erosion resulting in wind dispersion Storm water runoff and infiltration External irradiation Volatilization	On-site workers	On-site workers
Subsurface soil	Excavation or erosion resulting in surface release mechanisms	None	Construction workers On-site workers
Sediment/surface soil in drainages	Wind dispersion Runoff	None	Recreational users
Surface water	Runoff Evaporation resulting in surface release mechanisms	None	Recreational users

5.5.2 Remediation Decisions and Investigation Objectives

All of the PRSs in this aggregate are components of the TA-3 sanitary waste water treatment system. The RFI Phase I investigation will screen the products of the system to determine whether any hazardous or radioactive constituents have been released to the environment. The goals of this investigation are to identify PCOCs and to characterize the likeliest environmental release areas: soils and sediments at treatment plant outfalls and areas within the treatment plant grounds where sludge was applied as a soil amendment.

If any COCs are identified in Phase I samples, RFI Phase II investigations may be required to determine the extent of contamination in these release areas, particularly below active outfalls. If a baseline risk assessment indicates that remediation is necessary, it is likely to consist of removal of contaminated soil or sediments at the outfalls or within the plant grounds.

Further investigation, either of individual components within the sanitary waste water treatment plant or of upstream sources of contamination, will be coordinated with the decommissioning of the plant.

5.5.3 Data Needs and Data Quality Objectives

Environmental data are needed to determine the concentration levels of hazardous constituents in soils, sediments, and tuff below the outfalls and in surface soils in areas within the plant where sludge and effluent were used to maintain the grass covering. Because of the wide range of activities from which liquid wastes might have been received at the waste water treatment plant, almost all hazardous and radioactive constituents related to TA-3 processes are of potential concern (see Subsection 5.5.1.2.1).

The domain for Phase I decisions consists of four distinct areas:

- Surface soils from the area surrounding the Imhoff tanks and dosing siphons, where effluent and sludge from the treatment plant were applied to maintain the grass.
- Surface and near-surface soils below the abandoned outfalls, SWMU 3-014(c2). This includes soils excavated from the storm drainage ditch and thrown from the ditch onto the bank, erosion channels below the pump building, and the area between the flow measurement weir and the edge of the debris mound.
- Surface and near-surface sediments associated with current outfall SWMU 3-014(b2). This includes sediments from the end of the pipe about 265 ft northeast of the chlorination chamber.
- Soil or sediments at the power plant outfall SWMU 3-012(b), between the end of the pipe and the bottom of the storm drainage ditch about 10 ft below.

The first use of Phase I data will be to identify COCs by comparing the maximum observed soil concentrations of PCOCs with SALs for soil. The toxicity of the PCOCs is variable, and the decision domains could be moderately heterogeneous, but existing information from monitoring of sludge and effluent suggests that environmental releases to outfalls and grassy areas were not frequent or significant. Therefore, the proposed sample sizes will provide only moderate confidence for this screening assessment. Although sampling at the outfalls will be biased to the extent possible by professional judgment toward areas most likely to retain hazardous constituents, if released. Where such biasing is not possible, systematic sampling will be used to ensure that each part of the domain is represented.

If COCs are identified within the grounds of the plant or at the abandoned outfalls, the Phase I data should be sufficient to continue with a baseline risk assessment to determine whether or not remediation is required. Samples will be selected within each area where sludge has been applied as a soil amendment. At the older of the abandoned outfalls, the samples will represent several subpopulations: the channel directly below the pump building, before joining the storm runoff channel from the treatment plant grounds; the channel below this point; and the material cleared from the lower channel that was piled on the slope above it.

If contamination is found at either of the active outfalls, more data are likely to be required to characterize vertical and horizontal extent of the release and rate of migration of contaminants, as well as to determine whether some of the components of the plant are contaminated. Plans to acquire additional data will be developed as Phase II of the RFI, in conjunction with the decommissioning of the waste water treatment plant, or both, and details of their design will depend on the Phase I results. In addition, it is anticipated that investigations planned by Operable Unit 1049 (canyons) will include sampling in the well-developed wetlands in Sandia Canyon, which receives water not only from these outfalls but from several TA-3 storm drains.

5.5.4 Sampling and Analysis Plan

5.5.4.1 Field investigation

5.5.4.1.1 Engineering Surveys

Sampling points will be field surveyed before sample collection to provide a grid for radiological field screening. This will consist of site engineering (geodetic) mapping. Data will be recorded on a base map.

The geomorphologic survey will consist of mapping of the first-order drainage channels downslope of the three drain outfalls. Sample site selection will be guided by surface drainage mapping of sediment catchment sites from the outfall stream.

5.5.4.1.2 Sampling

SWMU 3-012(b). Two manual shallow core samples will be collected at the power plant outfall at points where the soil has formed a bank on either side of the concrete outfall apron (see Fig. 5-9).

SWMU 3-014(c2). Part 1 is the first abandoned outfall location, before the effluent was rerouted underground and north to the chlorination chamber in 1985. A total of seven sample sites will be located at part 1 of SWMU 3-014(c2). The first four will be manual shallow core samples (0 to 18 in. or soil/tuff interface) located in the two visible outfall channels that lay downslope to the north of the pump building, TA-3-166. The fifth sample location is a manual shallow core sample (0 to 18 in. or soil/tuff interface) placed downslope of the pump house channels in the storm drain trench. The remaining two shallow core samples (0 to 18 in. or soil/tuff interface) will be collected in the excavated material piled upslope of the storm drain trench (see Fig. 5-10). A collocated and duplicate sample will be collected with one of these last two shallow cores.

SWMU 3-014(c2). Part 2 is the second location of the abandoned outfall, after the chlorination chamber was installed. Previously this area received uncontrolled flow of effluent out of the flow measurement weir. Two manual shallow core samples (0 to 18 in. or soil/tuff interface) will be placed between the flow measurement weir and the edge of the debris mound (see Fig. 5-10).

SWMU 3-014(b2). Four samples will be collected at the active outfall. Two manual shallow core samples (0 to 18 in. or soil/tuff interface) will be located on either side (north and south) of the rock outcrop at the outfall. After the effluent passes over the rock outcrop, it diverges into two separate courses that then drop 30 to 50 ft to the bottom of Sandia Canyon. Several sediment catchments are located approximately mid-way down the slope face. Two manual shallow core samples (0 to 18 in. or soil/tuff interface) will be

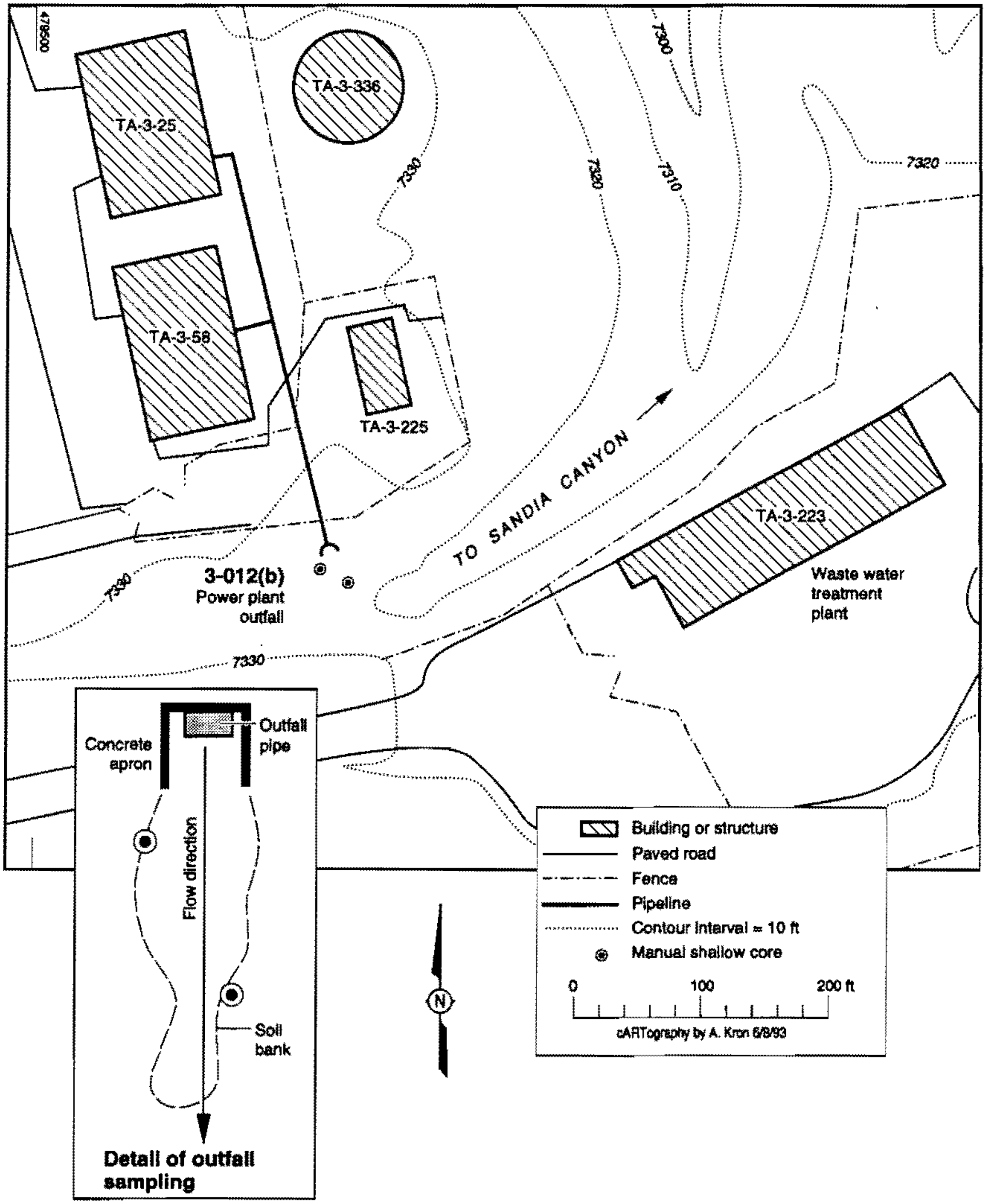

Fig. 5-9. Sample locations for SWMU 3-012(b) in the sanitary treatment system.

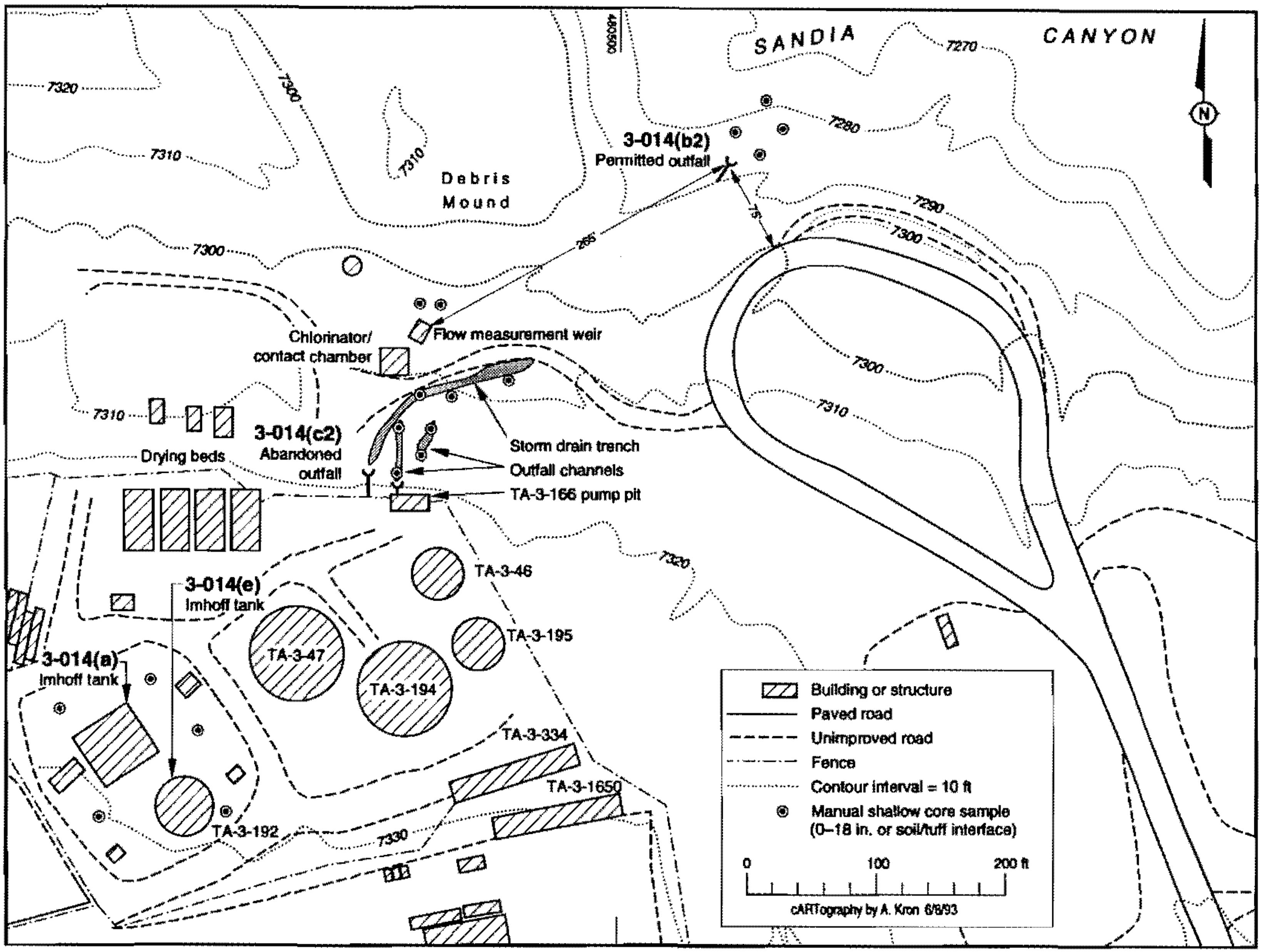

Fig. 5-10. Sample locations for SWMUs 3-014(a, e, b2, c2,) in the sanitary treatment system.

collected from the catchments, one sample per "stream" course. (see Fig. 5-10). A collocated and field duplicate sample will be collected with one of these last two samples.

SWMU 3-014(a,e). Five manual shallow core samples (0 to 18 in. or soil/tuff interface) will be collected from surface soils between components that make up the entrance works. The Imhoff tanks are the two largest components of the entrance works and are called out in Fig 5-10. One collocated and duplicate sample will be collected with these five cores.

In addition to the duplicate and collocated samples mentioned above, QA sampling will follow the guidelines of the QAPjP in Annex II of this work plan. Guidelines for sample size selection are located in Subsection 5.0.1.

All of the manual shallow core samples will be collected in accordance with LANL-ER-SOP-06.10, R0, Hand Auger and Thin-Wall Tube Sampler. Samples to be analyzed for metals, radionuclides and SVOCs will be taken from the 0 to 12 in. interval of each core. Samples for volatile organic analyses and for cyanides must be collected from depths greater than 12 in.

5.5.4.1.3 Laboratory Analyses

All samples for the Sanitary Treatment System aggregate will be field screened for organic vapors and gross alpha and beta/gamma radiation. If radioactivity is detected during the screening at levels above 1 000 cpm, the samples will be sent to a field screening trailer for gross alpha, gross beta, gamma spectroscopy, and tritium analyses. If radioactivity is not detected, or detected at levels below 1 000 cpm, the samples will be sent to a fixed laboratory for confirmatory gross alpha, gross beta, gross gamma, and tritium analyses. Isotopic uranium and isotopic plutonium analysis will be conducted on any samples that have gross alpha results indicating possible presence of these isotopes.

All samples will be analyzed for the OU 1114 metals suite: beryllium, cadmium, chromium, lead, mercury, nickel, and silver. In addition, samples will be analyzed for cyanide, pesticides, herbicides, volatile and semivolatile organics. A total of five samples will be analyzed for additional RCRA Subpart S metals: antimony, arsenic, barium, selenium, thallium, and vanadium: two samples located at the power plant outfall, one sample from the area around the Imhoff tanks, one sample from the rock outcrop at the top of the active outfall, and the duplicate sample from the bench below this outfall. See Table 5-16 and Appendix D for specific EPA methods.

TABLE 5-16

SCREENING AND ANALYSIS FOR OU 1114 PHASE I SAMPLING PLAN SUMMARY OF THE SANITARY TREATMENT SYSTEM AGGREGATE

		SAMPLE DESCRIPTION						FIELD SCREENING				FIELD LAB		LABORATORY ANALYSIS															
														Radionuclides					Organics							Metals			Misc
SAMPLING LOCATION/TYPE	SAMPLE LOCATION DESCRIPTION	Sample depth (inches)	Sample I.D. number	Field duplicate	Field split	Collocated sample	Total samples	Gross alpha	Gross beta	Gross gamma	Organic vapor	GC/FID for TPH (SW 8015)	Immunoassay kit for PCBs (SW 4020)	Gross alpha	Gross beta	Gross gamma	Strontium-90	Tritium	Herbicides (SW 8150)	Organochlorine pesticides (SW 8080)	Organophosphorus pesticides (SW 8140)	PCBs (SW 8080)	SVOCs (SW 8270)	TPH (SW 8015)	VOCs (SW 8240)	Mercury (SW 7470, 7471)	OU 1114 metals suite (SW 6010)[1]	OU 1114 Subpart S metals (SW 7000)[2]	Cyanide (SW 9010, 9012)
SWMU 3-012(b)	Power Plant outfall																												
Manual shallow core	Soil bank at pipe outlet	0–12					1	1	1	1	1			1	1	1		1	1	1			1			1	1	1	
		12–18 s/t					1	1	1	1	1														1				1
Manual shallow core	Soil bank at pipe outlet	0–12					1	1	1	1	1			1	1	1		1	1	1			1			1	1	1	
		12–18 s/t					1	1	1	1	1														1				1
SWMU 3-014(c2) Part 1	Abandoned outfall																												
Manual shallow core	Channel 1 north of TA-3-166	0–12					1	1	1	1	1			1	1	1		1	1	1			1			1	1		
		12–18					1	1	1	1	1														1				1
Manual shallow core	Channel 1 north of TA-3-166	0–12					1	1	1	1	1			1	1	1		1	1	1			1			1	1		
		12–18					1	1	1	1	1														1				1
Manual shallow core	Channel 2 north of TA-3-166	0–12					1	1	1	1	1			1	1	1		1	1	1			1			1	1		
		12–18					1	1	1	1	1														1				1
Manual shallow core	Channel 2 north of TA-3-166	0–12					1	1	1	1	1			1	1	1		1	1	1			1			1	1		
		12–18					1	1	1	1	1														1				1
Manual shallow core	Storm drain ditch	0–12					1	1	1	1	1			1	1	1		1	1	1			1			1	1		
		12–18					1	1	1	1	1														1				1
Manual shallow core	Excavated soil	0–12					1	1	1	1	1			1	1	1		1	1	1			1			1	1		
		12–18					1	1	1	1	1														1				1
Manual shallow core	Excavated soil	0–12				1	2	2	2	2	2			2	2	2		2	2	2			2			2	2		
		12–18		1			2	2	2	2	2														2				2
TOTAL NUMBER OF SAMPLES							20	20	20	20	20			10	10	10		10	10	10			10		10	10	10	2	10

[1]OU 1114 metals suite: beryllium, cadmium, chromium, lead, mercury, nickel, silver
[2]Subpart S metals (TAL list): antimony, arsenic, barium, selenium, thallium, vanadium

s/t = soil/tuff interface
SCB = sediment catchment basin

TABLE 5-16 (continued)

SCREENING AND ANALYSIS FOR OU 1114 PHASE I SAMPLING PLAN SUMMARY OF THE SANITARY TREATMENT SYSTEM AGGREGATE

SAMPLING LOCATION/TYPE	SAMPLE LOCATION DESCRIPTION	Sample depth (inches)	Sample I.D. number	Field duplicate	Field split	Collocated sample	Total samples	Gross alpha	Gross beta	Gross gamma	Organic vapor	GC/FID for TPH (SW 8015)	Immunoassay kit for PCBs (SW 4020)	Gross alpha	Gross beta	Gross gamma	Strontium-90	Tritium	Herbicides (SW 8150)	Organochlorine pesticides (SW 8080)	Organophosphorous pesticides (SW 8140)	PCBs (SW 8080)	SVOCs (SW 8270)	TPH (SW 8015)	VOCs (SW 8240)	Mercury (SW 7470, 7471)	OU 1114 metals suite (SW 6010)[1]	OU 1114 Subpart S metals (SW 7000)[2]	Cyanide (SW 9010, 9012)
		SAMPLE DESCRIPTION						FIELD SCREENING				FIELD LAB		LABORATORY ANALYSIS: Radionuclides					Organics							Metals			Misc
SWMU 3-014(c2) Part 2	Abandoned outfall																												
Manual shallow core	North of chlorinator	0–12					1	1	1	1	1			1	1	1		1	1	1			1			1	1		
		12–18					1	1	1	1	1														1				1
Manual shallow core	North of chlorinator	0–12					1	1	1	1	1			1	1	1		1	1	1			1			1	1		
		12–18					1	1	1	1	1														1				1
SWMU 3-014(b2)	Active outfall																												
Manual shallow core	North of rock outcrop	0–12					1	1	1	1	1			1	1	1		1	1	1			1			1	1	1	
		12–18					1	1	1	1	1														1				1
Manual shallow core	South of rock outcrop	0–12					1	1	1	1	1			1	1	1		1	1	1			1			1	1		
		12–18					1	1	1	1	1														1				1
Manual shallow core	Catchment stream 1	0–12					1	1	1	1	1			1	1	1		1	1	1			1			1	1		
		12–18					1	1	1	1	1														1				1
Manual shallow core	Catchment stream 2	0–12				1	2	2	2	2	2			2	2	2		2	2	2			2			2	2	2	
		12–18		1			2	2	2	2	2														2				2
TOTAL NUMBER OF SAMPLES							14	14	14	14	14			7	7	7		7	7	7			7		7	7	7	3	7

[1]OU 1114 metals suite: beryllium, cadmium, chromium, lead, mercury, nickel, silver
[2]Subpart S metals (TAL list): antimony, arsenic, barium, selenium, thallium, vanadium

s/t = soil/tuff interface
SCB = sediment catchment basin

TABLE 5-16 (continued)

SCREENING AND ANALYSIS FOR OU 1114 PHASE I SAMPLING PLAN SUMMARY OF THE SANITARY TREATMENT SYSTEM AGGREGATE

SAMPLING LOCATION/TYPE	SAMPLE LOCATION DESCRIPTION	SAMPLE DESCRIPTION						FIELD SCREENING				FIELD LAB		LABORATORY ANALYSIS															
														Radionuclides					Organics							Metals			Misc
		Sample depth (inches)	Sample I.D. number	Field duplicate	Field split	Collocated sample	Total samples	Gross alpha	Gross beta	Gross gamma	Organic vapor	GC/FID for TPH (SW 8015)	Immunoassay kit for PCBs (SW 4020)	Gross alpha	Gross beta	Gross gamma	Strontium-90	Tritium	Herbicides (SW 8150)	Organochlorine pesticides (SW 8080)	Organophosphorous pesticides (SW 8140)	PCBs (SW 8080)	SVOCs (SW 8270)	TPH (SW 8015)	VOCs (SW 8240)	Mercury (SW 7470, 7471)	OU 1114 metals suite (SW 6010)[1]	OU 1114 Subpart S metals (SW 7000)[2]	Cyanide (SW 9010, 9012)
SWMU 3-014(a, e)	Soil around entrance works																												
Manual shallow core	Soil around Imhoff tanks	0–12					1	1	1	1	1			1	1	1		1	1	1			1			1	1		
		12–16					1	1	1	1	1														1				1
Manual shallow core	Soil around Imhoff tanks	0–12					1	1	1	1	1			1	1	1		1	1	1			1			1	1		
		12–18					1	1	1	1	1														1				1
Manual shallow core	Soil around Imhoff tanks	0–12					1	1	1	1	1			1	1	1		1	1	1			1			1	1	1	
		12–18					1	1	1	1	1														1				1
Manual shallow core	Soil around Imhoff tanks	0–12					1	1	1	1	1			1	1	1		1	1	1			1			1	1		
		12–18					1	1	1	1	1														1				1
Manual shallow core	Soil around Imhoff tanks	0–12				1	2	2	2	2	2			2	2	2		2	2	2			2			2	2		
		12–18		1			2	2	2	2	2														2				2
TOTAL NUMBER OF SAMPLES							12	12	12	12	12			6	6	6		6	6	6			6		6	6	6	1	6

[1]OU 1114 metals suite: beryllium, cadmium, chromium, lead, mercury, nickel, silver
[2]Subpart S metals (TAL list): antimony, arsenic, barium, selenium, thallium, vanadium

s/t = soil/tuff interface
SCB = sediment catchment basin

5.6 SWMU 60-006(a): Septic Tank

5.6.1 Background

5.6.1.1 Description and History

SWMU 60-006(a) is an abandoned septic system located approximately 32 ft northeast beyond the northeast corner of the fence that surrounds the Nevada Test Site (NTS) Test Rack Fabrication Facility (TA-60-17) and test tower (TA-60-19) on Sigma Mesa. The facility commenced operations in 1986 and is the location of equipment fabrication for testing activities carried out at NTS. During the first three years of operation (1986 to 1989) waste water generated from facility bathrooms and seven floor drains, including one in a paint booth, was discharged to a septic system, SWMU 60-006(a). The septic system consists of a 1 000-gal. septic tank and associated seepage pit that measures approximately 4 ft wide by 50 ft deep, Engineering drawing ENG-C 44841, sheet C-11. There is no outfall associated with this septic system.

Paint is typically allowed to accumulate on the paint booth floor during painting operations. This area has been cleaned by spraying with water approximately four times since 1986. The floor drain in the paint booth is now covered during painting operations (LANL 1992, 17-697).

The septic system was abandoned in place in 1989 when the facility was connected to the sanitary sewer and TA-3 waste water treatment plant. There is no documentation indicating that the septic tank was ever pumped out after its use was discontinued. Therefore, if any contaminants are present, they are expected to be found in any sludge remaining in the tank.

5.6.1.2 Conceptual Exposure Model

The conceptual exposure model is presented in Chapter 4, Fig. 4-4. Site-specific information on potential release sources, chemicals of concern, migration pathways, and potential receptors follows.

5.6.1.2.1 Nature and Extent of Contamination

The 1990 SWMU Report (LANL 1990, 0145) suggests the possibility that hazardous materials (paint, solvents, or oils) may have been discharged to the septic tank and it is possible that the tank has released hazardous waste through leakage or discharge to the associated seepage pit. PCOCs include volatile and SVOCs and metals listed in OU 1114 metals suite.

5.6.1.2.2 Potential Pathways and Exposure Routes

A summary of exposure mechanisms and human receptors is presented in Table 5-17.

TABLE 5-17

EXPOSURE MECHANISMS AND RECEPTORS FOR INACTIVE SEPTIC TANK, SWMU 60-006(A)

POTENTIAL AREA OF CONTAMINATION	RELEASE MECHANISMS	CURRENT POTENTIAL RECEPTORS	FUTURE POTENTIAL RECEPTORS
Inside septic tank	Leak to subsurface soil	None	Construction workers On-site workers
Subsurface soil and tuff surrounding septic system, including the seepage pit	Excavation or erosion resulting in wind dispersion, surface water runoff and infiltration, and volatilization	None	Construction workers On-site workers

Volatile and semivolatile organic compounds could migrate horizontally and vertically in the subsurface by vapor-phase transport.

5.6.2 Remediation Decisions and Investigation Objectives

Potential corrective measures for the inactive septic system are

- removal of material remaining in the septic tank if it is contaminated, and
- excavation of the septic tank and underlying soil and tuff if the septic tank appears to have leaked.

RFI Phase I investigations will provide data for a screening assessment of the septic system. If COCs are identified in material from the septic tank, VCA to remove sludge and fluid from the tank, and possibly to remove the tank itself, will be initiated. Phase II sampling of the seepage pit may be required to perform baseline risk assessment or design a corrective measure if contamination is observed in the septic tank.

If no COCs are identified during Phase I of the RFI, NFA will be proposed for SWMU 60-006(a).

5.6.3 Data Needs and Data Quality Objectives

Environmental data are required to determine the concentrations of hazardous constituents in septic tank sludge. The significant PCOCs are heavy enough to be retained in the sludge of the tank and, therefore, the tank itself is the only domain being considered for Phase I decisions.

The principal use of the Phase I data will be to identify COCs by comparing the maximum observed soil concentrations of the constituents of potential concern with SALs for soil. (See Subsection 5.6.1.2.1 for the PCOCs.) The toxicity of the PCOCs is generally low, and the decision domain is both small and relatively homogenous. Sample sizes should be selected to provide moderate confidence for bounding the median contamination in the septic tank for this screening assessment.

VCA may be initiated for the septic tank based on the presence of contamination in sludge. In this case, removal of remaining sludge and fluids will be followed by inspection of the tank to assess its integrity. If removal of the tank is necessary, confirmatory soil samples will be collected from the underlying soil or tuff and analyzed for all COCs.

5.6.4 Sampling and Analysis Plan

5.6.4.1. Field Investigation

5.6.4.1.1 Engineering Surveys

The engineering survey will locate the tank from present Engineering drawing ENG-C 44841, sheets C-11 and G-2. In the field, the engineering survey will locate, stake, and document all PRS boundaries and all surface engineering features.

5.6.4.1.2 Sampling

Field screening of this PRS will include monitoring of the atmosphere inside the tank for VOCs with a photoionization detector (PID). Depth of sludge in the tank will be measured at a minimum of three locations (along the centerline of the tank, at each end, and at the middle) using a dowel rod or similar device. If discrete liquid and sludge layers are encountered, each will be sampled separately (see Fig. 5-11).

A Coliwasa sampling tube will be used for sample collection in accordance with LANL-ER-SOP-06.15, R0. Three samples will be collected for volatile organic analysis with minimum disturbance of the sludge matrix. After the volatile samples are collected, three additional samples will be collected for the analyses of SVOCs and metals. A liquid sample (if a liquid layer is present in the tank) will be collected as one of the three samples from each group of analyses; otherwise, all will be sludge samples.

No duplicate samples are proposed. Other QA sampling will follow the guidelines of the QAPjP in Annex II of this work plan. Guidelines for sample size selection are located in Subsection 5.0.1.

If analyses of the tank sludge indicates the presence of COCs in concentrations exceeding established action levels, the tank may be removed as part of a VCA. After excavation of the tank, three samples will be collected from the first 6 in. of soil and/or tuff directly beneath the tank in accordance with LANL-ER-SOP-06.09, R0, Spade and Scoop Method for Collection of Soil Samples.

5.6.4.1.3 Laboratory Analyses

Samples will be analyzed for VOCs and SVOCs, and the OU 1114 metals suite: beryllium, cadmium, chromium, lead, mercury, nickel, and silver (see Table 5-18 and Appendix D for specific EPA methods).

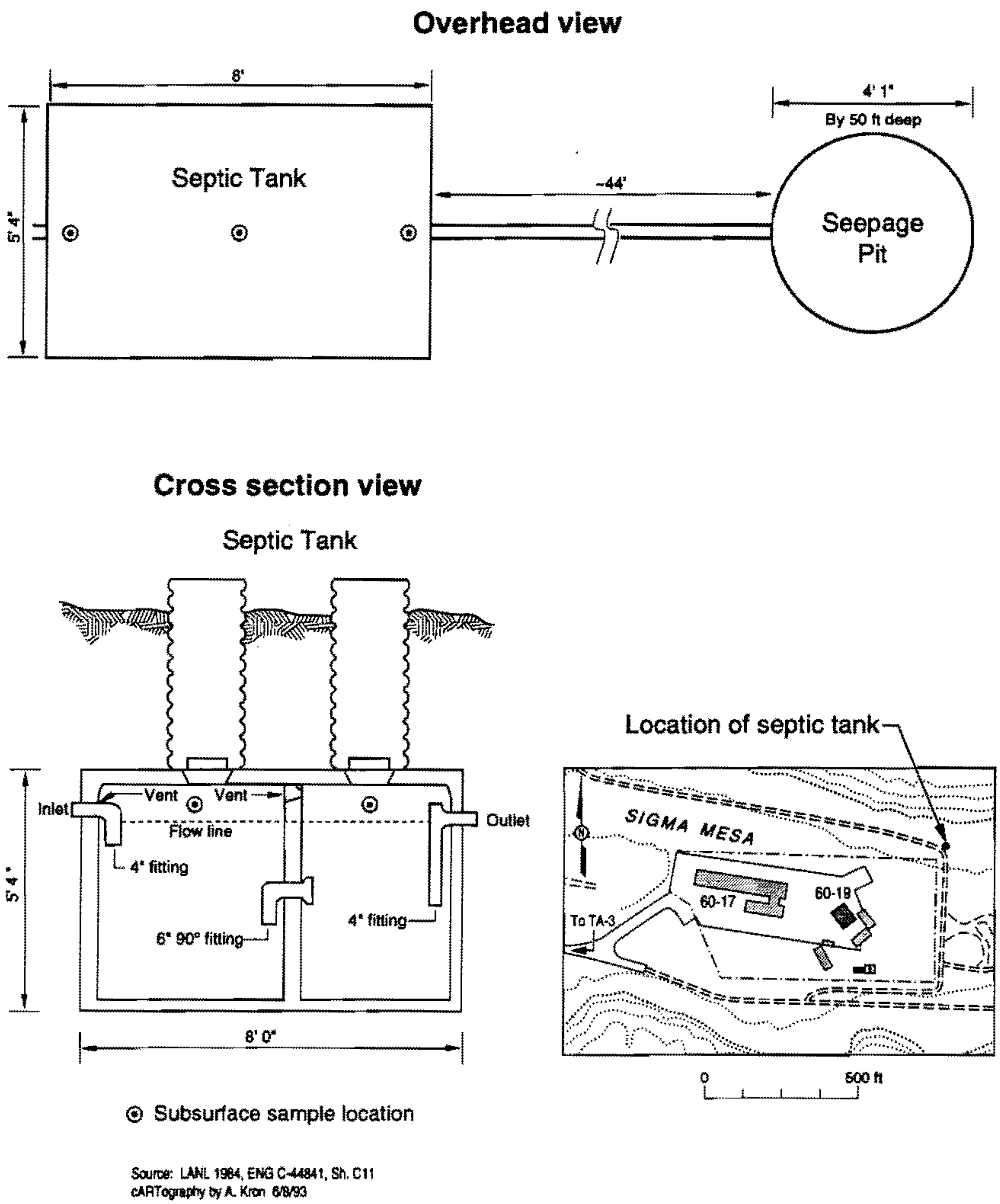

Fig. 5-11. Sample locations for SWMU 60-006(a), septic tank (see also Fig. E-9, Appendix E).

TABLE 5-18

SCREENING AND ANALYSIS FOR OU 1114 PHASE I SAMPLING PLAN SUMMARY SWMU 60-006(A), SEPTIC TANK

		SAMPLE DESCRIPTION						FIELD SCREENING				FIELD LAB		LABORATORY ANALYSIS															
														Radionuclides					Organics							Metals			Misc
SAMPLING LOCATION/TYPE	SAMPLE LOCATION DESCRIPTION	Sample depth (inches)	Sample I.D. number	Field duplicate	Field split	Collocated sample	Total samples	Gross alpha	Gross beta	Gross gamma	Organic vapor	GC/FID for TPH (SW 8015)	Immunoassay kit for PCBs (SW 4020)	Gross alpha	Gross beta	Gross gamma	Strontium-90	Tritium	Herbicides (SW 8150)	Organochlorine pesticides (SW 8080)	Organophosphorous pesticides (SW 8140)	PCBs (SW 8080)	SVOCs (SW 8270)	TPH (SW 8015)	VOCs (SW 8240)	Mercury (SW 7470, 7471)	OU 1114 metals suite (SW 6010)[1]	OU 1114 Subpart S metals (SW 7000)[2]	Cyanide (SW 9010, 9012)
SWMU 60-006(a)	Septic tank																												
Dowel rod	Measurement of sludge																												
	End (pt. 1)																												
	Middle																												
	End (pt. 2)																												
Tank atmosphere	Inside tank (pt. 1)	N/A		1			2				2																		
	Inside tank (pt. 2)	N/A					1				1																		
Liquid sample	Undisturbed sludge/liquid (pt. 1)	N/A					1																		1				
Liquid sample	Undisturbed sludge (pt. 2)	N/A					1																		1				
Liquid sample	Undisturbed sludge (pt. 3)	N/A					1																		1				
Liquid sample	Sludge/liquid (pt. 1)	N/A					1																1				1		
Liquid sample	Sludge (pt. 2)	N/A					1																1				1		
Liquid sample	Sludge (pt. 3)	N/A					1																1				1		
TOTAL NUMBER OF SAMPLES							9				3												3		3		3		

[1]OU 1114 metals suite: beryllium, cadmium, chromium, lead, mercury, nickel, silver
[2]Subpart S metals (TAL list): antimony, arsenic, barium, selenium, thallium, vanadium

s/t = soil/tuff interface
SCB = sediment catchment basin

5.7 Sigma Mesa East Aggregate

5.7.1 Background

5.7.1.1 Description and History

This aggregate is composed of four PRSs located within a 2.5-acre area at the east end of Sigma Mesa. Aggregation is based on proximity and similar PCOCs such as oil and petroleum products, as well as other organic constituents that may be present in surface soils throughout the area. The individual PRSs are listed in Table 5-19.

TABLE 5-19

DESCRIPTION OF PRS AGGREGATE

SWMU	LOCATION	DESCRIPTION	PCOC
60-004(b)	Sigma Mesa east	Drum storage	Diesel fuel
60-004(d)	Sigma Mesa east	Drum cutting area	Waste oil
60-004(e)	Sigma Mesa east	Storage	PCB-containing oil
60-007(a)	Sigma Mesa east	Equipment area	Waste oil

The area was first developed in July of 1979, when a major effort to drill a geothermal well was undertaken. During this drilling project, several pieces of drilling equipment, bulldozers, trucks, cars, generators, and fuel storage tanks were used at the site. A large area surrounding the well platform was scraped and leveled, and two temporary trailers were erected for personnel at the site. The very high costs associated with cementing the casings determined the decision to suspend drilling operations on September 25, 1979, without producing a well that could be used as an energy source. The well was double capped (welded caps on both the 20 in. and 30 in. casings) and a steel plate covers the collar welded to the 30 in. casing (LANL 1979, 17-812). Today only the concrete well platform surrounded by a fence remains at the site, together with a large pit [SWMU 60-005(b)] immediately to the west that was used for drilling mud (see Subsection 6.2.4.1, Table 6-11). The trailers have been removed; only one small shed remains on the site. Like other sections of Sigma Mesa, this area has been used for storage of equipment and other materials since the end of the drilling project.

SWMU 60-004(b) is a site next to the road, north of the drilling mud pit, where a dozen drums containing diesel sludge from the USTs that were removed from the Western Steam Plant were stored for a short time in 1988.

SWMU 60-004(d) is in the same area, and is a site about 60 ft square that was used for cutting up decommissioned USTs and for the temporary storage of drums to contain the residues after cleaning them. Oil stains are visible in the area. The northern edge of the area has been used for the disposal of building rubble, concrete, and rebar.

SWMU 60-004(e) is an area about 100 ft square at the south end of the leveled area, southeast of the well. A 1989 reconnaissance survey noted several large items here, including five transformers that possibly contained PCBs, and five large (3 000 to 5 000-gal.) storage tanks (LANL 1990, 0145). Oil-containing equipment stored on Sigma Mesa from the CLS Division was tested for PCBs in 1991 and found to be <5 ppm or non-PCB-containing oil (LANL 1991, 17-813). It is unknown whether equipment from other groups contained PCB-contaminated oil. These items have since been removed, but several large oil stains remained visible in early 1992. The area was inspected by the New Mexico Environment Department in March 1992, following a report that a private company, having purchased the large storage tanks from Johnson Controls, was unable to lift them onto their truck and therefore dumped oil and water onto the ground before removing them.

SWMU 60-007(a) is identified in the SWMU Report (LANL 1990, 0145) as an area of stained soil about 20 ft square, approximately 20 ft east of the concrete pad for the geothermal well. The drill rig and associated equipment were oiled and greased in this area. More generally, it is reported that the entire leveled area east of the mud pit and drill well were used to park tanks for mixing the bentonite, to store fuel tanks for generators, and to park earth movers, drilling rigs, and other vehicles. In addition, oil, hydraulic fluid, antifreeze, etc., was dumped directly on the ground (Martell 1992, 17-600). SWMU 60-007(a) and 60-004(e) are assumed to encompass the majority of the scraped area surrounding the concrete well platform.

During July 1992, soil from stained areas of both SWMU 60-004(e) and SWMU 60-007(a) was dug up, placed in drums, and removed (LANL 1992, 17-771). The remediated areas were covered with gravel. No sampling accompanied this corrective action.

5.7.1.2 Conceptual Model

The conceptual exposure model is presented in Chapter 4, Fig. 4-3. Site-specific information on potential release sources, chemicals of concern, migration pathways, and potential receptors follows.

5.7.1.2.1 Nature and Extent of Contamination

The USTs were to be emptied before being brought to SWMU 60-004(d), but oil stains from some source are visible in the area. PCOCs are hazardous constituents associated with fuel oils and other petroleum products, including hydrocarbons, which may be present in surface soils for all PRSs in this aggregate. Waste oil may contain very low concentrations of hazardous metal contaminants, principally copper, chromium, and possibly lead, due to corrosion of engine parts. Since concentrations would only be present far below SALs, metals are not considered PCOCs at this PRS.

SWMU 60-004(e) and SWMU 60-007(a) have recently been remediated, but no sampling was done to confirm that the remediation was complete. Areas to be remediated were defined by visible staining. In addition to the PCOCs listed above, PCBs might have leaked from electrical equipment once stored at SWMU 60-004(e).

5.7.1.2.2 Potential Pathways and Exposure Routes

A summary of exposure mechanisms and human receptors is presented in Table 5-20.

5.7.2 Remediation Decisions and Investigation Objectives

Some remediation of surface contamination in the area covered by this aggregate has already been done. Field analyses will determine whether PCOCs (TPH or PCBs) remain in the surface soils of this PRS aggregate, in either remediated areas or elsewhere. Any area found above TPH cleanup levels (100 ppm) will require additional field sampling and analyses to determine the extent of contamination. The contaminated areas would then undergo a VCA in which all soil will be removed and drummed until field analyses indicate that surrounding soil concentrations are below cleanup standards. Samples from each cleaned area will then be sent for confirmatory analyses at a fixed laboratory.

TABLE 5-20

EXPOSURE MECHANISMS AND RECEPTORS FOR SIGMA MESA EAST AGGREGATE

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

PCB-suspect areas will be screened using immunoassay techniques with a detection limit of 5 ppm. Soils exceeding the TSCA cleanup standard of 10 ppm (for unrestricted industrial use) will be removed until field analysis conducted during the VCA indicates that surrounding soils are below the determined cleanup standard. Confirmatory samples will then be collected for fixed laboratory PCB analyses. Sites that are more difficult to clean up may require an evaluation from regional EPA to determine the cleanup level (EPA 1991, 17-852).

If PCOCs are not detected above cleanup levels, at least 4 confirmatory samples will be analyzed for TPH and PCBs at a fixed laboratory.

5.7.3 Data Needs and Data Quality Objectives

Screening data are required to determine concentrations of hazardous constituents in surface soils in the PRS aggregate, in order to perform an assessment of SWMU 60-004(b) and SWMU 60-004(d), and to verify the attainment of cleanup levels at remediated SWMU 60-004(e) and SWMU 60-007(a).

The domain for Phase I decisions includes both the recently remediated spots in SWMU 60-004(d) and SWMU 60-007(a), where data will be used to verify that satisfactory cleanup levels have been attained, and unremediated areas throughout the aggregate, where data will be used to perform a screening assessment. The sampling will be designed to address three sub-populations within this domain.

- Approximately 35 areas of varying size (6 in. to 15 ft diameter) were remediated during the summer of 1992. A representative sample of these spots will be examined by collecting soil from the soil or tuff beneath the new gravel.
- Additional samples will be selected from the remainder of the leveled area [SWMU 60-004(e) and SWMU 60-007(a)], where there are no remaining visual indications of contamination.
- At SWMUs 60-004(b,d), sampling will be biased by visible stains that remain in that area.

All samples will be analyzed in the field for TPH and PCBs. Field analytical results will be compared with cleanup levels for soil to determine the need for VCAs (see Subsection 5.7.1.2.1 for the PCOCs). The toxicity of the PCOCs is generally low, but the decision domain is large (several acres) and potentially heterogeneous. Field analyses using GC/FID and PCB immunoassay techniques will be used to improve the probability that contamination, if present, will be detected. VCAs will be conducted if necessary. Confirmatory samples and a randomly selected subset of the remaining sample (stratified by the three domains described above) will be submitted for off-site analysis. The number of samples submitted for off-site analysis will be selected to provide confidence for bounding an upper percentile of the concentrations of PCOCs in this aggregate.

5.7.4 Sampling and Analysis Plan

5.7.4.1 Field Investigation

5.7.4.1.1 Engineering Surveys

Figure 5-12 shows remediated areas at this aggregate. Each numbered dot is a previously excavated oil stain ranging in size up to 2 ft in diameter. Numbers 1 and 19 represent the largest excavated oil stains with diameters

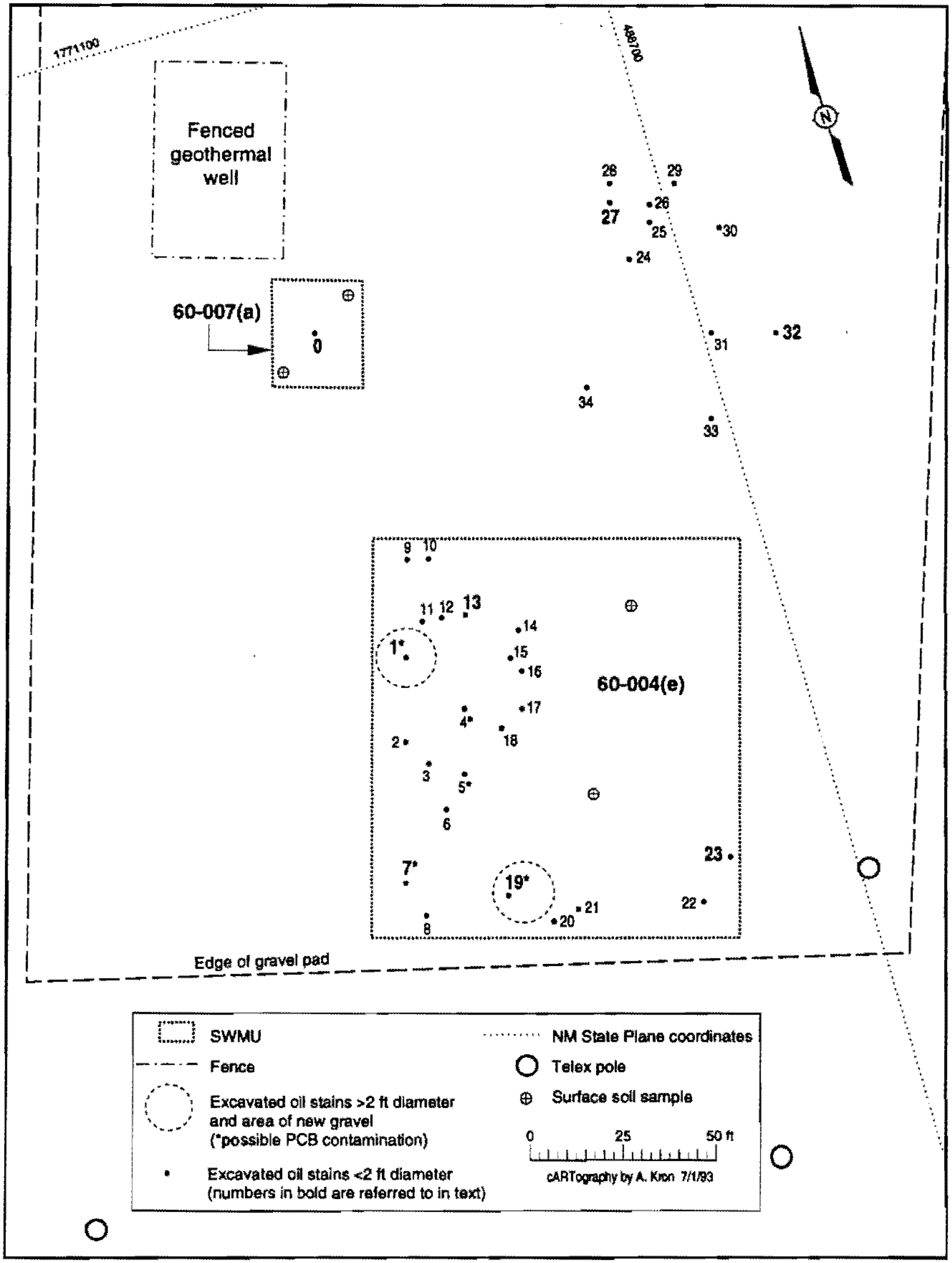

Fig. 5-12. Approximate locations of excavated oil stains and samples to be taken at Sigma Mesa East, SWMUs 60-004(e) and 60-007(a).

over 2 ft. These two points, together with #0 [identified as being the center point of SWMU 60-007(a)], were used as references for a preliminary mapping of additional stains.

Sampling points shown on Figs. 5-12 and 5-13 will be field surveyed before sample collection. If any additional samples are required, the sample locations will be marked with pin flags and surveyed as soon as possible. The field survey will consist of site engineering (geodetic) mapping. Data will be recorded on a base map.

5.7.4.1.2 Sampling

Seven samples plus one field duplicate will be collected at SWMUs 60-004(b,d) (see Fig. 5-13). Three or four of these samples are expected to be located based on visible staining observed in the site survey, with remaining samples placed at points of known activity. One collocated sample will also be collected. One field split will be prepared from one of the samples for field laboratory QC. The sample interval to be collected is 0 to 12 in. using a hand auger or thin-wall tube sampler, in accordance with LANL-ER-SOP-06.10, R0, Hand Auger and Thin-Wall Tube Sampler. At least two confirmatory samples will be collected from SWMU 60-004(b,d) for PCB and TPH analyses at a fixed laboratory. One of the samples will be collected from a stained area and one from within PRS boundaries away from the stained areas. Additional field analyses and confirmatory samples may be required in contamination is detected.

Ten samples are proposed for remediated areas in SWMU 60-004(e), designated on Fig. 5-12 as #1, #4, #6, #7, #9, #12, #16, #19, #21, and #22. The sample interval will be 0 to 12 in. When sampling remediated areas, the 0 to 12 in. sample interval will be measured from the surface below the new gravel. Sample collection method will be LANL-ER-SOP-06.10, R0, Hand Auger and Thin-Wall Tube Sampler. Of these remediated areas, #1, #7, and #19 are fairly large areas; therefore, the samples will be taken near their centers, including one collocated sample at location #19. Two additional sampling locations have been selected from within the PRS boundaries, away from remediated areas (shown on Fig. 5-12). At least two confirmatory samples will be collected from SWMU 60-004(e) for PCB and TPH analyses at a fixed laboratory. One of the samples will be collected from previously

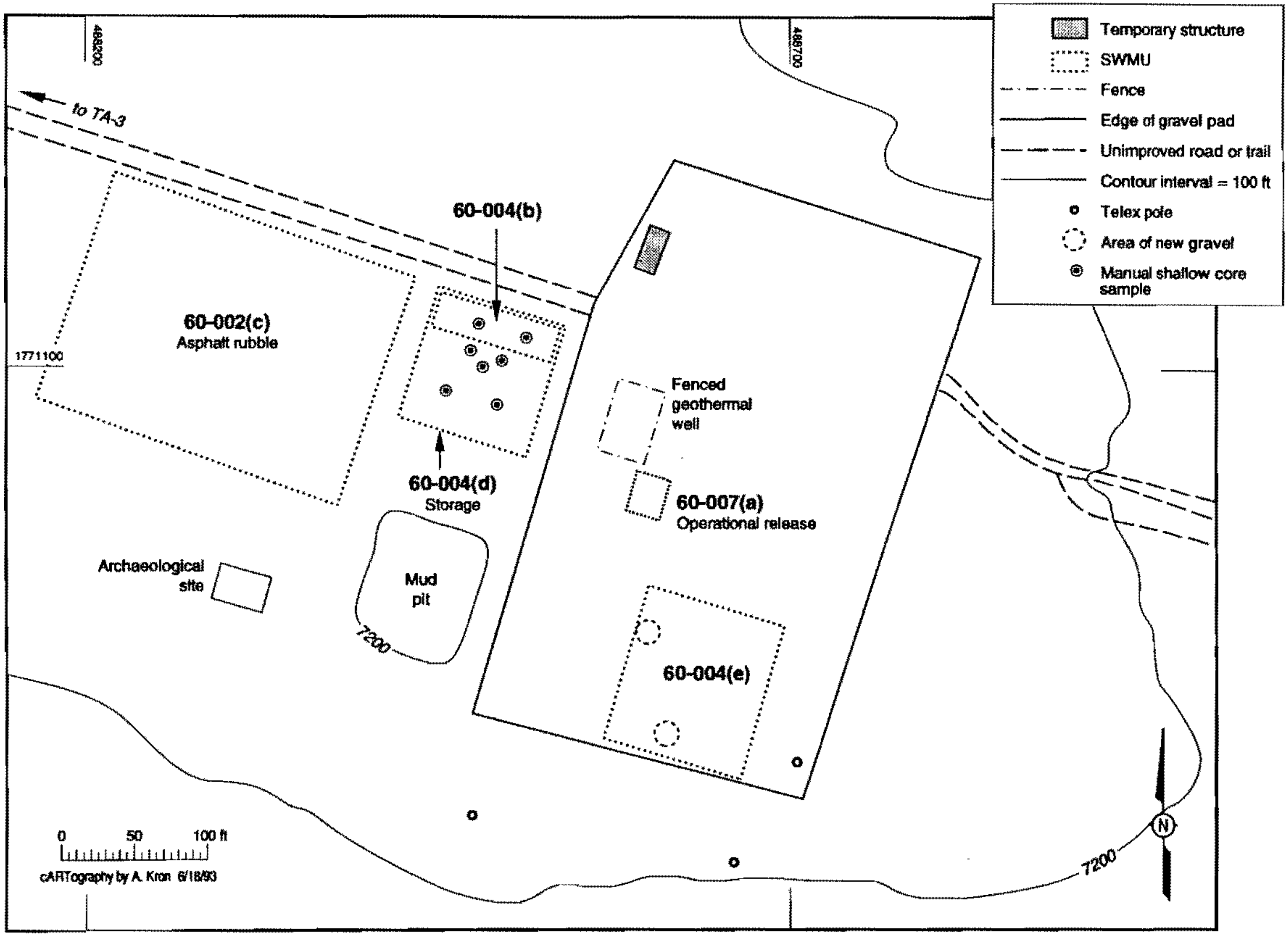

Fig. 5-13. Sample locations for SWMUs 60-004(b) and 60-004(d) at the Sigma Mesa East (also see Fig. E-10, Appendix E).

remediated areas and one from within PRS boundaries away from the remediated areas.

Six samples plus one collocated sample will be collected from remediated areas at SWMU 60-007(a), including #0, #24, #28, #30, #31, and #34. One collocated sample will be collected from point # 0. Two additional sampling locations away from remediated areas, are shown on Fig. 5-12. Field splits of samples from #24, #31, and one of the additional locations will be prepared for field laboratory QC. One confirmatory sample will be collected at SWMU 60-007(a) for TPH analyses at a fixed laboratory. Additional field analyses and confirmatory samples may be required if contamination is detected.

In addition to the collocated and split samples mentioned above, QA sampling will follow the guidelines of the QAPjP in Annex II of this work plan. Guidelines for sample size selection are located in Subsection 5.0.1.

5.7.4.1.3 Laboratory Analyses

Samples from SWMUs 60-004(b,d) and 60-004(e) will be analyzed in the field for TPH using GC/FID and for PCBs using immunoassay techniques. Samples from SWMU 60-007(a) will be field screened for TPH. Based on these results, VCAs will be performed on any areas having contaminants above cleanup levels. Confirmatory samples will be collected for fixed laboratory TPH and PCB analyses as described in Subsection 5.7.4.1.2. Analyses will be performed as listed in Table 5-21.

TABLE 5-21

SCREENING AND ANALYSIS FOR OU 1114 PHASE I SAMPLING PLAN SUMMARY OF SIGMA MESA EAST AGGREGATE

SAMPLING LOCATION/TYPE	SAMPLE LOCATION DESCRIPTION	SAMPLE DESCRIPTION: Sample depth (inches)	Sample I.D. number	Field duplicate	Field split	Collocated sample	Total samples	FIELD SCREENING: Gross alpha	Gross beta	Gross gamma	Organic vapor	FIELD LAB: GC/FID for TPH (SW 8015)	Immunoassay kit for PCBs (SW 4020)	LABORATORY ANALYSIS: Radionuclides: Gross alpha	Gross beta	Gross gamma	Strontium-90	Tritium	Organics: Herbicides (SW 8150)	Organochlorine pesticides (SW 8080)	Organophosphorous pesticides (SW 8140)	PCBs (SW 8080)	SVOCs (SW 8270)	TPH (SW 8015)	VOCs (SW 8240)	Metals: Mercury (SW 7470, 7471)	OU 1114 metals suite (SW 6010)[1]	OU 1114 Subpart S metals (SW 7000)[2]	Misc: Cyanide (SW 9010, 9012)
SWMU 60-004(e)	Oil stains																												
Surface soil	Remediated area (pt. 1)	0–12					1					1	1																
Surface soil	Remediated area (pt. 4)	0–12					1					1	1																
Surface soil	Remediated area (pt. 6)	0–12					1					1	1																
Surface soil	Remediated area (pt. 7)	0–12					1					1	1																
Surface soil	Remediated area (pt. 9)	0–12					1					1	1																
Surface soil	Remediated area (pt. 12)	0–12					1					1	1																
Surface soil	Remediated area (pt. 16)	0–12					1					1	1																
Surface soil	Remediated area (pt. 19)	0–12				1	2					2	2																
Surface soil	Remediated area (pt. 21)	0–12					1					1	1																
Surface soil	Remediated area (pt. 22)	0–12					1					1	1																
Confirmatory	Remediated area (pt. 22)	0–12					1															1		1					
Surface soil	Unremediated area	0–12					1					1	1																
Surface soil	Unremediated area	0–12					1					1	1																
Confirmatory	Unremediated area	0–12					1															1		1					
TOTAL NUMBER OF SAMPLES							15					13	13									2		2					

[1]OU 1114 metals suite: beryllium, cadmium, chromium, lead, mercury, nickel, silver
[2]Subpart S metals (TAL list): antimony, arsenic, barium, selenium, thallium, vanadium

s/t = soil/tuff interface
SCB = sediment catchment basin

TABLE 5-21 (continued)

SCREENING AND ANALYSIS FOR OU 1114 PHASE I SAMPLING PLAN SUMMARY OF SIGMA MESA EAST AGGREGATE

		SAMPLE DESCRIPTION						FIELD SCREENING				FIELD LAB		LABORATORY ANALYSIS															
														Radionuclides					Organics							Metals			Misc
SAMPLING LOCATION/TYPE	SAMPLE LOCATION DESCRIPTION	Sample depth (inches)	Sample I.D. number	Field duplicate	Field split	Collocated sample	Total samples	Gross alpha	Gross beta	Gross gamma	Organic vapor	GC/FID for TPH (SW 8015)	Immunoassay kit for PCBs (SW 4020)	Gross alpha	Gross beta	Gross gamma	Strontium-90	Tritium	Herbicides (SW 8150)	Organochlorine pesticides (SW 8080)	Organophosphorous pesticides (SW 8140)	PCBs (SW 8080)	SVOCs (SW 8270)	TPH (SW 8015)	VOCs (SW 8240)	Mercury (SW 7470, 7471)	OU 1114 metals suite (SW 6010)[1]	OU 1114 Subpart S metals (SW 7000)[2]	Cyanide (SW 9010, 9012)
SWMU 60-007(a)	Oil stains																												
Surface soil	Remediated area (pt. 0)	0–12				1	2					2																	
Surface soil	Remediated area (pt. 24)	0–12			1		2					2																	
Surface soil	Remediated area (pt. 28)	0–12					1					1																	
Surface soil	Remediated area (pt. 30)	0–12					1					1																	
Surface soil	Remediated area (pt. 31)	0–12			1		2					2																	
Surface soil	Remediated area (pt. 34)	0–12					1					1																	
Confirmatory	Remediated area (pt. 34)	0–12					1																	1					
Surface soil	Unremediated area	0–12			1		2					2																	
Surface soil	Unremediated area	0–12					1					1																	
SWMU 60-004(b, d)	Oil stains																												
Surface soil	Oil stained area	0–12					1					1	1																
Surface soil	Oil stained area	0–12				1	2					2	2																
Surface soil	Oil stained area	0–12					1					1	1																
Confirmatory	Oil stained area	0–12					1															1		1					
Surface soil	Unstained area	0–12					1					1	1																
Surface soil	Unstained area	0–12			1		2					2	2																
Surface soil	Unstained area	0–12					1					1	1																
Surface soil	Unstained area	0–12					1					1	1																
Confirmatory	Unstained area	0–12					1															1		1					
TOTAL NUMBER OF SAMPLES							24					21	9									2		3					

[1]OU 1114 metals suite: beryllium, cadmium, chromium, lead, mercury, nickel, silver
[2]Subpart S metals (TAL list): antimony, arsenic, barium, selenium, thallium, vanadium

s/t = soil/tuff interface
SCB = sediment catchment basin

5.8 Sigma Mesa Solar Pond Aggregate

5.8.1 Background

5.8.1.1 Description and History

This aggregate has two PRSs, a former solar pond, 60-005(a), and a used drum storage area, 60-004(c). These two PRSs are aggregated because the drum storage was inside the fenced area enclosing the solar pond.

SWMU 60-005(a) is an inactive surface impoundment, located on the east end of Sigma Mesa, approximately 1.2 miles east of the NTS Building (TA-60-19), on the south side of the road. A 6 ft security fence surrounds the pond.

Beginning in the spring of 1979, the pond was constructed for an experiment by HSE-7, the Waste Management Group. The pond was excavated, bermed, and inlaid with native tuff to form the specified outer dimensions. A sand-bentonite clay mixture (20%:80%, respectively) was put in the bottom of the excavation, extending up the three foot slope to form the edges. Next, 2 in. of 3/8 in. gravel was added and a leakage detection system was laid down. The leak detection system was covered with another 4 in. of 5/8 in. gravel, then another layer of sand and bentonite was placed. This last layer extended to the outermost edges of the pond. Finally, a Hypalon liner, approximately 50 mils thick, was installed (Gillespie 1979, 17-550).

The experiment was designed to evaluate evaporation as a method for reducing the volume of treated effluent from the liquid waste treatment facility at TA-50, the industrial waste treatment plant. A total of 140 000 gal. of treated effluent from the final holding tanks of TA-50 were trucked to the pond on Sigma Mesa between August 1979 and June 1981 (Gillespie 1981, 17-538). During this two-year period the pond was actively monitored (see Subsection 5.8.1.2.1). Liquid did not evaporate rapidly from the Sigma Mesa pond, probably because of its depth. During the experiment, the pond actually gained liquid from natural precipitation (Martell 1992, 17-636).

The experiment was abandoned in 1981. Between 1981 and 1989 quarterly visual inspections were performed to check on the water level and the pond liner (Martell 1992, 17-636).

HSE-7 began cleaning up the pond in 1989. Liquid remaining in the pond was pumped into the nearby waste line through the air bleed-off valves in the pipe running from TA-21 to TA-50. After the pond had dried, the dirt and debris remaining within the liner (mostly blown in by wind or rain) was put into five 55-gal. drums and removed to TA-54. The Hypalon liner, still intact at this point, was rinsed several times, the rinse water was also pumped into the waste line for disposal (Martell 1992, 17-636).

Currently, the site remains fenced and posted as a radioactive hazard. The Hypalon liner has partially disintegrated as a result of its exposure to air and sun, and water from precipitation is sometimes present in the bottom of the pond.

SWMU 60-004(c) is a former drum-storage area within the fence surrounding the Sigma Mesa pond, to the east of the pond. There appear to be oil stains on the ground in this area (Martell 1992, 17-599).

In December of 1985, approximately 125 empty, used 55-gal. drums were trucked to the solar pond fenced enclosure and stacked in a pyramid along the east fence for approximately eight months. A field observation dated February 18, 1986, reported the inappropriate drum storage as part of an ongoing EPA RCRA compliance investigation (Perkins 1986, 17-222). In June or July of 1986, the drums were returned to TA-54, crushed, and disposed of in Area J, a non-hazardous material facility.

5.8.1.2 Conceptual Exposure Model

The conceptual exposure model is presented in Chapter 4, Fig. 4-4. Site-specific information on potential release sources, chemicals of concern, migration pathways, and potential receptors follows.

5.8.1.2.1 Nature and Extent of Contamination

Potential contaminants for SWMU 60-004(c) include organics from the drum storage area. The labels on the empty drums indicated that they had contained freon, chlorothane, solvit, Shell Dralla A+ oil (sic), and several blue drums (Perkins 1986, 17-222). PCBs are also a possible COC since some of the drums were missing labels, documented during the site investigation. PCOCs for SWMU 60-005(a) include tritium and other low-level radionuclides, also metals and cyanide from the solar pond experiment.

Historical releases to the environment could have occurred by leaking or spillage from the pond or drums. Resistivity measurements from the leak detection system indicated no leakage under the pond as of January 1981 (Gillespie 1981, 17-547), but monitoring ceased after 1981. At the time of the 1989 cleanup, the liner was still intact. Contaminated dust might have been blown out of the open solar pond. Rodent intrusion (pocket gophers) was noted in the berm during 1980 (Gillespie 1980, 17-551). Thus, contaminants may be present in surface and near-surface soils around the pond and in materials used to line the pond.

Throughout the experiment in 1980 and 1981, liquid and sediments in the pond were sampled and analyzed for radionuclides, metals, nitrate, fluoride, and cyanide (Gillespie 1981, 17-539; Gillespie 1981, 17-541). A very conservative upper bound on the maximum inventory of radionuclides at PRS 60-005(a) can be derived from measurements of water and sludge that were formerly in the solar pond. Based on the measurements reported in (Gillespie 1981, 17-541), the total amounts of radionuclides present in the 140 000-gal. of effluent trucked to the pond are estimated in Table 5-22.

TABLE 5-22

ESTIMATES OF TOTAL RADIONUCLIDES IN 140 000 GALLONS OF SOLAR POND WATER (μCI)

RADIONUCLIDE	MEAN	STANDARD DEVIATION	MAXIMUM
Americium-241	36	55	239
Cesium-137	1 650	4 000	23 900
Plutonium-238	4	5	29
Plutonium-239	13	17	70
Strontium-90	28	13	57
Uranium	7	6	33

Similarly, based on reported sediment measurements (Gillespie 1980, 17-545), the total amount of contamination that might have been in the approximately 400 kg of material removed from the pond in 1989 (Martell 1992, 17-636) is generously bounded as shown in Table 5-23.

TABLE 5-23

BOUND ON RADIONUCLIDE INVENTORY OF 400 kg OF SOLAR POND SEDIMENTS (µCi)

RADIONUCLIDE	MEAN	STANDARD DEVIATION	MAXIMUM
Americium-241	30	28	113
Cesium-137	1 100	185	1 330
Plutonium-238	7	10	35
Plutonium-239	17	35	120
Strontium-90	78	44	166
Uranium	1.7	0.4	2.1

From these estimates we can conclude that even if the *entire* contents of the pond had infiltrated beneath the lining to contaminate the underlying material, the concentrations of plutonium-238, plutonium-239, strontium-90, americium-241, and uranium in these materials would be below 10 pCi/g. Only the cesium-137 observations suggest any possible problem. In view of the fact that water and solid material were removed from the pond while the liner was still intact, after which the liner was rinsed several times, it is unlikely that more than a very small fraction of the quantities estimated above remain at the site.

5.8.1.2.2 Potential Pathways and Exposure Routes

A summary of exposure mechanisms and human receptors is presented in Table 5-24. VOCs at the atmosphere/soil interface would have evaporated, but VOCs and SVOCs may be present in near-surface soils due to infiltration.

The uppermost rock unit in this location is the Tshirege unit of the Bandelier Tuff, a welded ash-flow deposit which will act to retard moisture transport in the vadose zone above the water table due to its high porosity and low moisture content. The solar pond was probably cut into the Tshirege unit of the Bandelier Tuff, and then lined with plastic over layers of sand and bentonite. There should have been no drainage from the pond into underlying tuff. Available water capacity in runoff is slow in this moderately permeable soil and water erosion is slight. Depth to solid tuff is typically 20-40 in.

TABLE 5-24

EXPOSURE MECHANISMS AND RECEPTORS FOR SIGMA MESA SOLAR POND AGGREGATE

POTENTIAL AREA OF CONTAMINATION	RELEASE MECHANISMS	CURRENT POTENTIAL RECEPTORS	FUTURE POTENTIAL RECEPTORS
Surface soil around solar pond and temporary storage area	Erosion resulting in wind dispersion Storm water runoff and infiltration Volatilization External irradiation	On-site workers	On-site workers
Material within the pond (i.e., Hypalon liner and clay/ bentonite lining)	Erosion resulting in wind dispersion Storm water runoff and infiltration beneath the pond External irradiation	On-site workers	On-site workers
Subsurface soil beneath the solar pond	Future excavation or erosion resulting in surface release mechanisms	None	Construction workers On-site workers

5.8.2 Remediation Decisions and Investigation Objectives

The solar pond experiment has been terminated and the fenced area is no longer used for storage of any kind. The goal of this RFI is to determine whether any contaminants have been released to the environment, and if so, to determine the extent of such releases prior to completing the decommissioning of the site.

Specifically, the objectives of the RFI Phase I investigation will be to answer the following questions:

- Have the radionuclides that were originally pumped into the pond migrated beneath the Hypalon liner and into the clay/bentonite lining of the pond or beyond into subsurface soils?

- Did the temporary storage of empty drums at the storage site result in the release of any contaminants?

- Has the surface surrounding the solar pond been contaminated with radionuclides through air-borne suspension of soil/sediment that blew into and then out of the solar pond?

If any of these questions is answered positively, then additional Phase II investigation might be required to determine the extent of contamination in order to complete a baseline risk assessment or to determine appropriate corrective measures. Otherwise, removal of the remaining artifacts (fence, Hypalon liner) from the site and leveling of the berm will complete the decommissioning of this site.

5.8.3 Data Needs and Data Quality Objectives

The available data and the calculations in Subsection 5.8.1.2.1 provide enough information to bound the total quantity of radionuclides that were ever present in the solar pond. Among these radionuclides, it appears that cesium-137, a beta- and gamma-emitter, was present at the highest concentrations. While it is unlikely that more than a small part of the total contamination estimated in Subsection 5.8.1.2.1 was ever released to the environment, environmental data are needed to evaluate this expectation and also to investigate the adjacent SWMU 60-004(c).

Phase I of the RFI will provide data for estimating concentrations of hazardous and radioactive constituents in material lining the pond and in surface soils adjacent to the pond. The domain for Phase I decisions includes the remaining Hypalon liner, the bentonite/sand mixture within the berms around the pond, and surface soils, both near the east fence where the empty drums were stored and adjacent to the pond.

If there were undetected pinhole leaks in the liner, this could have led to local contamination concentrations in the material beneath the liner. Therefore, sampling at SWMU 60-005(a) of the bentonite-sand material and the surrounding surface soil will be biased by the results of a field radioactivity survey.

Sampling within SWMU 60-004(c) will be biased by soil staining (Martell 1992, 17-599) or field PID measurements.

The principal use of the Phase I data will be to identify COCs by comparing the maximum observed soil concentrations of the constituents of potential concern with SALs for soil. Samples of material from the solar pond and surface samples from the surrounding area will be analyzed for metals as listed in the OU 1114 metals suite, radionuclides, and cyanide. Soil samples from the drum storage area will be analyzed for VOCs, SVOCs, and PCBs. The potential inventory of the PCOCs is small, and sample sizes will provide moderate nominal confidence for the detection of contamination if present. The use of field screening and visual indications to bias sampling should provide increased confidence, however.

5.8.4 Sampling and Analysis Plan

5.8.4.1 Field Investigation

5.8.4.1.1 Engineering Surveys

Sampling points will be field surveyed before sample collection to provide a grid for radiological screening, if applicable. This will consist of site engineering (geodetic) mapping. Data will be recorded on a base map. The assumed locations of subsurface structures will be surveyed based on existing engineering drawings.

5.8.4.1.2 Sampling

SWMU 60-004(c). Field screening for VOCs at the drum storage site will dictate sample location selection (field screening methods are detailed in Appendix D). If no elevated readings are observed during field screening, four default sample locations will be selected as shown in Fig. 5-14, two in the stained soil areas near the entry gate, and two approximately 25 and 50 ft to the south of the gate. One field duplicate for VOC analyses and a collocated sample will be added to this set. Shallow manual core samples (0 to 18 in.) will be collected at each location in accordance with LANL-ER-SOP-06.10, R0, Hand Auger and Thin-Wall Tube Sampler.

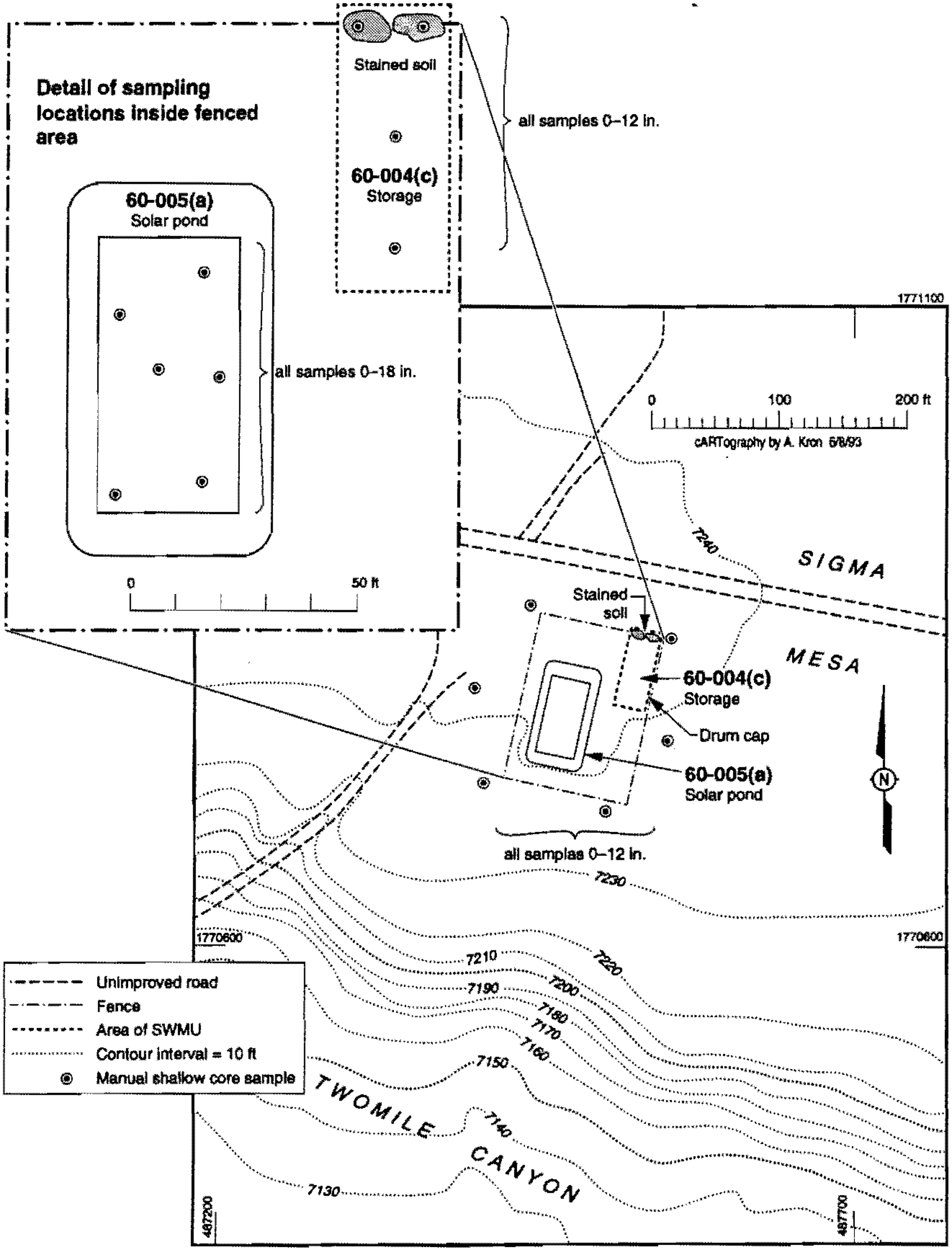

Fig. 5-14. Sample locations for SWMUs 60-004(c) and 60-005(a), Sigma Mesa solar pond aggregate (also see Fig. E-10, Appendix E).

SWMU 60-005(a). The Hypalon liner will be screened for radioactivity and placed in 55-gal. barrels for disposal at Area G. Additional field screening for radioactivity at the exposed sand/bentonite/gravel layer of the solar pond site will dictate sample location selection. If no elevated readings are observed during field screening, six sample locations will be selected as shown in the inset to Fig. 5-14. These will be manual shallow core samples through the two sand/bentonite clay layers and the middle gravel layer (a total depth of 18 in. to the inlaid tuff below). Sample collection will be conducted in accordance with LANL-ER-SOP-06.10, R0, Hand Auger and Thin-Wall Tube Sampler. Nine samples for analysis will be selected from the six samples collected: six from the layer above the gravel (three from the 0 to 12 in. interval and three from the 12 to 18 in. interval), and three from the layer below, all from the 0 to 12 in. interval. The three points for which two intervals will be collected will be selected on the basis of positive field screening results for radioactivity, if any, otherwise at random. Two field splits will be collected, one from each layer.

Six manual shallow core samples (0 to 18 in.) plus one collocated field duplicate will also be collected outside the fence approximately 50 ft from the center of the solar pond every 60° in a circle. Manual shallow core sample collection will be conducted in accordance with LANL-ER-SOP-06.10, R0, Hand Auger and Thin-Wall Tube Sampler.

In addition to the collocated and split samples mentioned above, QA sampling will follow the guidelines of the QAPjP in Annex II of this work plan. Guidelines for sample size selection are located in Subsection 5.0.1.

5.8.4.1.3 Laboratory Analyses

SWMU 60-004(c). Samples from the former drum storage area will be analyzed for PCBs, SVOCs, and VOCs. Samples for VOCs must be collected from the 12 to 18 in. interval of each core.

SWMU 60-005(a). All samples for the solar pond will be field screened for gross alpha and beta/gamma radiation and organic vapors (only floor of solar pond for organic vapors). If radioactivity is detected during the screening at levels above 1 000 cpm, the samples will be sent to a field screening trailer for gross alpha, gross beta, gamma spectroscopy, and tritium analyses. If radioactivity is not detected, or detected at levels below 1 000 cpm, the samples will be sent to a fixed laboratory for confirmatory gross alpha, gross beta, gross gamma, and tritium analyses. Isotopic uranium, isotopic plutonium, and strontium-90 analysis will be conducted on any samples that have gross analyses results indicating the possible presence of these isotopes.

Samples from the solar pond will also be analyzed for SVOCs and the OU 1114 metals suite (beryllium, cadmium, chromium, lead, mercury, nickel, and silver) and RCRA Subpart S metals (antimony, arsenic, barium, selenium, thallium, and vanadium) in the upper bentonite layer. The three samples from the lower bentonite layer will be analyzed for all analytes listed above plus cyanide and VOCs. The interval collected for cyanide analyses shall be 12 to 18 in.

Samples taken from the mesa surrounding the solar pond will be field screened for radionuclides but not for organic vapor. All other samples will be analyzed for the same constituents as listed above except for VOCs, which will not be included. See Table 5-25 and Appendix D for specific EPA methods.

TABLE 5-25

SCREENING AND ANALYSIS FOR OU 1114 PHASE I SAMPLING PLAN SUMMARY OF SIGMA MESA SOLAR POND

SAMPLING LOCATION/TYPE	SAMPLE LOCATION DESCRIPTION	SAMPLE DESCRIPTION						FIELD SCREENING				FIELD LAB		LABORATORY ANALYSIS															
														Radionuclides					Organics							Metals			Misc
		Sample depth (inches)	Sample I.D. number	Field duplicate	Field split	Collocated sample	Total samples	Gross alpha	Gross beta	Gross gamma	Organic vapor	GC/FID for TPH (SW 8015)	Immunoassay kit for PCBs (SW 4020)	Gross alpha	Gross beta	Gross gamma	Strontium-90	Tritium	Herbicides (SW 8150)	Organochlorine pesticides (SW 8080)	Organophosphorous pesticides (SW 8140)	PCBs (SW 8080)	SVOCs (SW 8270)	TPH (SW 8015)	VOCs (SW 8240)	Mercury (SW 7470, 7471)	OU 1114 metals suite (SW 6010)[1]	OU 1114 Subpart S metals (SW 7000)[2]	Cyanide (SW 9010, 9012)
SWMU 60-004(c)	Temporary drum storage																												
Manual shallow core	Stained soil	0–12					1															1	1						
		12–18					1																		1				
Manual shallow core	Stained soil	0–12				1	2															2	2						
		12–18		1			2																		2				
Manual shallow core	25 ft south of gate	0–12					1															1	1						
		12–18					1																		1				
Manual shallow core	50 ft south of gate	0–12					1															1	1						
		12–18																							1				
SWMU 60-005(a)	Solar Pond																												
Liner removal	Hypolon liner	N/A					1	1	1	1																			
Manual shallow core	Pond bottom (above gravel)	0–12			1		2	2	2	2	1			2	2	2		2					2				2	2	
		12–18			1		2	2	2	2	1			2	2	2		2							2		2	2	2
Manual shallow core	Pond bottom (above gravel)	0–12					1	1	1	1	1			1	1	1		1					1				1	1	
		12–18					1	1	1	1	1			1	1	1		1							1		1	1	1
Manual shallow core	Pond bottom (above gravel)	0–12					1	1	1	1	1			1	1	1		1					1				1	1	
		12–18					1	1	1	1	1			1	1	1		1							1		1	1	1
Manual shallow core	Pond bottom (below gravel)	0–12					1	1	1	1	1			1	1	1		1					1				1	1	
Manual shallow core	Pond bottom (below gravel)	0–12					1	1	1	1	1			1	1	1		1					1				1	1	
Manual shallow core	Pond bottom (below gravel)	0–12					1	1	1	1	1			1	1	1		1					1				1	1	
TOTAL NUMBER OF SAMPLES							21	12	12	12	9			11	11	11		11				5	12		9		11	11	4

[1]OU 1114 metals suite: beryllium, cadmium, chromium, lead, mercury, nickel, silver
[2]Subpart S metals (TAL list): antimony, arsenic, barium, selenium, thallium, vanadium

s/t = soil/tuff interface
SCB = sediment catchment basin

TABLE 5-25 (continued)

SCREENING AND ANALYSIS FOR OU 1114 PHASE I SAMPLING PLAN SUMMARY OF SIGMA MESA SOLAR POND

SAMPLING LOCATION/TYPE	SAMPLE LOCATION DESCRIPTION	SAMPLE DESCRIPTION						FIELD SCREENING				FIELD LAB		LABORATORY ANALYSIS															
														Radionuclides					Organics							Metals			Misc
		Sample depth (inches)	Sample I.D. number	Field duplicate	Field split	Collocated sample	Total samples	Gross alpha	Gross beta	Gross gamma	Organic vapor	GC/FID for TPH (SW 8015)	Immunoassay kit for PCBs (SW 4020)	Gross alpha	Gross beta	Gross gamma	Strontium-90	Tritium	Herbicides (SW 8150)	Organochlorine pesticides (SW 8080)	Organophosphorus pesticides (SW 8140)	PCBs (SW 8080)	SVOCs (SW 8270)	TPH (SW 8015)	VOCs (SW 8240)	Mercury (SW 7470, 7471)	OU 1114 metals suite (SW 6010)[1]	OU 1114 Subpart S metals (SW 7000)[2]	Cyanide (SW 9010, 9012)
SWMU 80-005(a)	Solar Pond																												
Manual shallow core	Soil around solar pond	0–12					1	1	1	1				1	1	1		1					1				1	1	
		12–18					1	1	1	1																			1
Manual shallow core	Soil around solar pond	0–12				1	2	2	2	2				2	2	2		2					2				2	2	
		12–18				1	2	2	2	2																			2
Manual shallow core	Soil around solar pond	0–12					1	1	1	1				1	1	1		1					1				1	1	
		12–18					1	1	1	1																			1
Manual shallow core	Soil around solar pond	0–12					1	1	1	1				1	1	1		1					1				1	1	
		12–18					1	1	1	1																			1
Manual shallow core	Soil around solar pond	0–12					1	1	1	1				1	1	1		1					1				1	1	
		12–18					1	1	1	1																			1
Manual shallow core	Soil around solar pond	0–12					1	1	1	1				1	1	1		1					1				1	1	
		12–18					1	1	1	1																			1
TOTAL NUMBER OF SAMPLES							14	14	14	14				7	7	7		7					7				7	7	7

[1]OU 1114 metals suite: beryllium, cadmium, chromium, lead, mercury, nickel, silver
[2]Subpart S metals (TAL list): antimony, arsenic, barium, selenium, thallium, vanadium

s/t = soil/tuff interface
SCB = sediment catchment basin

5.9 Storm Drains Aggregate

5.9.1 Background

5.9.1.1 Description and History

Two PRSs have been aggregated due to their common origin and contaminant concerns. SWMU 3-013(b) is a floor drain in Building TA-3-38 that empties into a storm drain, SWMU 3-013(a).

SWMU 3-013(a) is a 1 500 ft storm drain serving the Johnson Controls Shops Building, TA-3-38. The grated inlet to this storm drain is located at the northeast corner of the building. The majority of the storm drain is an underground, corrugated metal pipe that runs south, then east around TA-3-38, and east along the south side of the Otowi Building, TA-3-261. Engineering drawings indicate that four other storm drains connect to this line before it emerges to daylight 100 ft east of the Otowi Building (ENG-LA-WN-C-01). This section of drain is an open, concrete and rock-lined ditch to a point west of Buildings TA-3-1616/1617, passing under streets and sidewalks to an EPA-permitted outfall, EPA 03A023. At this point, the ditch becomes a natural drainage channel and stays so until it enters a corrugated metal pipe that passes under Diamond Drive. East of Diamond Drive, the storm line empties into the head of Sandia Canyon (LANL 1987, 17-763).

This PRS received waste water from floor drains, sinks, and water fountains until 1987 when the drains were rerouted to the TA-3 sanitary sewer system (LANL 1987, 17-763). During 1968, Stoddard solvent (xylene-petroleum naphtha product) from the maintenance shop and dry acid and caustic materials from the fitters operations were discarded through sinks and floor drains into this storm drain (LASL 1968, 17-145).

SWMU 3-013(b) consists of floor drains in the basement of the NTS shop in TA-3-38. Engineering drawing, ENG-LA-WN-C-01, shows floor drains in the plasma burning machine area, metals-cutting room, and the pipe-fabrication shop. A notation on the drawings indicated that this floor drain empties into the storm drain system, SWMU 3-013(a). The floor drain piping in the basement of TA-3-38 was rerouted in 1987; it now drains into the sanitary sewer system (LANL 1987, 17-763). The entire TA-3 sanitary sewer system is considered a PRS (LANL 1990, 0145). During the 1960s and 1970s, spent paint solvents and cutting oils contaminated with machined beryllium particles may have been released into floor drains of TA-3-38 (LANL 1990, 0145). Waste water emptying into the storm drain may have contained lead, chromium, nickel, and other metals.

5.9.1.2 Conceptual Exposure Model

The conceptual exposure model is presented in Chapter 4, Fig 4-4. Site-specific information on potential release sources, chemicals of concern, migration pathways, and potential receptors follows.

5.9.1.2.1 Nature and Extent of Contamination

The outfall included in SWMU sites 3-013(a,b) is categorized by the NPDES permit as industrial. The prefix 03A includes outfalls that receive waters from non-contact cooling water, non-destructive testing discharge, and water production facilities. All 03A outfalls throughout the Lab are sampled weekly on a sequential rotating basis. The monitoring parameters include flow rate, total suspended solids, chlorine, pH, and total phosphorus. None of the monitoring parameters are of interest to the Environmental Restoration (ER) Program. The application for NPDES permits began in the mid 1970s. Reapplication for the NPDES permit every five years requires analyses of over 120 analytes, including some RCRA-regulated constituents. Analytical reports from these water analyses are not included in this RFI, which is concerned with PCOCs that may have accumulated in the soil since the early 1960s.

The extent of possible contamination associated with these PRSs is unknown. The only sections of the storm drain that can be considered potential sources of exposure to the public are the open concrete and rock-lined ditch east of Building TA-3-261 and north of Building TA-3-207 and the natural channel between the designated outfall and the channel running south of TA-3-443. The rest of the storm drain is underground. The channel beyond the outfall may be contaminated by drainage from parking lots and other buildings to the extent that the contaminant source cannot be identified. PCOCs for SWMUs 3-013(a,b) include metals listed in the OU 1114 metals suite.

5.9.1.2.2 Potential Pathways and Exposure Routes

A summary of exposure mechanisms and human receptors is presented in Table 5-26. VOCs at the atmosphere/soil interface would have evaporated.

TABLE 5-26

EXPOSURE MECHANISMS AND RECEPTORS FOR STORM DRAIN AGGREGATE

POTENTIAL AREA OF CONTAMINATION	RELEASE MECHANISMS	CURRENT POTENTIAL RECEPTORS	FUTURE POTENTIAL RECEPTORS
Surface soil in storm drains	Erosion resulting in wind dispersion Storm water runoff and infiltration Volatilization	None	On-site workers
Sediment in storm drains	Wind dispersion Runoff	None	On-site workers
Surface water	Runoff Evaporation resulting in surface release mechanisms	None	On-site workers
Subsurface soil	Excavation or erosion resulting in surface or release mechanisms	On-site workers	On-site workers, construction workers

5.9.2 Remediation Decisions and Investigation Objectives

If corrective measures are required for this PRS aggregate, they are most likely to consist of the removal and disposal of contaminated media from the storm drain system. The objective of the RFI Phase I investigation is to determine whether sediments in the natural channel below the outfall contain residual contamination above SALs. If COCs are identified in these sediments, further investigation will be required to trace its source, including additional sampling in the open, lined parts of the channel and in the underground sections of the system.

If no residual contamination is identified during RFI Phase I, then NFA will be proposed for these PRSs because the potential contamination was the result of one-time spills or of procedures which have been discontinued.

5.9.3 Data Needs and Data Quality Objectives

Environmental data are needed to determine the concentrations of hazardous constituents in the surface and near-surface soils and sediments within the storm drain system. The domain on which Phase I decisions will be based consists of sediments in the natural channel between the TA-3 northeast parking lot and the footbridge south of the University House (TA-3-443) (see Fig. 5-15).

Professional judgment will be used to the extent possible to determine locations in this domain that are most likely to retain hazardous constituents, e.g., sediment catchment basins. Shallow cores will be sited within these locations. Field screening for volatile organics may be used to select samples for analysis from these cores.

The principal use of the Phase I data will be to identify COCs by comparing the maximum observed soil concentrations of the constituents of potential concern with SALs for soil. (See Subsection 5.9.1.2.1 for the PCOCs for each PRS). The toxicity of the PCOCs is generally low, but the decision domain is quite heterogeneous. Sample sizes should be selected to provide moderate confidence for this screening assessment.

5.9.4 Sampling and Analysis Plan

5.9.4.1 Field Investigation

5.9.4.1.1 Engineering Surveys

A preliminary survey will include site engineering mapping (geodetic) and geomorphologic mapping in order to define sediment catchment basins suitable for sampling between the outfall and the footbridge south of TA-3-443. All sample locations will be registered on a base map. If, during the course of sampling, any sample points must be relocated, the new position will be surveyed and the revised locations will be indicated on the map.

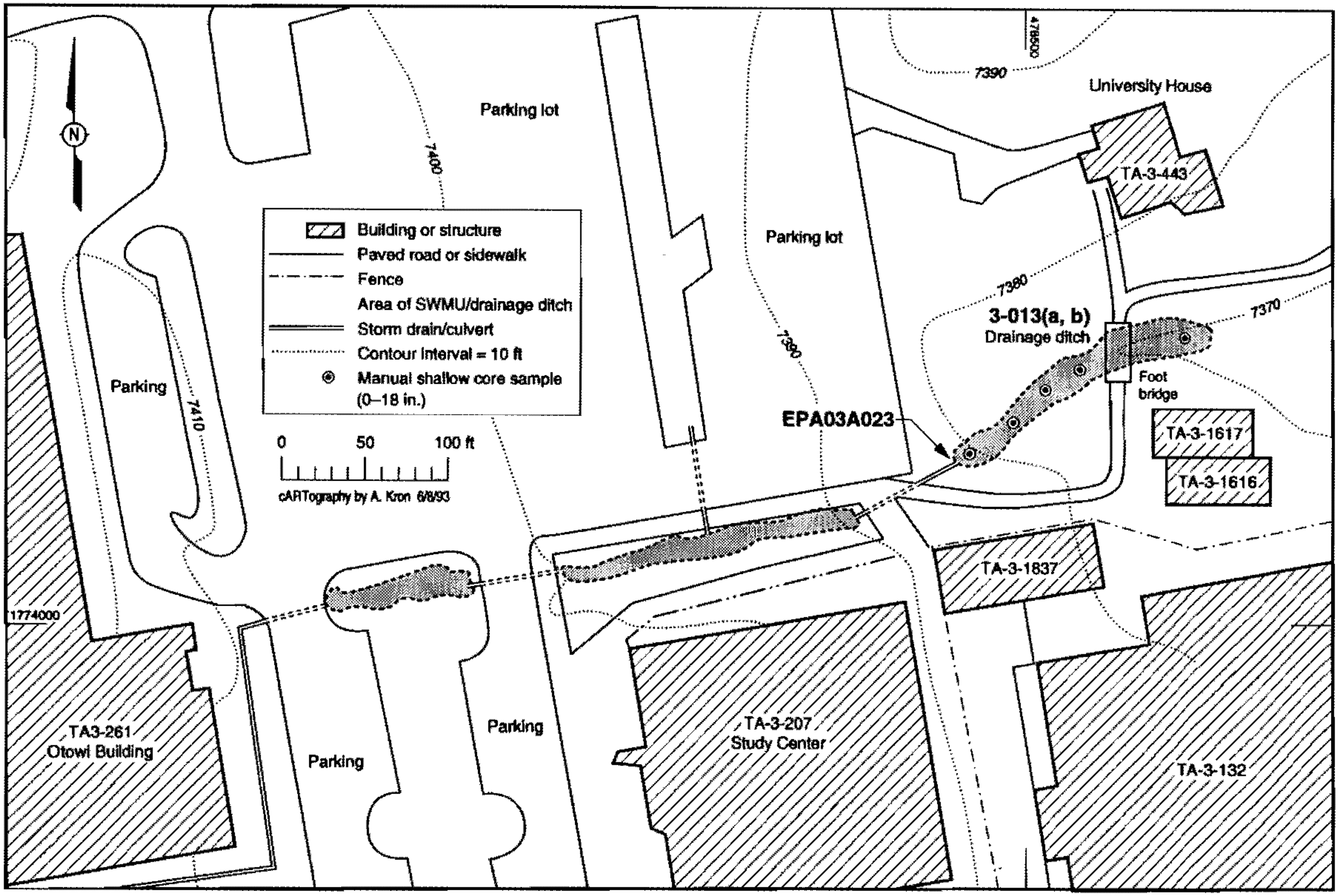

Fig. 5-15. Sample locations for SWMUs 3-013(a, b), storm drain aggregate (also see Fig. E-2, Appendix E).

5.9.4.1.2 Sampling

Five manual shallow core samples (0 to 18 in.) will be collected in the ditch that is located to the south of TA-3-443, four west of the footbridge, and one east of the foot bridge. Proposed sample locations are shown on Fig. 5-15. The core samples will be field screened for organic vapors using a PID. If positive results are obtained, a sample from the 12 to 18 in. interval of the core will be sent to a fixed laboratory for VOC analyses. One field duplicate and one collocated sample, selected from a core with positive field screening results, if possible, will be prepared. If no positive readings result from field screening, at least one confirmatory sample will be collected for fixed laboratory analyses of VOCs. Sample collection method for manual shallow core samples will be in accordance with LANL-ER-SOP-06.10, R0, Hand Auger and Thin-Wall Tube Sampler.

In addition to the field duplicate mentioned above, QA sampling will follow the guidelines of the QAPjP in Annex II of this work plan. Guidelines for sample size selection are located in Subsection 5.0.1.

5.9.4.1.3 Laboratory Analyses

Samples will be analyzed for the OU 1114 metals suite: beryllium, cadmium, chromium, lead, mercury, nickel, and silver. Positive results from field screening and/or confirmatory samples will be analyzed for VOCs (see Table 5-27 and Appendix D for specific EPA methods).

TABLE 5-27

SCREENING AND ANALYSIS FOR OU 1114 PHASE I SAMPLING PLAN SUMMARY FOR STORM DRAINS AGGREGATE

		SAMPLE DESCRIPTION						FIELD SCREENING				FIELD LAB		LABORATORY ANALYSIS															
														Radionuclides					Organics							Metals			Misc
SAMPLING LOCATION/TYPE	SAMPLE LOCATION DESCRIPTION	Sample depth (inches)	Sample I.D. number	Field duplicate	Field split	Collocated sample	Total samples	Gross alpha	Gross beta	Gross gamma	Organic vapor	GC/FID for TPH (SW 8015)	Immunoassay kit for PCBs (SW 4020)	Gross alpha	Gross beta	Gross gamma	Strontium-90	Tritium	Herbicides (SW 8150)	Organochlorine pesticides (SW 8080)	Organophosphorus pesticides (SW 8140)	PCBs (SW 8080)	SVOCs (SW 8270)	TPH (SW 8015)	VOCs (SW 8240)	Mercury (SW 7470, 7471)	OU 1114 metals suite (SW 6010)[1]	OU 1114 Subpart S metals (SW 7000)[2]	Cyanide (SW 9010, 9012)
SWMU 3-013(a, b)	Drainage ditch																												
Manual shallow core	Ditch west of footbridge	0–12					1				1																1		
		12–18		1			2				1														2		1		
Manual shallow core	Ditch west of footbridge	0–18				1	2				2																2		
Manual shallow core	Ditch west of footbridge	0–18					1				1																1		
Manual shallow core	Ditch west of footbridge	0–18					1				1																1		
Manual shallow core	Ditch east of footbridge	0–18					1				1																1		
Confirmatory	Ditch west of footbridge	0–18					1																		1				
TOTAL NUMBER OF SAMPLES							9				7														3		7		

[1]OU 1114 metals suite: beryllium, cadmium, chromium, lead, mercury, nickel, silver
[2]Subpart S metals (TAL list): antimony, arsenic, barium, selenium, thallium, vanadium

s/t = soil/tuff interface
SCB = sediment catchment basin

5.10 Waste Oil Storage Areas Aggregate

5.10.1 Background

5.10.1.1 Description and History of Aggregate

This aggregate is composed of areas that temporarily held drums and salvage electrical equipment containing oils contaminated with PCBs. Aggregation is based on common contaminants. Table 5-28 lists the PRS, its description, location, and PCOCs.

TABLE 5-28

WASTE OIL STORAGE AREA(S) AGGREGATE

SWMU	LOCATION	DESCRIPTION	PCOC
3-003(a)	TA-3-218	Equipment storage area	PCBs, waste oil, metals
3-003(b)	TA-3-253	Equipment storage area	PCBs, waste oil
3-056(c)	TA-3-223	Storage area	PCBs, solvents, mercury, waste oil
61-001	TA-61-23	Storage area	PCBs, waste oil

SWMU 3-003(a) is a decommissioned, outdoor area used for temporary storage of salvage electrical equipment, some of which contained PCB-contaminated oils. This equipment was located on both the north and west sides of the magnetic energy and storage facility, TA-3-218. The 1986 CEARP survey team noted six 55-gal. drums stored next to capacitors on asphalt. Some of the drums leaked and staining is still visible on the north side of TA-3-218. The contents of the drums were unknown (Perkins 1986, 17-214). A visual inspection of the unimpaired asphalt surface indicates that solvents were not stored in the unmarked drums.

Other types of equipment, including PCB-containing capacitors and transformers, were stored west of TA-3-218. This area consists of an L-shaped, 43 x 27 ft concrete pad surrounded by soil covered with gravel. Abutting the pad to the south is a 30 x 60 ft asphalt area with an 4 to 5 ft oval of bare soil north of the storm drain.

Approximately 30 years ago a wooden oil surge tank was erected on the concrete pad. The pad had a 18 to 20-in. asphalt curbing as secondary containment. When heavy rains occurred oil overflowed from the containment.

A chain link fence surrounded the entire surge tank area. For 20 years it was used as a junk yard for old equipment. Most of the capacitors that were stored here had labels that read less than 50 ppm PCBs. In 1985, the surge tank, chain link fence, and asphalt curbing around the cement pad were removed. At this point, many of the transformers and capacitors were also removed. A small asphalted area just north of the visible storm drain was excavated to a depth of about 3 in. where a large oil stain had been. The area has not been repaved, nor was the excavated soil sampled (Sobojinski 1992, 17-688).

During a Weston inspection in 1989, leaking capacitors were still present west of TA-3-218, as were old drums of epoxy, one or two batteries, and operational vacuum pumps. One pump was labeled as containing contaminated wastes. These pumps were used for TA-3-218. They remained outdoors because of noise and for exhaust purposes. Oil stains on the cement pad were also noted (Weston 1992, 17-582).

SWMU 3-003(b) was a temporary, outdoor storage area for salvage electrical equipment which contained oil (LANL 1990, 0145). The storage site was located west of the electron prototype laboratory, TA-3-253. The area west of this building is mostly soil covered with gravel. A cement pad about 6 ft wide extends the length of the north half of the building.

The storage area between TA-3-253 and TA-3-255 once held about 100 PCB capacitors (Sobojinski 1992, 17-688). Some of the capacitors were observed to be stacked and leaking (Perkins 1986, 17-668). In 1985-1986, the capacitors and underlying stained soil were removed and the storage area was decommissioned (Weston 1992, 17-582). A transportainer (transportable container), TA-3-1950, was installed in 1989 and sits on the southwest edge of the cement pad (Weston 1992, 17-582).

SWMU 3-056(c) is a decommissioned, unpaved, outdoor storage area located on the north side of the utilities control center, TA-3-223. Items stored in this area included capacitors and transformers filled with PCB-containing oils as well as unmarked drums that may have contained waste oils and solvents. Some of the drums were noted to be leaking in a 1987 field survey (LANL 1990, 0145). On November 11, 1991, EM-8 collected a few surface (0 to 3 in.) soil samples northeast of TA-3-223 as part of an interim action reconnaissance survey prior to the addition of soil for a slope stabilization project (Fresquez 1991, 17-498). High concentrations (9 600 ppm) of PCBs were found in one soil sample. Mercury was also found at a concentration of 0.471 ppm (LANL 1992, 17-776).

Johnson Controls occupies the building and will be responsible for remediation costs if they plan to continue the slope stabilization project (addition of 700 yd of soil to north side of TA-3-223) as scheduled; otherwise this PRS site will be remediated as a VCA accompanying the RFI investigation.

SWMU 61-001 is a storage area east of TA-61-23 (formerly TA-3-282). This PRS is part of a large fenced area measuring 81 x 91 ft. The area has historically been used for storage of capacitors and transformers, and contained unmarked drums and several oil-filled vessels. Drainage from the area is to the south toward the head of Sandia Canyon.

Prior to 1985, the storage area was a soil surface on which drums with oil containing PCBs were stored. These drums were known to have leaked (LANL 1990, 0145). In 1986, 32 soil samples were taken on the east side of building TA-61-23. PCB levels ranged from 0.31 to 691 ppm in surface soil samples 0 to 6 in. The area was then excavated to a depth of at least 10 in. and re-sampled. The results of the analytical report showed that contamination was reduced to 11.7 to 51.3 ppm in surface soil samples (0 to 6 in.) at the excavated depth. Following the sampling and excavation, clean fill was brought in and the surface asphalted. To date, no spill or closure documents have been written for this outdoor storage area (Morales 1992, 17-743). After the 1986 remediation and subsequent paving, the east side of the storage area was filled once again with electrical equipment, some containing PCBs. There is evidence of oil in several places on the surface of the asphalt (Sobojinski 1992, 17-690).

5.10.1.2 Conceptual Exposure Model

The conceptual exposure model is presented in Chapter 4, Fig. 4-3. Site-specific information on potential release sources, chemicals of concern, migration pathways, and potential receptors follows.

5.10.1.2.1 Nature and Extent of Contamination

The PCOCs at SWMU 3-003(a) are PCBs and hydrocarbons and possibly lead. Some cleanup has occurred to the west of the same building. Oil stains are still visible on the concrete pad. The surrounding surfaces are bare, graveled, or asphalted. Some contamination, again with PCBs or hydrocarbons, is possible. A visual inspection of the asphalt north of TA-3-218 concludes that solvents are not considered a PCOC at this site.

Recent cleanups and landscaping have also altered the former storage area [SWMU 3-003(b)] to the west of TA-3-253. PCBs and hydrocarbons may remain in the soil, which is now covered by landscaping cloth and large gravel.

SWMU 3-056(c) has been surveyed by EM-8. Five soil samples were taken from the storage area north of TA-3-223; four of the samples had <10 ppm PCBs, while the fifth sample had 9 600 ppm PCBs. Mercury also was present at 0.471 ppm (Fresquez 1992, 17-610). The SAL for mercury is equal to 24 ppm in soil (Installation Work Plan, Appendix J) (LANL 1992, 0768). The area of potential concern starts just short of the northeast corner of the building and extends approximately 120 ft to the north into a tributary of Sandia Canyon (Fresquez 1992, 17-610). Unmarked drums that may contain waste oil and solvents are stored in this area.

The 1986 remediation of SWMU 61-001 achieved the 90-99% reduction of PCBs called for by treatability variance guidance in the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and RCRA (40 CFR 268.44). Residual levels above 10 ppm require additional long-term controls, provided at this site by the asphalt pavement. Since the available data only identifies where high PCB levels were prior to remediation, it will not be included in this RFI. Staining of the new pavement has been noted, indicating a potential for additional PCB contamination both on the pavement and in downgradient surface soils.

5.10.1.2.2 Potential Pathways and Exposure Routes

A summary of exposure mechanisms and human receptors is presented in Table 5-29. VOCs are not considered PCOCs since volatile organics at the atmosphere/soil interface would have evaporated.

TABLE 5-29

EXPOSURE MECHANISMS AND RECEPTORS FOR WASTE OIL STORAGE AREAS AGGREGATE

POTENTIAL AREA OF CONTAMINATION	RELEASE MECHANISMS	CURRENT POTENTIAL RECEPTORS	FUTURE POTENTIAL RECEPTORS
Surface soil and asphalt	Erosion resulting in wind dispersion Storm water runoff and infiltration Volatilization	On-site workers	On-site workers
Surface soil beneath asphalt	Removal of asphalt resulting in surface release mechanisms	None	Construction workers On-site workers
Sediment in drainage channel	Wind dispersion Runoff	None	Recreational users

5.10.2 Remediation Decisions and Investigation Objectives

Laboratory analyses will be used for the detection of lead in samples from SWMU 3-003(a,b). On-site corrective measures are proposed for waste oil stained areas at SWMUs 3-003(a,b). Field analyses for TPH and PCBs will be performed at all sampling sites. Any area found above TPH cleanup levels (100 ppm) will require additional field sampling and analyses to determine the extent of contamination. The contaminated areas would then undergo a VCA in which all soil will be removed and drummed until field analyses indicate that surrounding soil concentrations are below cleanup standards. Samples from each cleaned area will then be sent for confirmatory analyses at a fixed laboratory.

PCB-suspect areas will be screened using immunoassay techniques with a detection limit of 5 ppm. Soils exceeding the TSCA cleanup standard of 10 ppm (for unrestricted industrial use) will be removed until field analyses conducted during the VCA indicate that surrounding soils are below the determined cleanup standard for the site. Confirmatory samples will then be collected for fixed laboratory PCB analyses. Sites that are more difficult to clean up may require an evaluation from the Regional EPA to determine the cleanup level (EPA 1991, 17-852).

If contamination is not detected above cleanup levels, at least one confirmatory sample will be collected from each representative area. The confirmatory samples will be analyzed for TPH and PCBs at a fixed laboratory.

SWMU 3-056(c) has already been the subject of an Environmental Restoration interim action reconnaissance survey. These data indicate an area of concern for PCB contamination to the north of TA-3-223, as well as the presence of mercury below action levels. RFI characterization will be integrated with VCA at this site as described above.

Some remediation has already been carried out at SWMU 61-001, although PCB contamination up to 50 ppm (TSCA standard for industrial sites) remains beneath the asphalt. However, there are no immediate exposure routes for this buried contamination, and unless migration away from the site is extensive, further remediation will not be performed. RFI Phase I investigations will be designed to detect contamination on the new asphalt paving and to observe migration if it is occurring in runoff areas to the south as described above in the VCA process above.

5.10.3 Data Needs and Data Quality Objectives

Environmental data are needed to determine the concentration levels of hazardous constituents at SWMUs 3-003(a,b) and SWMU 61-001.

The domain for RFI Phase I decisions concerning SWMUs 3-003(a,b) includes:

- the asphalted area north of TA-3-218 where electrical equipment and 55-gal. drums were stored;
- the concrete pad to the west of TA-3-218 together with soil and asphalt surrounding it, where equipment of various types was stored and oil spills are known to have occurred; and,
- surface soil west of TA-3-253 and around the transportainer, TA-3-1950.

Pavement samples west and north of TA-3-218 will be selected in visibly stained areas. A confirmatory sample from the excavated area just north of the storm drain west of TA-3-218 will be included. Because a good deal of remediation has already been done, there is little opportunity to bias sampling on the basis of visual evidence in the remainder of the site, but over sampling and use of a field method capable of detecting PCB contamination down to 5 ppm will be used to reduce the number of samples submitted to an analytical laboratory. All confirmatory samples will be analyzed for TPH and PCBs in a fixed laboratory.

The principal use of the Phase I data from these two PRSs will be to determine if residual PCB contamination is present by comparing the maximum observed soil concentrations of the constituents of potential concern with the TSCA cleanup level of 10 ppm, applicable to industrial sites with otherwise unrestricted use. Sample sizes will be selected to provide moderate confidence for this assessment of a site where contamination has probably been homogenized by past remediation and landscaping. TPH analyses will be performed for comparison with the regulatory cleanup standard of 100 ppm.

The domain to be investigated in conjunction with VCA at SWMU 3-056(c) includes:

- surface soils between TA-3-223 and the fence to the north and west of the building, and,
- surface and near-surface soils along the eroding channel between the existing fence and the point where runoff enters the stream channel below.

Samples for 3-056(c) will be tested for PCB concentrations in a mobile field laboratory using the draft SW 846 Method 4020, capable of quantifying PCB concentration down to 5 ppm. These data will be used to delineate areas requiring remediation. Following removal of contaminated soil, confirmatory samples for field PCB and TPH analyses will be collected from the remediated areas, from perimeter areas along the north side of TA-3-223 downgradient toward the stream channel, and from the stream channel itself.

These post-remediation Phase I data will be used to determine whether residual contamination is present. The maximum PCB observations will be used to verify the attainment of cleanup levels. Maximum observations for mercury, VOCs, and SVOCs in the confirmatory samples, will be compared with SALs. Sample sizes will provide moderate confidence for detecting contamination in a potentially heterogeneous population.

The domain for RFI Phase I decisions for SWMU 61-001 consists of the 81 x 91 ft paved surface east of TA-61-23 and surface soils in adjacent runoff areas to the south. Pavement sampling will be biased by visual evidence of staining if any is observed, and soil samples will be selected in rills channeling the surface runoff.

Phase I data from SWMU 61-001 will be used to determine if PCB contamination is present by comparing concentrations from pavement and soil samples and samples from the runoff areas with the 10 ppm TSCA level for unrestricted industrial use. Confirmatory soil samples will be analyzed by GC to attain a lower level of detection, but pavement samples will be adequately assessed by the field analytical technique.

5.10.4 Sampling and Analysis Plan

5.10.4.1 Field Investigation

5.10.4.1.1 Engineering Surveys

Sampling points presented in Figs. 5-16, 5-17, and 5-18 will be field surveyed before sample collection. If any additional samples are required, the sample locations will be marked with pin flags and surveyed as soon as possible. The field survey will consist of site engineering (geodetic) mapping. Data will be recorded on a base map.

5.10.4.1.2 Sampling

The eight samples at SWMU 3-003(a) will include two asphalt chip samples from the pavement north of TA-3-218. Four manual shallow core samples (0 to 12 in.) will be collected from beneath the graveled area to the west of TA-3-218. The final two surface samples (0 to 6 in.) will be collected from the previously excavated area north of the storm drain (see Fig. 5-16). At least one confirmatory and one collocated sample will be collected.

Sampling at SWMU 3-003(b) will include six surface samples (0 to 6 in.) from beneath the gravel; three adjacent to the paved strip immediately west

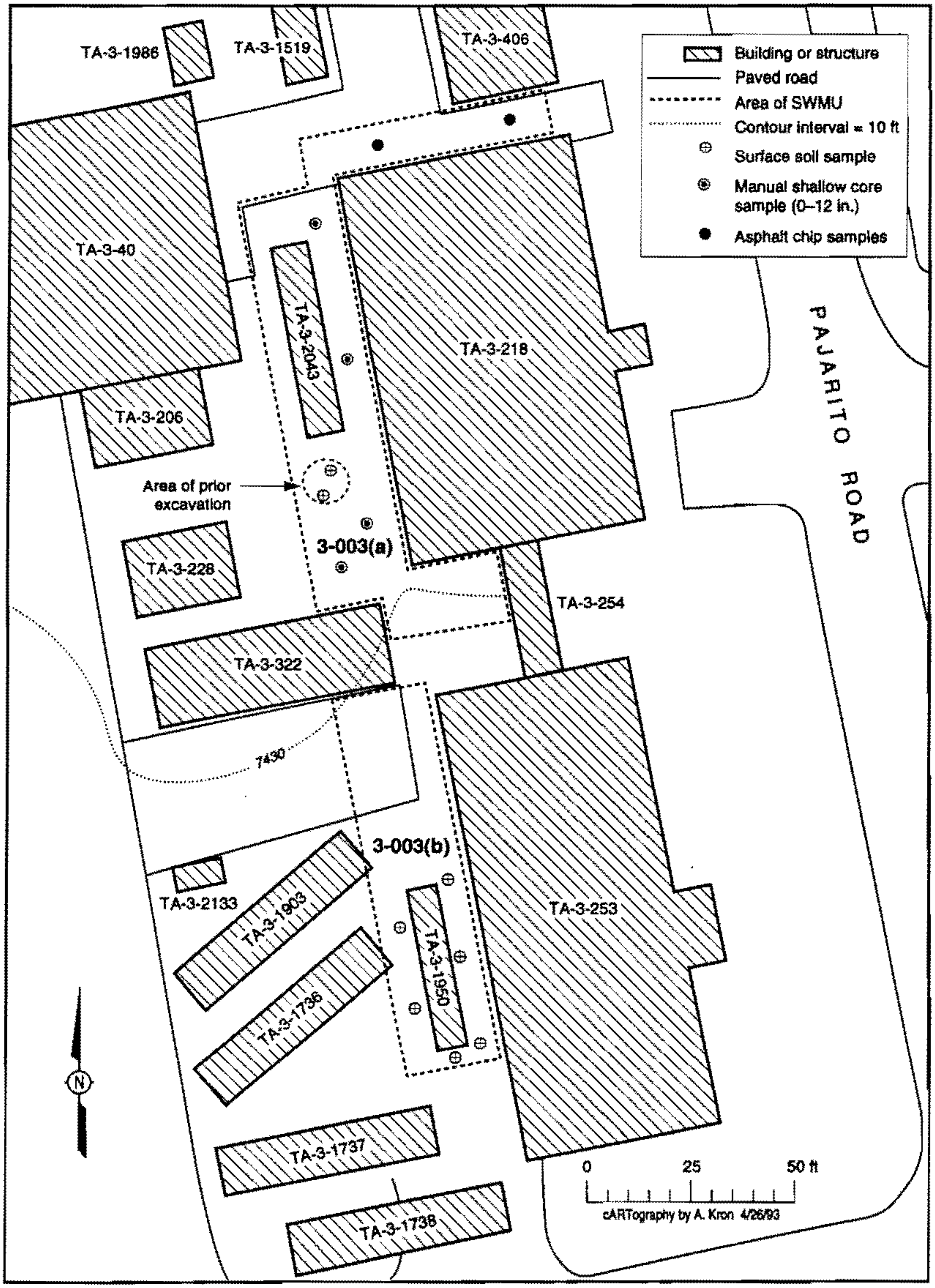

Fig. 5-16. Sample locations for SWMUs 3-003(a) and 3-003(b), waste oil aggregate (also see Fig. E-4, Appendix E).

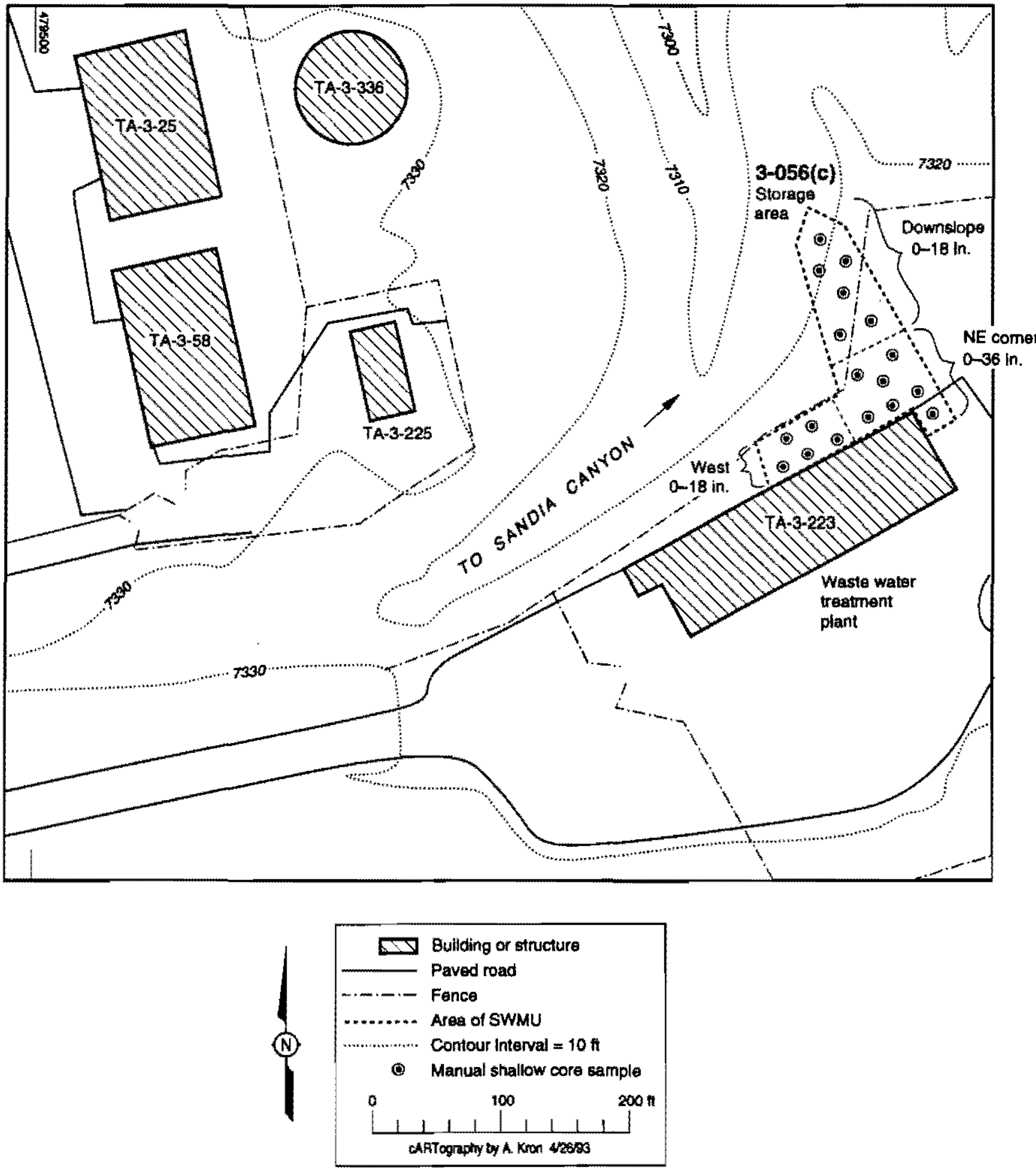

Fig. 5-17. Sample locations for SWMU 3-056(c), storage area (also see Fig. E-5, Appendix E).

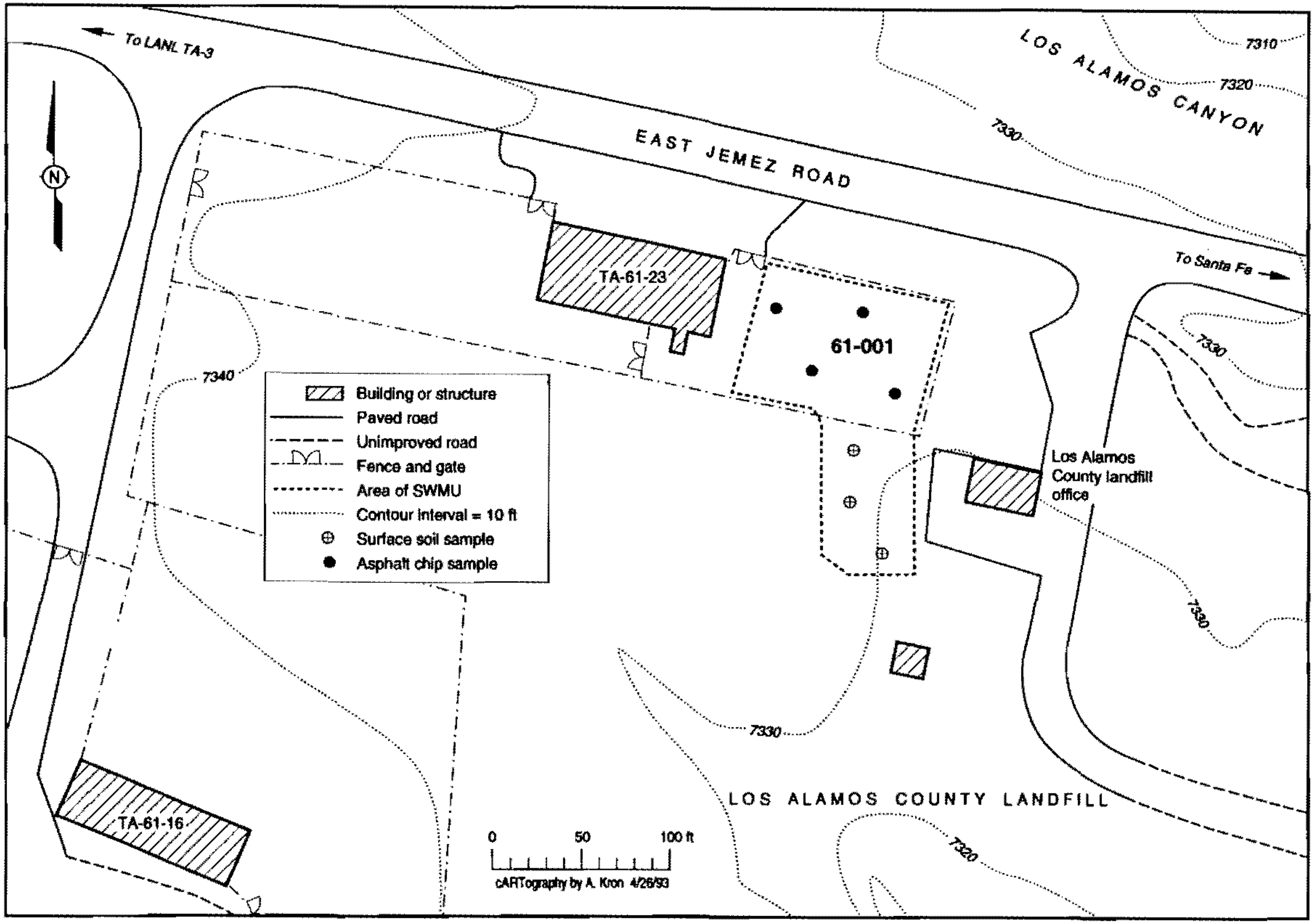

Fig. 5-18. Sample locations for SWMU 61-001, waste oil (also see Fig. E-3, Appendix E).

of TA-3-253 and the remainder on the south and west sides of the transportainer TA-3-1950 (see Fig. 5-16). At least one confirmatory and one collocated sample will be collected from SWMU 3-003(b).

Sampling at SWMU 3-056(c) will consist of the collection of 18 manual shallow core samples north of TA-3-223. Seven of the eighteen samples will be collected in the area that had the highest levels of PCBs detected (the northeast corner of the building). These seven samples will be collected from 36 in. cores. For each 36 in. core, at least three samples for field analyses will be collected: one from the 0 to 6 in. interval, one from the 12 to 18 in. interval, and one from the 30 to 36 in. interval. Additional samples will be collected from any visibly stained intervals observed in any core.

The remaining eleven samples will be collected from 18 in. cores. Five of the 11 samples are located at the westernmost portion of the sample grid and the remaining 6 samples extend downslope toward Sandia Canyon (see Fig. 5-17). The 18 in. core will have one sample collected from the 0 to 6 in. interval for field analysis unless staining is visible from deeper intervals within any core.

Three field splits will be prepared for field laboratory QC purposes: 1 from the set of 7 cores from the northeast corner of the building, 1 from the set of 5 cores collected from the western portion of the sample grid, and 1 from the set of 6 collected downslope toward Sandia Canyon. Confirmatory samples, including a field duplicate for VOC analysis, will be collected from any remediated areas and from 50% of the cores in unremediated areas. The confirmation samples from unremediated areas will include, in approximately equal proportions, samples from the remaining unremediated areas within the fence north of TA-3-223, and from the north-sloping hillside.

Seven samples will be collected for field analyses at SWMU 61-001. Four will be asphalt chip samples, selected preferentially from stained areas of the pavement. Additionally, three surface samples (0 to 6 in.) and one collocated sample will be collected from the small drainage channels that carry runoff from the pavement to the south (see Fig. 5-18). One confirmatory sample will also be collected from the surface samples.

In addition to the collocated field duplicates mentioned above, QA sampling will follow the guidelines of the QAPjP in Annex II of this work plan. Guidelines for sample size selection can be found in Subsection 5.0.1.

Procedural control of surface soil sample collection will be in accordance with LANL-ER-SOP-06.09, R0, Spade and Scoop Method for Collection of Soil Samples, or LANL-ER-SOP-06.11, R0, Stainless Steel Surface Soil Sampler. Manual shallow core samples will be collected in accordance with LANL-ER-SOP-06.10, R0, Hand Auger and Thin-Wall Tube Sampler. Chip samples will be collected in accordance with LANL-ER-SOP-06.28, R0, Chip Sampling Method for Porous Materials.

5.10.4.1.3 Laboratory Analyses

Asphalt (paved) and soil samples from SWMUs 3-003(a,b) will be analyzed in the field for PCBs using immunoassay techniques capable of detecting contamination down to 5 ppm. Non-paved sampling points will also be analyzed in the field for TPH using GC/FID and PCBs using immunoassay techniques. Areas found to be contaminated above 10 ppm or other determined level (see Subsection 5.10.2) for PCBs or 100 ppm for TPH will be remediated by removal of contaminated soil. After cleanup, confirmatory samples will be collected for PCB and/or TPH laboratory analyses. Confirmatory samples will also be analyzed for the OU 1114 metals suite and mercury because of the remote possibility of these constituents being present.

All cores at SWMU 3-056(c) will be analyzed in a fixed laboratory for mercury by cold-vapor atomic absorption, and in the field for PCBs using immunoassay methods, and TPH using a GC/FID. VCAs will be considered (after results from mercury analysis are evaluated) on all areas having PCB and/or TPH contaminants above cleanup levels, specified above. In addition to the field analyses, 9 samples (based on the extent of remediation) will be submitted for off-site analysis of PCBs, TPH, VOCs and SVOCs. Aliquots for volatile organic analysis must be selected from the 12 to 18 in. interval of the core.

Chip samples for SWMU 61-001 will be analyzed in the field only for PCBs, unless the field analytical method is unsatisfactory for chip samples. Soil samples from the adjacent runoff area will be analyzed in the field for PCBs and TPH using methods described above. Confirmatory soil samples will be submitted for fixed laboratory analyses for TPH and PCBs.

See Table 5-30 and Appendix D for specific field and EPA analytical methods.

TABLE 5-30

SCREENING AND ANALYSIS FOR OU 1114 PHASE I SAMPLING PLAN SUMMARY OF WASTE OIL STORAGE AREAS AGGREGATE

		SAMPLE DESCRIPTION						FIELD SCREENING				FIELD LAB		LABORATORY ANALYSIS															
														Radionuclides					Organics							Metals			Misc
SAMPLING LOCATION/TYPE	SAMPLE LOCATION DESCRIPTION	Sample depth (inches)	Sample I.D. number	Field duplicate	Field split	Collocated sample	Total samples	Gross alpha	Gross beta	Gross gamma	Organic vapor	GC/FID for TPH (SW 8015)	Immunoassay kit for PCBs (SW 4020)	Gross alpha	Gross beta	Gross gamma	Strontium-90	Tritium	Herbicides (SW 8150)	Organochlorine pesticides (SW 8080)	Organophosphorous pesticides (SW 8140)	PCBs (SW 8080)	SVOCs (SW 8270)	TPH (SW 8015)	VOCs (SW 8240)	Mercury (SW 7470, 7471)	OU 1114 metals suite (SW 6010)[1]	OU 1114 Subpart S metals (SW 7000)[2]	Cyanide (SW 9010, 9012)
SWMU 3-003(a)	Waste oil stains																												
Asphalt chip	North of TA-3-218	0– 2					1						1																
Asphalt chip	North of TA-3-218	0– 2					1						1																
Manual shallow core	Under gravel west of TA-3-216	0–12				1	2					2	2																
Manual shallow core	Under gravel west of TA-3-216	0–12					1					1	1																
Manual shallow core	Under gravel west of TA-3-218	0–12					1					1	1																
Manual shallow core	Under gravel west of TA-3-216	0–12					1					1	1																
Surface soil	Excavated soil north of drain	0– 6					1					1	1																
Surface soil	Excavated soil north of drain	0– 6					1					1	1																
Confirmatory	West of TA-3-218	0–12					1															1		1		1	1		
Confirmatory	Excavated soil north of drain	0– 6					1															1		1		1	1		
SWMU 3-003(b)	Waste oil stains																												
Surface soil	Under gravel west of TA-3-1950	0– 6					1					1	1																
Surface soil	Under gravel west of TA-3-1950	0– 6				1	2					2	2																
Surface soil	Under gravel west of TA-3-1950	0– 6					1					1	1																
Surface soil	Under gravel south of TA-3-1950	0– 6					1					1	1																
Surface soil	Under gravel west of TA-3-1950	0– 6					1					1	1																
Surface soil	Under gravel west of TA-3-1950	0– 6					1					1	1																
Confirmatory	Under gravel west of TA-3-1950	0– 6					1															1		1					
TOTAL NUMBER OF SAMPLES							19					14	16									3		3		2	2		

[1]OU 1114 metals suite: beryllium, cadmium, chromium, lead, mercury, nickel, silver
[2]Subpart S metals (TAL list): antimony, arsenic, barium, selenium, thallium, vanadium

s/t = soil/tuff interface
SCB = sediment catchment basin

TABLE 5-30 (continued)

SCREENING AND ANALYSIS FOR OU 1114 PHASE I SAMPLING PLAN SUMMARY OF WASTE OIL STORAGE AREAS AGGREGATE

SAMPLING LOCATION/TYPE	SAMPLE LOCATION DESCRIPTION	SAMPLE DESCRIPTION						FIELD SCREENING				FIELD LAB		LABORATORY ANALYSIS															
														Radionuclides					Organics							Metals			Misc
		Sample depth (inches)	Sample I.D. number	Field duplicate	Field split	Collocated sample	Total samples	Gross alpha	Gross beta	Gross gamma	Organic vapor	GC/FID for TPH (SW 8015)	Immunoassay kit for PCBs (SW 4020)	Gross alpha	Gross beta	Gross gamma	Strontium-90	Tritium	Herbicides (SW 8150)	Organochlorine pesticides (SW 8080)	Organophosphorous pesticides (SW 8140)	PCBs (SW 8080)	SVOCs (SW 8270)	TPH (SW 8015)	VOCs (SW 8240)	Mercury (SW 7470, 7471)	OU 1114 metals suite (SW 6010)[1]	OU 1114 Subpart S metals (SW 7000)[2]	Cyanide (SW 9010, 9012)
SWMU 3-056(c)	Northeast corner of TA-3-223																												
Manual shallow core	Northeast corner of TA-3-223	0– 6					1					1	1													1			
		12–18					1					1	1																
		30–36					1					1	1																
Manual shallow core	Northeast corner of TA-3-223	0– 6			1		2					2	2													2			
		12–18			1		2					2	2																
		30–36			1		2					2	2																
Manual shallow core	Northeast corner of TA-3-223	0– 6					1					1	1													1			
		12–18					1					1	1																
		30–36					1					1	1																
Manual shallow core	Northeast corner of TA-3-223	0– 6					1					1	1													1			
		12–18					1					1	1																
		30–36					1					1	1																
Manual shallow core	Northeast corner of TA-3-223	0– 6					1					1	1													1			
		12–18					1					1	1																
		30–36					1					1	1																
Manual shallow core	Northeast corner of TA-3-223	0– 6					1					1	1													1			
		12–18					1					1	1																
		30–36					1					1	1																
TOTAL NUMBER OF SAMPLES							21					21	21													7			

[1]OU 1114 metals suite: beryllium, cadmium, chromium, lead, mercury, nickel, silver

[2]Subpart S metals (TAL list): antimony, arsenic, barium, selenium, thallium, vanadium

s/t = soil/tuff interface

SCB = sediment catchment basin

TABLE 5-30 (continued)

SCREENING AND ANALYSIS FOR OU 1114 PHASE I SAMPLING PLAN SUMMARY OF WASTE OIL STORAGE AREAS AGGREGATE

SAMPLING LOCATION/TYPE	SAMPLE LOCATION DESCRIPTION	SAMPLE DESCRIPTION						FIELD SCREENING				FIELD LAB		LABORATORY ANALYSIS															
														Radionuclides					Organics							Metals			Misc
		Sample depth (inches)	Sample I.D. number	Field duplicate	Field split	Collocated sample	Total samples	Gross alpha	Gross beta	Gross gamma	Organic vapor	GC/FID for TPH (SW 8015)	Immunoassay kit for PCBs (SW 4020)	Gross alpha	Gross beta	Gross gamma	Strontium-90	Tritium	Herbicides (SW 8150)	Organochlorine pesticides (SW 8080)	Organophosphorous pesticides (SW 8140)	PCBs (SW 8080)	SVOCs (SW 8270)	TPH (SW 8015)	VOCs (SW 8240)	Mercury (SW 7470, 7471)	OU 1114 metals suite (SW 6010)[1]	OU 1114 Subpart S metals (SW 7000)[2]	Cyanide (SW 9010, 9012)
SWMU 3-056(c)	(continued)																												
Manual shallow core	Northeast corner of TA-3-223	0– 6					1					1	1													1			
		12–18					1					1	1																
		30–36					1					1	1																
Confirmatory	Northeast corner of TA-3-223	0– 6					1															1	1	1					
		12–18		1			2															2	2	2	2				
		30–36		1			2															2	2	2	2				
Confirmatory	Northeast corner of TA-3-223	0– 6					1															1	1	1					
		12–18					1															1	1	1	1				
		30–36					1															1	1	1	1				
Confirmatory	Northeast corner of TA-3-223	0– 6					1															1	1	1					
		12–18					1															1	1	1	1				
		30–36					1															1	1	1	1				
TOTAL NUMBER OF SAMPLES							14					3	3									11	11	11	8	1			

[1]OU 1114 metals suite: beryllium, cadmium, chromium, lead, mercury, nickel, silver
[2]Subpart S metals (TAL list): antimony, arsenic, barium, selenium, thallium, vanadium

s/t = soil/tuff interface
SCB = sediment catchment basin

TABLE 5-30 (continued)

SCREENING AND ANALYSIS FOR OU 1114 PHASE I SAMPLING PLAN SUMMARY OF WASTE OIL STORAGE AREAS AGGREGATE

SAMPLING LOCATION/TYPE	SAMPLE LOCATION DESCRIPTION	SAMPLE DESCRIPTION						FIELD SCREENING				FIELD LAB		LABORATORY ANALYSIS															
														Radionuclides					Organics							Metals			Misc
		Sample depth (inches)	Sample I.D. number	Field duplicate	Field split	Collocated sample	Total samples	Gross alpha	Gross beta	Gross gamma	Organic vapor	GC/FID for TPH (SW 8015)	Immunoassay kit for PCBs (SW 4020)	Gross alpha	Gross beta	Gross gamma	Strontium-90	Tritium	Herbicides (SW 8150)	Organochlorine pesticides (SW 8080)	Organophosphorous pesticides (SW 8140)	PCBs (SW 8080)	SVOCs (SW 8270)	TPH (SW 8015)	VOCs (SW 8240)	Mercury (SW 7470, 7471)	OU 1114 metals suite (SW 6010)[1]	OU 1114 Subpart S metals (SW 7000)[2]	Cyanide (SW 9010, 9012)
SWMU 3-056(c)	Western portion of sample grid																												
Manual shallow core	Western portion of sample grid	0–18*					1					1	1													1			
Manual shallow core	Western portion of sample grid	0–18*					1					1	1													1			
Manual shallow core	Western portion of sample grid	0–18*			1		2					2	2													2			
Manual shallow core	Western portion of sample grid	0–18*					1					1	1													1			
Manual shallow core	Western portion of sample grid	0–18*					1					1	1													1			
Confirmatory	Western portion of sample grid	0– 6					1															1	1	1					
		12–18		1			2																		2				
Confirmatory	Western portion of sample grid	0– 6					1															1	1	1					
		12–18					1																		1				
Confirmatory	Western portion of sample grid	0– 6					1															1	1	1					
		12–18					1																		1				
TOTAL NUMBER OF SAMPLES							13					6	6									3	3	3	4	6			

[1]OU 1114 metals suite: beryllium, cadmium, chromium, lead, mercury, nickel, silver
[2]Subpart S metals (TAL list): antimony, arsenic, barium, selenium, thallium, vanadium

s/t = soil/tuff interface
SCB = sediment catchment basin

*The 0–6-in. interval of the core will be analyzed in the field unless staining is visible from deeper intervals

TABLE 5-30 (continued)

SCREENING AND ANALYSIS FOR OU 1114 PHASE I SAMPLING PLAN SUMMARY OF WASTE OIL STORAGE AREAS AGGREGATE

SAMPLING LOCATION/TYPE	SAMPLE LOCATION DESCRIPTION	SAMPLE DESCRIPTION						FIELD SCREENING				FIELD LAB		LABORATORY ANALYSIS															
														Radionuclides					Organics							Metals			Misc
		Sample depth (inches)	Sample I.D. number	Field duplicate	Field split	Collocated sample	Total samples	Gross alpha	Gross beta	Gross gamma	Organic vapor	GC/FID for TPH (SW 8015)	Immunoassay kit for PCBs (SW 4020)	Gross alpha	Gross beta	Gross gamma	Strontium-90	Tritium	Herbicides (SW 8150)	Organochlorine pesticides (SW 8080)	Organophosphorus pesticides (SW 8140)	PCBs (SW 8080)	SVOCs (SW 8270)	TPH (SW 8015)	VOCs (SW 8240)	Mercury (SW 7470, 7471)	OU 1114 metals suite (SW 6010)[1]	OU 1114 Subpart S metals (SW 7000)[2]	Cyanide (SW 9010, 9012)
SWMU 3-056(c)	Downslope towards Sandia Canyon																												
Manual shallow core	Downslope towards Sandia Canyon	0–18*					1					1	1													1			
Manual shallow core	Downslope towards Sandia Canyon	0–18*					1					1	1													1			
Manual shallow core	Downslope towards Sandia Canyon	0–18*					1					1	1													1			
Manual shallow core	Downslope towards Sandia Canyon	0–18*					1					1	1													1			
Manual shallow core	Downslope towards Sandia Canyon	0–18*			1		2					2	2													2			
Manual shallow core	Downslope towards Sandia Canyon	0–18*					1					1	1													1			
Confirmatory	Downslope towards Sandia Canyon	0– 6					1															1	1	1					
		12–18		1			2																		2				
Confirmatory	Downslope towards Sandia Canyon	0– 6					1															1	1	1					
		12–18					1																		1				
Confirmatory	Downslope towards Sandia Canyon	0– 6					1															1	1	1					
		12–18					1																		1				
TOTAL NUMBER OF SAMPLES							14					7	7									3	3	3	4	7			

[1]OU 1114 metals suite: beryllium, cadmium, chromium, lead, mercury, nickel, silver
[2]Subpart S metals (TAL list): antimony, arsenic, barium, selenium, thallium, vanadium

s/t = soil/tuff interface
SCB = sediment catchment basin

TABLE 5-30 (continued)

SCREENING AND ANALYSIS FOR OU 1114 PHASE I SAMPLING PLAN SUMMARY OF WASTE OIL STORAGE AREAS AGGREGATE

		SAMPLE DESCRIPTION						FIELD SCREENING				FIELD LAB		LABORATORY ANALYSIS															
														Radionuclides					Organics							Metals			Misc
SAMPLING LOCATION/TYPE	SAMPLE LOCATION DESCRIPTION	Sample depth (inches)	Sample I.D. number	Field duplicate	Field split	Collocated sample	Total samples	Gross alpha	Gross beta	Gross gamma	Organic vapor	GC/FID for TPH (SW 8015)	Immunoassay kit for PCBs (SW 4020)	Gross alpha	Gross beta	Gross gamma	Strontium-90	Tritium	Herbicides (SW 8150)	Organochlorine pesticides (SW 8080)	Organophosphorus pesticides (SW 8140)	PCBs (SW 8080)	SVOCs (SW 8270)	TPH (SW 8015)	VOCs (SW 8240)	Mercury (SW 7470, 7471)	OU 1114 metals suite (SW 6010)[1]	OU 1114 Subpart S metals (SW 7000)[2]	Cyanide (SW 9010, 9012)
SWMU 61-001																													
Asphalt chip	Northwest corner of asphalt pad	0–2					1						1																
Asphalt chip	Northeast corner of asphalt pad	0–2					1						1																
Asphalt chip	South central portion of asphalt pad	0–2					1						1																
Asphalt chip	Southeast corner of asphalt pad	0–2					1						1																
Surface soil	Drainage Channel 1	0–6					1					1	1																
Surface soil	Drainage Channel 2	0–6				1	2					2	2																
Surface soil	Drainage Channel 3	0–6					1					1	1																
Confirmatory	Drainage Channel 1	0–6					1															1		1					
TOTAL NUMBER OF SAMPLES							9					4	8									1		1					

[1]OU 1114 metals suite: beryllium, cadmium, chromium, lead, mercury, nickel, silver
[2]Subpart S metals (TAL list): antimony, arsenic, barium, selenium, thallium, vanadium

s/t = soil/tuff interface
SCB = sediment catchment basin

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Chapter 6

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6.0 POTENTIAL RELEASE SITES RECOMMENDED FOR NO FURTHER ACTION OR DEFERRED ACTION

According to proposed Subpart S of 40 CFR 264, a potential release site (PRS) can be recommended for no further action (NFA) if it can be demonstrated that the unit poses no threat to human health or the environment (EPA 1990, 0432). In Operable Unit (OU) 1114, 49 PRSs listed in Module VIII of the US Environmental Protection Agency (EPA) section of the Laboratory Hazardous Waste Permit (NMEID 1989, 0595) are recommended for no further action under this RFI work plan. An additional eight PRSs are recommended for deferred action (DA) until future closure. Module VIII-listed PRSs are discussed in Subsection 6.1. Twenty PRSs included in the 1990 Solid Waste Management Unit (SWMU) Report, but not included in the 1988 Module VIII, are also recommended for NFA or DA. These are discussed in Subsection 6.2.

Recommendations for NFA or DA are based on the four-step evaluation criteria described in Appendix I, Subsection 4.1 of the Installation Work Plan (IWP), Revision 2 (LANL 1992, 0768). Rationale for these recommendations is based on archival information and field investigations. Table 6-1 summarizes the four-step criteria applicable to this section. Subsection 6.3 contains a table that provides a complete summary of listed and non-listed PRSs recommended for NFA or DA.

TABLE 6-1

FOUR-STEP CRITERIA FOR NFA OR DA

STEP	SUBSECTION	CRITERIA
Step 1 NFA	6.1.1.1 6.1.1.2	PRS has undergone regulatory closure SWMU Report is inaccurate
Step 2 NFA	6.1.2.1	PRS is a satellite accumulation area
Step 3 DA	6.1.3.1 6.1.3.2	PRS is active site with no credible off-site pathways PRS is undergoing voluntary corrective action (VCA)
Step 4 NFA	6.1.4.1	PRS poses no threat to on-site or off-site workers, the general public, or to the environment

Throughout this chapter reference is made to target analyte list (TAL) or target compound list (TCL). TAL elements and TCL compounds have been determined to be hazardous and are identified in the proposed Subpart S of RCRA (EPA 1990, 0432). Both lists are described in Appendix J of the IWP; Table J-1 contains complete target lists (LANL 1992, 0768).

6.1 Listed PRSs Recommended for No Further Action or Deferred Action

PRSs listed in the 1988 Module VIII are shown in Table 6-2, which gives a specific SWMU identification number and the subsection in which it is discussed. The third column indicates which of the four steps for evaluating candidacy for NFA or DA is applicable, and the fourth column lists the rationale within that step.

6.1.1 Listed PRSs Recommended for NFA Under Step One

6.1.1.1 Rationale: PRS Has Undergone Regulatory Closure

Since the Hazardous and Solid Waste Amendments (HSWA) Module was approved in 1988, the Laboratory has initiated cleanup and closure under various programs. Table 6-3 lists PRSs at TA-3 that have undergone regulatory closure and the regulation governing each closure. These units include an underground storage tank (UST) at the TA-3 service station and polychlorinated biphenyl (PCB) spills at a former transformer staging area on East Jemez Road.

6.1.1.2 Rationale: SWMU Report is Inaccurate

SWMU 3-009(h) is described in the SWMU Report as asphalt piles and concrete debris on Sigma Mesa (LANL 1990, 0145). This is a duplicate of SWMU 60-002, described in Subsection 6.1.4.1.2.

SWMU 61-002 is a duplicate of SWMU 61-001. It is described in the SWMU Report as an inactive PCB storage area at TA-61-23. SWMU 61-001 is listed as being an active site at the same location (LANL 1990, 0145). Because there has been only one storage area at this building, it is believed that SWMUs 61-001 and 61-002 are the same unit (Griggs 1992, 17-672). SWMU 61-001 is discussed in Chapter 5, Subsection 5.10 [Note: SWMU 61-002 is listed as 3-003(c) in the 1988 Module VIII].

TABLE 6-2

LISTED PRSs RECOMMENDED FOR NFA OR DA

SWMU ID	SUBSECTION	STEP	RATIONALE
3-001 (a,b,c,m,p,r)	6.1.2.1	2, NFA	Satellite accumulation area
3-001(k)	6.1.4.1.3.2	4, NFA	No threat
3-002(b)	6.1.2.1	2, NFA	Satellite accumulation area
3-003(c)	6.1.4.1.3.2	4, NFA	No threat
3-009(a)	6.1.4.1.2	4, NFA	No threat
3-009(b)	6.1.4.1.2	4, NFA	No threat
3-009(c,d,e,f,g)	6.1.4.1.2	4, NFA	No threat
3-009(h)	6.1.1.2	1, NFA	Duplicate
3-010(a)	6.1.3.2	3, DA	VCA
3-010(b,c,d)	6.1.4.1.3.1	4, NFA	No threat
3-012(a)	6.1.4.1.3.2	4, NFA	No threat
3-013(c,d,e,f,g,h)	6.1.4.1.3.2	4, NFA	No threat
3-018	6.1.4.1.3.5	4, NFA	No threat
3-020(a,b)	6.1.4.1.3.3	4, NFA	No threat
3-028	6.1.3.1.4	3, DA	Active, no pathway
3-029(b)	6.1.3.2	3, DA	VCA
3-035(a)	6.1.1.1	1, NFA	Undergone closure
3-035(b)	6.1.3.1.3	3, DA	Active, no pathway
3-036(a,c,d,e)	6.1.4.1.3.4	4, NFA	No threat
3-037	6.1.3.1.3	3, DA	Active, no pathway
3-038(a,b)	6.1.3.1.2	3, DA	Active, no pathway
3-039(a,b,c,d,e)	6.1.4.1.1	4, NFA	no threat
3-044(a)	6.1.3.1.1	3, DA	Active, no pathway
3-044(b)	6.1.2.1	2, NFA	Approved accumulation area
3-056(b)	6.1.3.1.1	3, DA	Active, no pathway
59-001	6.1.4.1.3.5	4, NFA	No threat
60-001(a)	6.1.2.1	2, NFA	Approved accumulation area
60-002	6.1.4.1.2	4, NFA	No threat
61-002	6.1.1.2	1, NFA	Duplicate SWMU
61-005	6.1.3.1.2	3, DA	Regulated active landfill
61-006	6.1.3.1.2	3, DA	Regulated active recycle
61-007	6.1.1.1	1, NFA	Undergone closure

TABLE 6-3

PRSs THAT HAVE UNDERGONE REGULATORY CLOSURE

SWMU ID	LOCATION	DESCRIPTION	REGULATION	REFERENCE	RECOMMENDATION
3-035(a)	TA-3-36-3	UST	RCRA	McInroy 1992, 17-748	NFA
61-007	E. Jemez Rd.	Transformers	TSCA	Griggs 1992, 17-756	NFA

6.1.2 Listed PRSs Recommended for NFA Under Step Two

6.1.2.1 Rationale: PRS is an Approved Accumulation Area

Satellite accumulation areas and less-than-ninety-day accumulation areas were established at OU 1114 in conformance with 40 CFR 262, Standards Applicable to Generators of Hazardous Waste and managed under the Laboratory spill prevention control and countermeasure (SPCC) plan (Delta H. Engineering, Ltd. 1990, 17-820). The EPA and the Laboratory have agreed that accumulation areas are not PRSs provided that they have no history of release and have no credible pathway to the environment (Twombly 1992, 17-681). PRSs listed in Table 6-4 meet these criteria. They are either indoors with no potential for leaks beyond the building or they were extensively cleaned for the Department of Energy (DOE) Tiger Team inspection in 1991. None has a history of prior release. These PRSs are currently listed on the Laboratory registry of satellite and less-than-ninety-day accumulation areas (McInroy 1992, 17-748).

6.1.3 Listed PRSs Recommended for Deferred Action under Step Three

6.1.3.1 Rationale: Active Listed PRSs

The following 1988 Module VIII-listed PRSs are currently active operations or inactive units within active sites. Several are operated under regulatory permits; several are undergoing or proposed for voluntary corrective action (VCA). Within this section PRSs are aggregated by type for convenience of discussion. The PRS locations and descriptions are listed in Table 6-5.

6.1.3.1.1 Active Storage Area Aggregate

The following PRSs are currently active storage areas managed under appropriate regulations or are inactive units within active sites.

TABLE 6-4

ACTIVE CONTAINER ACCUMULATION AREAS

SWMU ID	LOCATION	AREA	DESCRIPTION
3-001(a)	TA-3-39	Loading dock	<90 accumulation
		Room 16	Satellite accumulation
		Room 42	Satellite accumulation
3-001(b)	TA-3-39	Room S123	Satellite accumulation
		Room W112	Satellite accumulation
		Photo lab	Satellite accumulation
	TA-3-40	Loading dock	<90 accumulation
		Room N121	Red can waste container*
		Room S106	Red can waste container*
		Room S12	Red can waste container*
		Room S130	Red can waste container*
		Room W116	Red can waste container*
		Room W122	Red can waste container*
		Room W124	Red can waste container*
		Room W130	Red can waste container*
		Room S2	No waste accumulation
		Room S31	No waste accumulation
		Room W123	No waste accumulation
3-001(c)	TA-3-102	Corner of shop	<90 accumulation
3-001(m)	TA-3-41		Satellite accumulation
3-001(p)	TA-3-37	Carpenter shed	Satellite accumulation
3-001(r)	TA-3-409	Room 101	Satellite accumulation
3-002(b)	TA-3-1966	Inactive	Satellite accumulation/indoors
3-044(b)	TA-3-102	Room 118A	Decommissioned/indoors
60-001(a)	TA-60-1	East side	Active container accumulation

* Red metal can is used for short term accumulation while work is in progress.

TABLE 6-5

ACTIVE MODULE VIII PRSs

SWMU ID	LOCATION	DESCRIPTION	STATUS
Storage Areas			
3-044(a)	TA-3-70	Drum storage	Active
3-056(b)	TA-3-70	Drum storage	Active
Landfills			
3-038(a,b)	W Jemez Rd.	Active intersection	Active
61-005	TA-61 landfill	Municipal landfill	Active
61-006	TA-61 landfill	Regulated oil holding tank	Active
Underground Storage Tank			
3-035(b)	TA-3-440	UST	Active
3-037	TA-3-66	UST	Active
Surface Impoundment			
3-028	TA-3-73	Settling pond	Active

SWMUs 3-056(b) and part of **3-044(a)** are located on a 30 x 100 ft concrete pad about 75 ft southeast of TA-3-70. In the past the concrete pad was used as a drum storage area. Drums of waste diesel fuel, kerosene, and oil were stored at SWMU 3-056(b); it is not known if the drums leaked. All waste oil drums have been removed. The pad currently contains both a curbed, 10 x 10 ft, non-regulated storage area and an adjacent, curbed 6 x 10 ft satellite accumulation area. These curbed sections occupy approximately one-quarter of the pad and are not considered PRSs. The remainder of the pad is empty.

These PRSs are located within a sand-storage area. The concrete pad is surrounded by sand piles varying from 6 ft to 15 ft in height; sand sometimes overlaps the pad. Heavy equipment operates throughout the storage area, constantly removing and adding large volumes of sand, gravel, and aggregate materials. Trucks and other vehicles often traverse the pad. Current pathways to the environment from SWMUs 3-056(b) or 3-044(a) are unlikely. The surrounding area is level and its use as a sand-storage area effectively creates barriers to movement of past leaks, spills, or liquids mobilized by runoff from rain and snow.

SWMU 3-044(a) consists of two parts. The first part is an active container storage area located at the asphaltic concrete plant, TA-3-73. Drums containing sand/asphalt mixtures were stored on pallets in an unpaved, 20 sq. ft area (DOE 1987, 0264). In 1987 all the drums were removed; however, the pad is still considered an active storage area (Sobojinski 1992, 17-643). The second part of the PRS was on the concrete pad described with SWMU 3-056(b), where drums held oil-soaked sand from a catch tray in a steam cleaning pit. The tray was filled with sand to absorb grease and oil from engines being cleaned. Drums of roofing compound were also stored in this area. The steam cleaning pit was decommissioned in 1990. Group HSE-7 has removed all drums.

Rationale for Recommendation: The area is an active one with constant truck traffic moving sand, gravel, and aggregate around the site. The site has been cleaned and a portion bermed to provide storage for an occasional waste drum from the asphalt plant. There is no documentation of large spills. Small spills may have occurred, but would not spread beyond the immediate area of the pad due to the level nature of the site. Since this PRS presents a low probability of contamination and no pathway to potential receptors or the environment, it is recommended that development of a sampling plan await decommissioning of the asphalt plant operation.

6.1.3.1.2 Inactive/Decommissioned Waste Lines Aggregate

This aggregate contains two PRSs located near the southwest end of Omega Bridge spanning Los Alamos Canyon. The PRSs were components of the Radioactive Liquid Waste Lines Removal Project of 1981-1986.

SWMU 3-038(a), TA-3-700, was an acid neutralizing and pumping building. It was constructed in 1952, and consisted of a 16 x 22 x 11 ft concrete-block pump house and two 14 x 22 x 14 ft concrete underground tanks. TA-3-700 was the central collection point for industrial waste from TA-3-29, TA-3-66, and other laboratory buildings. Waste was then pumped from the tanks into a line leading to the industrial waste treatment facility at TA-50.

SWMU 3-038(b), TA-3-738, was a 28 500-gal. industrial liquid waste (acid) retention tank located just north of TA-3-700. It was constructed in 1952 and consisted of an 11 ft-diameter by 44 ft-long steel tank, half buried in the ground, sited on the upper south wall of Los Alamos Canyon.

The area around both tanks was remediated in 1975 by the Zia Company (Ref. TA-3-700, Lab Job Nos. 863, 2715, 3102, 3164, 4775, 5418 and TA-3-738, Lab Job No. 188-A, 5253-0). In 1976 radioactive contamination was discovered near TA-3-700. Several areas were tested for radionuclides in soil. One-third of the 72 samples taken at 5 ft intervals out 12 to 14 ft from the west, south, and east sides were positive for gross-alpha. Values ranged from 27 to 170 pCi/g. It was estimated that 95% of the contamination was from plutonium-239. Portions of the site were excavated prior to sampling (Stoker 1976, 17-192).

Between 1981 and 1986 the Laboratory conducted an extensive project removing and remediating the liquid-waste lines serving the decommissioned waste-treatment plant at TA-45. In 1982, as part of this project, the tanks and building of these two PRSs were removed and taken to TA-54 for disposal. The tanks had never leaked; soil samples taken beneath them analyzed below guideline levels. All pipelines leading into and out of the PRS were removed, except for part of manhole TA-3-702 located at the north end of the pipe sections and 100 and 150 ft sections of 8 in.-diameter vitreous clay pipe which were left under West Jemez Road at the Diamond Drive intersection. Pits measuring 9 x 9 x 17 ft deep were excavated at each end of these pipe sections at manholes TA-3-702 and TA-3-703. Contaminated manhole TA-3-703 was removed. As part of an as low as reasonably achievable (ALARA) decision, contaminated soil around the manhole was removed until the gross alpha counts ranged from 78 to 255 pCi/g in the bottom of the pit. The pipes under the road were filled with an asphalt emulsion and capped at each end with 1 to 2 cu yd of Tigercrete, a quick-setting, hard-curing formulation of concrete with an adhesive additive. Brass monument warning plates were placed at each end of the pipes. All pits were backfilled with uncontaminated soil (Elder et al. 1986, 17-001) and landscaped.

Guideline levels for soil cleanup were specified, but the lowest level for subsurface contamination, 75 pCi/g, could not be reached. Upper limit guidelines were applied on a case-by-case basis to "Keep radiation exposure to the general public to as low a level as reasonably achievable ... Remaining soil contamination, after being minimized in accordance with the ALARA policy, must also comply with the requirement that no member of the public receive a dose, as a result of exposure to the contamination, exceeding specified dose limits of 500 mrem/yr to any organ of the body" (Elder et al. 1986, 17-001).

Rationale for Recommendation: DA is proposed because the unit is beneath an active area where there are no credible off-site pathways, and because disturbance of the unit may result in unnecessary exposure to the public. Remediation of this PRS will be deferred to any future reconstruction of the Jemez Road and Diamond Drive intersection that results in large scale excavation affecting the plugged pipes. At that time the Engineering Division would be required to review the characteristics of any PRSs in the construction area and apply the proper health and safety operations, standard operating procedures, and take other appropriate precautions.

6.1.3.1.3 Active Municipal Landfill Aggregate

Both the municipal landfill, SWMU 61-005, and the used-oil recycling center, SWMU 61-006, are active, regulated facilities. They are monitored on a regular basis as required by New Mexico state regulations, and will be brought to closure under applicable regulations. Sandia Canyon is monitored under the Laboratory's environmental surveillance program (Environmental Protection Group 1990, 0497).

SWMU 61-005 is the active Los Alamos municipal/Laboratory landfill located on the rim of Sandia Canyon near East Jemez Road. As structured, the landfill consists of large unlined pits, about 400 ft square, excavated into tuff. The pits are designed so that there is no runoff to the canyon. Waste and refuse are deposited in the active pit and covered with soil each evening. When filled, that pit is capped and a new pit is designated as the active pit.

The landfill was established in 1974 and is owned by the DOE. It is operated by Los Alamos County for public, county, and Laboratory use (LANL 1990, 0145). The landfill is permitted to manage non-hazardous waste and is regulated by the New Mexico Environment Department (NMED) Solid Waste Management Regulations. It has increased in area from the originally proposed 24.3 to 30 acres with the approval of DOE and NMED. The landfill is currently operating under the January 30, 1992, New Mexico Solid Waste

Management Regulations, Section 213, which allows an operating landfill to continue operation under interim status while permit requirements are being updated (NMED 1991, 17-767).

Rationale for Recommendation: The NMED monitors landfill wastes twice yearly for TAL and TCL, and annually for methane generation. In addition, NMED-certified landfill managers visually inspect all incoming refuse for TAL wastes and monitor all suspicious refuse using a hand-held radiation detector. Laboratory personnel must certify that Laboratory refuse entering the landfill contains no radioactive, mixed, or hazardous wastes. All demolition refuse must be certified to contain no asbestos (NMED 1991, 17-767).

SWMU 61-006 is an active, oil-recycling area located within, and regulated with, the county landfill, SWMU 61-005. The unit consists of a lined pit about 10 x 20 x 7 ft deep. Within the open pit is a 2 500 gal. holding tank. An 8 ft-long pipe leads to a filling bin at ground level. The unit is in active use; the front end of the tank and the filling bin are covered with oil. The facility is located in a level area about 300 ft north of Sandia Canyon. An unimproved road encircles the pit; the surrounding area is of packed dirt and used for storage.

The SWMU Report indicates that at one time there were three underground tanks. "Previously the storage tanks were underground. In 1989, two of the tanks were given to a recycler as scrap metal and were crushed and removed from the site at the DOE's request" (LANL 1990, 0145). The three tanks were in an area that has since been excavated as a large disposal pit for the landfill operation. The third tank was moved to an open, lined pit and fitted with the filling bin designed for public use.

Rationale for Recommendation: There is no drainage to the canyon from the pit. Renovation plans are under way to include a covering over the pit, a leak detector for the tank, and the pit will be relined with an improved liner (Hoard 1993, 17-816). No sampling is planned for this area while it is active.

6.1.3.1.4 Underground Storage Tank(s)

SWMU 3-035(b) is TA-3-1255, an 800-gal. underground diesel storage tank located near the Central Intrusion Detection Alarm Station, TA-3-440. This tank supplies the emergency electrical generator for the facility and has never leaked; it is scheduled for replacement under current UST guidelines (Sobojinski 1992, 17-751). The tank is regulated and monitored as required under RCRA, Subtitle I (McInroy 1992, 17-748).

SWMU 3-037 consists of a 9 000-gal. concrete tank divided into two 4 500-gal. unlined sections fitted with separate covers. It is located below floor grade at the Sigma Building, TA-3-66. One tank was used for storage of spent cyanide solution; the other for storage of nitric, sulfuric, and hydrochloric acid solutions (30% concentration) from electroplating operations. Both tanks discharge to the industrial waste line (Griggs 1992, 17-657). The cyanide tank is now inactive.

In the summer of 1989, the acid waste line serving the cyanide tank was found to have collapsed and leaked; the tank did not leak. The SWMU Report lists the waste as spent cyanide, acid, and metals from electroplating operations (LANL 1990, 0145). A preliminary study on two core samples along the route of the line was conducted in 1989. Analytical results showed no evidence of RCRA volatile or semivolatile compounds (Fresquez 1991, 17-653). In April 1991, the Environmental Protection Group (EM-8) conducted an Environmental Restoration Interim Action (ERIA) reconnaissance survey, as provided in Module VIII, Section I of the Laboratory Hazardous Waste Permit, in the basement of TA-3-66. Concrete core samples were collected from the basement floor and soil surface and subsurface samples from below the floor. Gross alpha, beta, and gamma screening results in all samples were at background levels. Samples were analyzed for toxicity characteristic leaching procedure (TCLP) metals and total uranium. TCLP (soluble TAL) metals were below 40 CFR 261.24 guidelines. Only 5 ppm of lead, far below the screening action level (SAL) of 500 ppm, was found in a soil sample 3 ft under the southeast corner of Room H-8. Total uranium levels were at background in concrete samples, but ranged from 11 to 22 ppm in surface soil samples and 4 to 17 ppm in subsurface samples, far below the SAL of 240 ppm (Fresquez 1991, 17-653).

Rationale for Recommendation: Both units are in active use. The diesel tank, SWMU 3-035(b), has never leaked. It is regulated under RCRA, Subtitle 1 and is scheduled for replacement. The leaks at SWMU 3-037 in

TA-3-66 have been repaired and the area tested for appropriate hazardous contaminants. Only lead and uranium were found, but at concentrations far below SALs in areas with no credible pathway to the environment. Based on this information, it is recommended that no action be taken until operations cease at both units.

6.1.3.1.5 Surface Impoundment

SWMU 3-028 is an active, concrete holding pond located at the northeast corner of the asphalt batch plant at the head of Sandia Canyon. This PRS serves as a settling pond for mineral dust and particulates captured by scrubber water from the asphalt batch plant. The pond is 12 x 15 x 6 ft deep. Water from the pond is recycled to the scrubber system. Discharge is intermittent and averages about 300 gal./day. The pond is replenished with potable make-up water. The outfall from the pond is under permit as NPDES 04A109 (EPA 1990, 17-606).

The area around the plant and the pond is unpaved. In the past, some water from the pond was diverted to wash vehicles and equipment. The wash water discharged to a ditch that led to the edge of Sandia Canyon. This area will be stabilized by the remediation described in Subsection 6.1.3.2, SWMU 3-029(b).

Rationale for Recommendation: The asphalt batch plant (TA-3-73) containing SWMU 3-028 is active. Water in the pond is no longer dispersed. Sampling should be deferred until the plant is decommissioned or the holding pond is no longer needed.

6.1.3.2 Rationale: PRSs Undergoing Voluntary Corrective Action

SWMU 3-010(a) is a surface disposal site located on a steep slope on the rim of Twomile Canyon approximately 30 ft west of building TA-3-30. In the 1950s technicians discarded pump oil from a vacuum pump repair shop located at the rear of the building. Oil from many of these pumps contained radionuclides and TAL contaminants, principally mercury. A former Laboratory employee estimated that over the years upwards of 100 pounds of mercury were dumped (Sobojinski 1992, 17-720). The waste content at the site became so high that "one could stand at that spot on a warm day and press a foot on the ground and see the mercury ooze out" (Ahlquist 1985, 17-215). The waste soaked into the soil and was not visible. An investigation in the summer of 1992 and interviews with former employees determined the exact location of the disposal site and located visible deposits of mercury.

SWMU 3-010(a) is now undergoing a VCA by the Laboratory. EM-8 provided written notification to the NMED pursuant to Section 1-203.A of the New Mexico Water Quality Control Commission Regulations. The Laboratory is required to undertake immediate action to remove all contaminants from the drainage channel as specified in Section 1-203.A.5 (Piatt 1992, 17-741). The "Sampling and Remediation Plan for Mercury Contaminated Soils at TA-3-30," Contract 9-XS-2-Y5348-1 was written and submitted to the NMED and EPA Region 6 for approval. The plan includes present and future cleanup measures and future sampling schemes to identify extent of contamination, and projected time frame for remediation (Tiedman 1992, 17-764). A confirmatory sampling program is included as part of the remediation plan.

SWMU 3-029(b) is a 30 x 70 ft, inactive landfill located about 300 ft south of TA-3-271 near the rim of Sandia Canyon. The 1986 CEARP survey team noted several inches of liquid in an unlined pit marked "asphalt and sealer accumulation point" (DOE 1987, 0264). Pits of this type received excess asphalt and clean-out from the asphalt plant and were later covered with sand. This disposal practice continued for some time; similar pits line the edge of Sandia Canyon. When one pit was full, a new pit was constructed (LANL 1990, 0145). These fills raised and leveled the surface areas at the rim of the mesa. Debris at the PRS appears to be pieces of asphalt, each piece less than 1 ft square (Griggs 1992, 17-753).

On June 12, 1992, the NMED issued a citation to the Laboratory for improper disposal of asphalt. Evidence showed that asphalt buried on site was leaching into Sandia Canyon from asphalt staging and disposal areas around the batch plant, TA-3-73. In response, the Laboratory developed a remediation plan to build a 250 ft long, 2 x 10-ft concrete dam along the north edge of the drainage channel into Sandia Canyon. Perforated pipe will be laid near the base of the dam on the upslope side to collect liquid percolating through the fill. An oil-separator will be installed at the discharge (east) end of the pipe (JCI 1992, 17-789). Because of this Sandia Canyon remediation, no samples will be collected from the fill or from Sandia Canyon as part of the RFI for OU 1114. Sampling will be performed in Sandia Canyon as part of the OU 1049 work plan (canyons).

6.1.4 Listed PRSs Recommended for NFA Under Step Four

6.1.4.1 Rationale: No Threat to Receptors

The following Module VIII-listed PRSs recommended for NFA meet health and safety criteria under step four of Subsection 4.1 of Appendix I of the IWP (LANL 1992, 0768). These criteria are summarized in Table 6-6. Potential exposures of on-site or off-site workers or the general public to hazardous materials are far below action levels. No credible exposure scenarios pose a danger for any present or foreseeable activity. The PRSs are aggregated by types, including silver recovery, landfill/surface disposal, point/spot spills, operational releases, decommissioned waste lines, and septic units.

TABLE 6-6

HEALTH AND SAFETY CRITERIA FOR NFA UNDER STEP 4

CONCERN	ENTITIES THAT MUST BE UNAFFECTED
Health and safety	On-and off-site workers, members of the public
Environmental risk	Sensitive environmental resources
Regulatory compliance	Characterization not required
Public concern	Workers and area residents
Impact	Laboratory programs and operations
Value of information	Present and future characterizations

6.1.4.1.1 Silver Recovery Aggregate

SWMUs 3-039(a-e) are located at five separate indoor sites within the OU. Two units are active; two are former photographic processing sites that used silver recovery units. Discharges from the fifth unit, SWMU 3-039(e), are collected and removed.

Prior to 1979, waste solutions from these PRSs were discharged to the sanitary sewer system serving the TA-3 waste water treatment facility, SWMUs 3-014(a-z), discussed in Subsection 5.5. Drain lines that transported silver wastes will be addressed during decontamination and decommissioning (D&D) of each building. The TAL element, silver, is now collected and removed from active sites. These recovery units are recommended for NFA because the only hazardous material, silver, had no credible pathway to the environment except via the waste water treatment plant. Subsections 5.5.1.1.2 and 5.5.1.1.4 discuss monitoring of the effluent from lines in TA-3 into the sewer system, and states that no RCRA-required analytes over detection limits were found. Consequently, it is believed that these PRSs pose no threat.

SWMUs 3-039(a-e) are photographic processing sites using silver recovery units which capture silver in resin-containing canisters. Rinse water circulating through the processor discharges to the sanitary sewer system through a floor drain. Laboratory analyses indicate that typical effluent flow contains about 0.29 mg/L of silver (LANL 1992, 17-727). The SAL for silver is 240 mg/L. Currently, the recovery canisters are collected by the Waste Management Group (EM-7) and either stored or processed at TA-54. Operators at the Laboratory have recovered silver from all these PRSs since 1979. Several types of silver recovery units have been used at the Laboratory. A newer type, used at the Laboratory since 1989, deposits silver onto a metal drum by means of an electrolytic reaction. Older units collected silver onto a "steel wool" material which was sent to Albuquerque for recovery.

SWMU 3-039(e), located in TA-3-409, is an x-ray processing unit used by the Laboratory medical facility. All developer and replenisher chemicals were discharged into a floor drain that was connected to the TA-3 sanitary sewer and waste water treatment facility. This practice was discontinued in March, 1992. The chemicals are now collected in double-walled containers and removed from the site.

6.1.4.1.2 Landfill/Surface Disposal Aggregate

This aggregate consists of disposal sites associated with normal construction and infrastructure maintenance. No activities at these sites generated TAL, TCL, or radioactive wastes. These disposal sites contain items such as concrete, cured asphalt, and soil. These PRSs meet step-four evaluation criteria as posing no threat to potential receptors or the environment. The PRSs, their locations, and modes of deposition are listed in Table 6-7.

TABLE 6-7

LANDFILL/SURFACE DISPOSAL PRSs

SWMU ID	LOCATION	MODE OF DEPOSITION
3-009(a)	South of TA-3-73	Soil fill
3-009(b)	North of TA-3-41	Parking lot leveling
3-009(c)	South of TA-3-66	Fence relocation
3-009(d)	South of TA-3-40	Asphalt and metal disposal
3-009(e)	Mortandad Canyon	Asphalt and concrete debris in soil fill
3-009(f)	North of TA-3-16	Road construction
3-009(g)	South of TA-3-30	Debris disposal
60-002	Sigma Mesa	Storage area

SWMU 3-009(a) is a 30 x 300 ft fill area located on the rim of a small tributary of Sandia Canyon south of the asphalt concrete plant. The PRS consists of soil fill generated by operations at the facility, with minor amounts of concrete and building materials. The depth of the fill is not known. The soil has not been compacted and is prone to erosion during periods of heavy rainfall, spilling soil into the tributary and eventually into Sandia Canyon. Plans are being implemented to install a concrete dam along the base of the fill to control erosion and to allow deposition of additional fill to level the grade, thereby expanding the usable surface of the mesa (JCI 1992, 17-789).

The SWMU Report states that a 20-ft section of asbestos-coated pipe was observed at this site (LANL 1990, 0145). There was no visual evidence of this pipe during an investigation by the OU 1114 team on April 3, 1992; it had either been buried or removed. In recommending NFA for SWMU 3-003(a), the OU 1114 team acknowledges that under prevailing conditions there is no reasonable or cost-effective method of locating a buried pipe if it is still present in the fill. Because the area received construction debris, including other metal objects, it is doubtful that a geophysical survey or like technique could identify this specific pipe.

Because asbestos will not migrate in soil, burial is the accepted method of disposal. Title 40 CFR 763, Subpart E, Appendix D requires a minimum of 6 in. soil cover. At closure, a final depth of 36 in. is required. Because of the proposed remediation for erosion control measures at SWMU 3-003(a) and proposed further expansion of the fill area, the pipe poses no threat. See Subsection 6.1.3.2, SWMU 3-029(b) for a description of proposed remediation.

SWMU 3-009(b) is described as follows: "Concrete and building debris are located in an approximately 1/2 acre fill area adjacent to the South Mesa fire station (TA-3-41)" (LANL 1990, 0145). Repeated searches did not located such debris adjacent to the building. The reference may be to a surface disposal area northeast of the South Mesa Fire Station, TA-3-41. The PRS is bounded on the east by the parking lot at the corner of Diamond Drive and West Jemez Road. On the west is a 3-ft-deep drainage ditch draining to the north. North of the PRS is the 300-ft-deep south wall of Los Alamos Canyon. The PRS consists of a pile of soil, natural tuff rubble, some road-construction debris including concrete blocks and asphalt chunks, plus a few pieces of PVC piping. The disposal site is about 100 x 200 ft and 5 ft high. A narrow band of rubble containing concrete curbing chunks is located at the north edge of the parking lot.

The SWMU Report speculates that this disposal area may contain decommissioned buildings from the original TA-3. The SWMU Report is incorrect. LASL aerial photo 32074, dated 1955, shows that no debris pile was located at the PRS after site preparation activities removed the original buildings for construction of the present TA-3 complex. Subsequent aerial photographs through 1986 show that a succession of shrubs, trees, and grass filled the area. The pile that is now the SWMU appears in 1991 aerial photographs as a new feature. Its placement indicates that the pile resulted from site preparation to construct the adjacent parking lot.

The PRS is currently under consideration as the site of a parking lot for a Laboratory industrial partnership center. As part of an ERIA survey, three composite soil surface samples consisting of five subsamples were collected and analyzed for TAL elements. All concentrations were below EPA action levels (Fresquez 1993, 17-787), which are equivalent to Laboratory SALs.

SWMU 3-009(c) is described as a "disturbed area" south of Sigma Building, TA-3-66, on the north rim of Mortandad Canyon. The Release Site Database, Task 20, Record 56, states that "The area appears to be only soil fill" (LANL 1989, 17-017). The only visible debris is four concrete cylinders approximately 10 in. in diameter and 16 in. long that appear to be footings for metal posts removed during relocation of the nearby security fence (Griggs 1992, 17-752). There is no archival or visible indication of TAL, TCL, or radioactive material discarded in this area.

SWMU 3-009(d) is a 20 x 40 ft surface disposal site where small piles of cured asphalt and pieces of metal were discarded. This disposal site is located in a wooded area southwest of transportable building TA-3-1572 (south of the Physics Building, TA-3-40) on the rim of Twomile Canyon. A culvert empties between the two debris piles, resulting in a large erosion gully. Tree branches and chunks of concrete have been thrown into the gully for erosion control. The asphalt was discarded after paving the nearby parking lot. The metal debris looks like pieces of a rusting stove pipe; its origin is unknown. None of this is TAL, TCL, or radioactive material.

SWMU 3-009(e) is a fill area located at the head of Mortandad Canyon southeast of the CMR Building, TA-3-29. The face of the fill is about 35 ft high and contains some concrete and cured asphalt debris. The fill was created between 1950 and 1952 during site preparation prior to building the present TA-3. LASL aerial photo 32074, dated March 23, 1955, shows the 250 x 300-ft area level and bare. Aerial photo 1372MCSUSAF #284 (1958) shows a parking lot built adjacent to the northwest corner of the level area. Subsequent LASL aerial photos 24-155 (1974), EG&G 1285 (1977), RN79042021 (1979), RN83-124-50 (1983), and RN86048014 (1986) show the area unused and the face of the fill undisturbed and covered with low shrubs. LANL/ER aerial photo of September 29, 1991 #5-27 shows a new parking lot constructed over most of the level area and the old parking lot at the northwest corner converted to a construction-staging area. The face of the fill is still undisturbed. By the time of Environmental Restoration surveys in spring of 1992, the area at the top of the fill was being used as a construction yard for parking-lot and road-reconfiguration projects.

The SWMU Report describes SWMU 3-009(e) as follows: "A soil fill area is located in Upper Mortandad Canyon, southeast of TA-3-29" (LANL 1990, 0145). Based on the aerial photo history, this fill was created during site preparation for TA-3. It has no history as a disposal area and was left undisturbed until construction activities began between 1986 and 1991. Cured asphalt and concrete debris are a result of the new construction.

In 1974, an accidental release of radioactive liquid from the TA-3 industrial drain line flowed through a storm drain into upper Mortandad Canyon. A small earthen dam was built about 35 ft upstream from SWMU 3-009(e). The dam contained the spill; about 142 cu ft of contaminated soil was removed and the area cleaned to levels less than 25 pCi/g. In 1991, preconstruction Environmental Restoration interim action investigations indicated that all contaminants were below action levels (Fresquez 1991, 17-297). The dam site is now filled for an access road crossing Mortandad Canyon to the TA-3-66 complex. This spill is not part of SWMU 3-009(e) nor is it a separate PRS. It is mentioned here as an adjunct to the history of the site.

SWMU 3-009(f) is mentioned in the SWMU Report as follows: "There have been reports of a landfill north of TA-3-16" (LANL 1990, 0145). The only feature in the area is a narrow strip of rocks along the roadside north of the Van de Graaff Building. A 1954 LASL aerial photograph (32074) indicates that the road was originally constructed in 1951 when the Van de Graaff facility was built. The area below the road is grassy and slopes from the road southwest to the rim of Twomile Canyon. Aerial photographs indicate that a fill area was never located between this road fill and TA-3-16. An aerial photograph of 1984 (RN 84-188103) shows fresh rock fill along the road. The PRS appears to be road fill with a few concrete pieces visible along the bank. There is no indication of TAL, TCL, or radioactive material in the fill or elsewhere in the area.

SWMU 3-009(g) is an unimproved storage and disposal area located approximately one-quarter mile south of Twomile Canyon Bridge. The PRS is located in a level, 100 x 300-ft excavated area surrounded by trees. Placement of the site and 1979 aerial photographs indicate that this was a borrow pit for material to build the Twomile Canyon Bridge, which actually is a causeway of fill that spans the canyon. The PRS contains two large piles of broken tuff and soil, one pile on the west and the other on the east. A few concrete and asphalt chunks are in the piles. Tractor-trailers are parked at the site. There is no evidence of TAL, TCL, or radioactive material in this area, nor has the area a history as a release site.

SWMU 60-002 consists of three storage areas on Sigma Mesa. [This PRS is designated 3-009(h) in the Module VIII listing.] The first area is approximately 900 ft southeast of TA-60-2 and lies on the north side of the unimproved road traversing the level mesa. The 200 x 300 ft PRS is a crescent-shaped area containing piles of materials such as large concrete blocks, piles of cured asphalt chunks, cables, and other similar types. A large mound, mainly soil with some asphalt and concrete, extends to the north. This mound appears to be debris from leveling the TA-60-2 construction site.

The second area on Sigma Mesa is 120 ft northwest of TA-60-29. It is a 50-ft diameter mound of soil approximately 10 ft high containing soil, rocks, concrete fence post supports, pipe, metal strips, wood, and similar debris. The materials appear to have been accumulated from several activities including fence relocation, mesa leveling, and decommissioning of a temporary water line that supported drilling at the east end of Sigma Mesa. There is no evidence of TAL, TCL, or radioactive material. The site is inactive.

The third area is on the south side of the unimproved road about 100 ft west of a drilling-mud pit near the end of the mesa [see SWMU 60-005(b)]. Approximately 50 piles of broken cured-asphalt chunks were deposited here by Johnson Controls in anticipation of recycling. The asphalt is scheduled to be moved to the Los Alamos municipal landfill for disposal (Martell 1992, 17-750).

6.1.4.1.3 Point/Spot Spills

The point/spot spills aggregate is based on similarities in nature of spill and rationale for recommendations. Although spills did take place at these PRSs, investigation revealed that the substances are not TAL, TCL, or radioactive waste. For convenience, these point/spot spills are further aggregated into groups determined by the nature of the substance. Table 6-8 lists the PRSs, their locations, and the substances spilled.

TABLE 6-8

POINT/SPOT SPILL PRSs

SWMU ID	LOCATION	SUBSTANCE SPILLED
Vacuum Pump Oil Leaks		
3-010(b)	North side of TA-3-29	Vacuum pump oil
3-010(c)	North of TA-3-216	Vacuum pump oil
3-010(d)	TA-3-141	Vacuum pump oil
Operational Releases		
3-003(c)	South side, TA-3-287	Dielectric oil
3-001(k)	South side, TA-3-16	Used solvents
3-012(a)	South of TA-3-66	Ammonium bifluoride
3-013(c)	West of TA-3-38	Kerosene, paraffins, grease
3-013(d)	West of TA-3-38	Hydraulic fluid
3-013(e)	TA-3-36	Ethylene glycol antifreeze
3-013(f)	East side of TA-3-66	Roofing tar
3-013(g)	NE of TA-3-316	Petroleum-based oils
3-013(h)	South of TA-3-39	Lubricating oils
Pits		
3-020(a)	North of TA-3-287	Petroleum-based oils
3-020(b)	SE of TA-3-70	Lubricating oils
Asphalt Releases		
3-036(a)	TA-3-70	Asphalt
3-036(c)	TA-3-70	Asphalt
3-036(d)	TA-3-70	Asphalt
3-036(e)	TA-3-70	Asphalt

6.1.4.1.3.1 Vacuum Pump Oil Leaks Aggregate

In all cases, the seal oil used in vacuum pumps, compressors, and comparable machinery is a light- to medium-weight, pure, petroleum-based oil with no detergents or additives. Such a product is not TCL waste. Thus, the only concerns with spills of seal oil is the possibility of introducing other contaminants into the oil or of having a major spill where residuals could cause detrimental effects to health or the environment. Neither concern is applicable to these spills.

SWMU 3-010(b) is the site of the vacuum pump on the north side of Wing 5 of TA-3-29. The pump was installed in the mid-1950s and was used for evacuating a nearby horizontal cylinder used for storing inert gases. The pump is a Kinney vacuum pump with a 10-horsepower motor. According to the manufacturer, this model of vacuum pump used a pure (no detergents or additives), low vapor pressure, medium-weight (30W) petroleum-based oil for the seal (LANL 1992, 17-734). The pump and motor are housed in a small metal shed (approximately 5 x 6 ft base) mounted on a concrete foundation that is approximately 3 to 4 in. higher than the surrounding asphalt paving. The pump has been inactive since 1982 and removal of the pump and shed are in progress.

Visual inspection of the vacuum pump by Laboratory personnel found oil stains inside the shed, on the pump, and on the concrete floor below the pump. No oil stains were evident outside the shed on either the concrete or asphalt, indicating that none of the seal oil leaks extended beyond the shed. A review of operations within TA-3-29 supported by this vacuum pump indicates that no radioactive materials, solvents, PCBs, or heavy metals were present in the gas stream entering the vacuum pump. Thus, there is no reason to suspect that the seal oil was contaminated with any TAL, TCL, or radioactive constituents.

SWMU 3-010(c) is the site of a hydraulic pump housed in a metal shed north of TA-3-216. The pump was mounted on a concrete pad elevated about 6 in. above the ground and enclosed in a small sheet metal housing. It was removed between December 1990 and August 1991. The ground around the pad is landscaped with gravel-covered plastic sheeting. Investigation by Laboratory staff determined that the unit was a belt-driven vacuum pump installed in the late 1980s and used in conjunction with a cryogenic liquid nitrogen Dewar flask. The pump used an oil comparable to the one described for SWMU 3-010(b) above. Operating practices included the placement of drip pans under the pump to catch any leakage (LANL 1992, 17-733).

The vacuum pump identified in this PRS has been removed, and a recent inspection by Laboratory personnel revealed no visual evidence of any seal oil spills, either on the concrete base or on the ground around the base. Because there are no stains, and because drip pans had been placed beneath the pump to contain any leaks, it can be concluded that there was no history of release to the environment from this PRS.

SWMU 3-010(d) is identified in the SWMU Report as "two vacuum pumps for the beryllium processing system in TA-3-141... located on the east side of the building" (LANL 1990, 0145). The pumps were mounted on the concrete floor of a 5 x 12 ft metal shed. The surrounding area is paved with asphalt. The two vacuum pumps in question were belt-driven Kinney vacuum pumps, models KC-46 and KC-15. These models used a pure petroleum-based seal oil (LANL 1992, 17-734) comparable to the one discussed above. The two belt-driven vacuum pumps were removed and replaced with a new direct-drive vacuum pump in 1991 (LANL 1992, 17-737). Investigations by Laboratory staff determined that these vacuum pumps were installed in the mid-1970s and were used in conjunction with a tungsten spray chamber. The air from the spray chamber was vented through these pumps directly to the main venting system for TA-3-141. Beryllium processing in TA-3-141 is self-contained; these pumps were not connected to beryllium processing systems. No radioactive materials, PCBs, solvents, or heavy metals were used in the spray chamber serviced by these vacuum pumps

Although the two vacuum pumps have been replaced by a new vacuum pump, there remains visual evidence of leakage from the old pumps. The concrete foundation within the pump shed is covered with oil stains. The asphalt paving has an oil plume extending from the shed north along the foundation of TA-3-141 for approximately 9 ft, with a lateral (east-west) spread of 1 to 3 ft. These oil stains are from seal oil, a pure petroleum product, not included on the TCL.

6.1.4.1.3.2 Storage Pad and Operational Releases Aggregate

Materials, compounds, substances, and products were stored, spilled, or discarded at the following storage areas or surface release sites. The nature of the activities and subsequent events, such as paving or dilution with storm water and snowmelt, indicate that none of these sites presents a threat to on-site or off-site workers, the public, or the environment now or in the future.

SWMU 3-003(c) was an equipment storage area used for dielectric oils and capacitors. It was located on the south side of TA-3-287. The building has been remodeled in support of a space technology center and the PRS sampled as part of an ERIA reconnaissance survey. One surface soil sample was taken at the PRS. It had no gross alpha, beta, and gamma activity above background levels and no PCBs were found (Fresquez 1992, 17-613).

SWMU 3-001(k) is a level, 40 x 50 ft paved area located on the south side of the Van de Graaff Building, TA-3-16. The asphalt surrounds an 8 x 10 ft concrete pad abutting doors opening from the building. Both asphalt and concrete appear weathered and devoid of stains, with the exception of two rust rings on the concrete. The area is fenced and used as a storage yard, principally for old electronic equipment. A shed on the southwest perimeter of the fenced area is a designated satellite accumulation area.

SWMU 3-001(k) is listed in the SWMU Report as a less-than-ninety-day accumulation area (LANL 1990, 0145). CEARP record 1174 quotes a 1986 field survey as noting the presence of "3 very oily, unmarked drums on the south side of SM-16 and in the backyard of SM-16 ... drums, etc., appear to be in this area" (LANL 1989, 17-018). The waste coordinator at TA-3-16 between 1980 and 1987 states that the "very oily" drums stored fresh vacuum oil to be used in experiments. Other drums included empty drums for salvage; empty drums to be filled with wastes; empty, tar-lined 55-gal. drums for waste tritium storage; and a few drums containing used solvents (Sobojinski 1992, 17-641). The area was used for the storage of power supplies. In 1989 samples were taken from oils, the power supplies, and an asphalt chip. All were negative except the chip, which contained 7.8 ppm of mixed arochlors, below Toxic Substances Control Act (TSCA) cleanup levels (LANL 1990, 17-814).

Recommendation for NFA is based on the scoured physical appearance of the surface of the concrete and asphalt. A few small oils stains appear only in the area where new product oil was dispensed. An asphalt seal-coat has been reapplied at least once (date unknown, but prior to 1979, based on aerial photos RN79042022 and RN84188103). There is no physical indication that sufficient solvent spills occurred to penetrate the asphalt and contaminate the subsurface. There are no records that tritium-contaminated waste was spilled from tar-lined drums.

SWMU 3-012(a) is located approximately 100 ft southeast of the Sigma Building on the north slope of Mortandad Canyon. A temporary holding dam was built, then destroyed after an operational release. The site has since been disturbed by construction of the Laboratory sanitary waste system consolidation pipeline.

The release was not a spill but a controlled operational pipe-cleaning procedure. In the fall of 1972, the recirculating chilled water system at Sigma Building was scheduled for treatment with ammonium bifluoride to remove scale deposits. A week or so before the cleaning, a small earthen dam was built to form a holding pond to catch effluent resulting from flushing the system (Hoard 1992, 17-650). The operation proceeded as planned. Lime (calcium oxide) was put in the pond at the time of release to form fluorite (calcium fluoride), an inert, unreactive, insoluble compound. After the liquid evaporated or soaked into the soil, the dam was destroyed.

Analysis of waste water in the pond on November 8, 1972, indicated a concentration of 20 ppm fluoride in 5 000 gal. of effluent, a total of 0.83 lb of fluoride (Garde 1972, 17-175). This amount spread over a 50 ft square area 6 in. deep would increase the fluoride content of the soil only by 5 ppm. Concentrations of fluoride in normal soils in the United States range from 100 to 400 ppm (Pendias and Pendias 1984, 17-760). Fluoride in soil is not a TAL material (see Appendix J of the IWP) (LANL 1992, 0768). Lime effectively nullified the corrosive effects of dissolved fluoride (Fragment memo 1972, 17-651). Ammonium ion, the second product of the degradation of ammonium bifluoride, is a common fertilizer.

SWMU 3-013(c) was a cable cleaning site, now removed. From the 1960s until 1991, new steel cable received by the Laboratory was soaked in a kerosene bath to remove factory-applied preservatives (petroleum-based paraffins and greases). This cleaning operation was performed on a paved asphalt area located approximately 200 ft west of TA-3-38 in the Johnson Controls storage yard. Runoff flows south to a storm drain about 200 ft south of the pad [see SWMU 3-013(a) for a description of the drain].

For cable-cleaning operations, a 10 x 20 ft, 4-in.-deep bed of sand, underlain by plastic and surrounded by a one-foot-high sand berm, was built in the middle of the asphalt pad. A 1 200-gal. tank containing kerosene was located on the sand bed and the new cables were placed in the tank to soak. Kerosene frequently spilled from the tank onto the sand bed. Cleaned cables were suspended above the tank for a period of time to allow residue to drain. The cables were then placed in wooden shipping boxes next to the tank but outside the sand berm where some remaining kerosene evaporated or dripped onto the asphalt surrounding the tank.

The sand bed and plastic liner were removed after each cable-cleaning operation and discarded at the Los Alamos municipal landfill. Kerosene remaining in the tank was recycled. In 1991, this operation, including the tank, was moved to TA-60. The area was swept clean and all sand was disposed of in the municipal landfill (LANL 1992, 17-739). There are some small (1- to 6-in. diameter) oil stains on the asphalt in or near the area, but no evidence that any significant releases occurred. No TCL materials, such as solvents, were involved in this operation.

SWMU 3-013(d) is the site of metal-working equipment. This PRS includes surface stains and plume from a hydraulic bender, now removed, and an active hydraulic shearer. Both were located in the JCI storage yard 125 to 150 ft southwest of TA-3-379. Drainage from the site is to the southeast toward the storm drain described above.

The bender was installed in 1952 when the area was first developed for use as a storage yard (LANL 1992, 17-739). It sat on a 50 sq. ft concrete pad surrounded by asphalt pavement. The shearer was installed in 1968 by cutting two rectangular (8 x 2 ft) areas through the asphalt and pouring concrete footings. Both units are visible in a 1974 aerial photograph, 34-155.

Both pieces of equipment were used in parts fabrication. The bender was used to shape steel plates, bars, etc., and the shearer was used to cut sheet steel. The bender was removed in May 1992 and sent to salvage after being tested by EM-8. The concrete pad remains. The shearer continues in active operation. The hydraulic fluids in both the bender and the shearer were tested by EM-8 and determined to be uncontaminated by PCBs.

Randahl AC-32 hydraulic fluid is currently used in the shearer. The only other substance in this PRS is associated with sheet metal. Sheet metal is steel stock which often has a thin film of a light lubricating oil on the surface.

Both the bender and shearer leaked hydraulic fluids that stained the areas under and around their locations. Inspection of the areas also found an oil stain that extends about 35 ft southeast of the shearer. Storm runoff from this area flowed southeast toward the same storm drain discussed above. These petroleum products are not TCL materials.

SWMU 3-013(e) is the site of a one-time antifreeze spill in the fenced, paved, storage yard west of the service station, TA-3-36. The service station and yard are in active service. In March 1989 an estimated 60 gal. of a 50/50 mix of ethylene glycol (antifreeze) and water spilled to an area about 8 ft square on the asphalt pavement west of TA-3-36. Most of the solution drained into a storm drain about 60 ft to the south of the spill area. There were no standing pools of the fluid, nor are there any sediment pockets in the area. The constituents, ethylene glycol and water, are not TCL materials.

SWMU 3-013(f) is an area of stained soil on the east side of TA-3-66 that was the temporary location of a tar-melting pot and hopper. The site is currently overgrown with native grasses and weeds. Only a few pieces of roofing tar/gravel aggregate are visible. The area of the spill was less than 10 ft square and is located 18 ft east of the building. The tar/gravel aggregate does not appear to have penetrated into the soil.

The area of stained soil that forms this PRS resulted from tar spills that occurred when TA-3-66 was reroofed in the late 1970s. The tar congealed quickly upon contact with the ground. Most of the material was cleaned up when the spills occurred, but some pieces, approximately 1 to 4 in. in diameter, are still visible. Cured tar is not a TCL material.

SWMU 3-013(g) is the site of a dumpster that was located in an unpaved parking area at the northeast corner of the High Voltage Test facility, TA-3-3161. The dumpster has been removed and the area was subsequently paved.

For at least ten years (1978 to 1988), the dumpster was used for disposal of oil-soaked Sorb-all. Spills occurred during disposal of the Sorb-all and oil stains were evident on the soil (LANL 1990, 0145). Between 1988 and 1990 the dumpster was removed as part of the construction of buildings TA-3-2003 through TA-3-2010, located just east of TA-3-316. During this project, the area was graded, leveled, and paved. The stained soil was either excavated and removed or paved over. Although there were a number of capacitor banks and power supplies in TA-3-316, testing of the oil has shown that few of the power supplies and none of the capacitors contained PCBs. The probability of PCB contamination in any of the oil that escaped the dumpster is low (LANL 1992, 17-736). The oils were petroleum-based and not regulated as TCL constituents.

SWMU 3-013(h) is oil stains associated with a 4 x 8 ft storage area located on the asphalt pavement south of TA-3-39. This area has been paved since the early 1950s and was repaved in the mid 1980s. Old or obsolete equipment is brought here for testing before disposal. Fluids (oils) are sampled by pumping from the top of tanks or reservoirs on the equipment, never by opening petcocks, drains, or other parts that could cause spills. Samples are collected by EM-8. Most of the fluids are light lubricating oils. Samples of possible PCB-containing oil are sent to the Health and Environmental Chemistry Group (EM-9) for analyses. Samples of possible asbestos-containing insulating materials are sent to the Industrial Hygiene Group (HS-5) for analyses. If there are no hazardous constituents associated with the fluids or insulation, the equipment is taken to the Johnson Controls salvage/redistribution center. If contaminated, equipment is sent to TA-54 for disposal (LANL 1992, 17-735).

The oil stains associated with this PRS are the result of drips and small leaks from the old equipment. From at least 1987 to the present, all equipment has been tested for possible PCB contamination before disposal, and no PCB-contaminated equipment has been found (LANL 1992, 17-735). The oils associated with this equipment are light lubricating oils for bearings and seals, and do not contain TCL material.

6.1.4.1.3.3 Pits Aggregate

Substances deposited by the following operations included only oils and water. No activity associated with these pits used TAL, TCL, or radioactive materials or products. These pits present no threats to on-site or off-site workers, the public, or the environment.

SWMU 3-020(a) was described as a covered pit on the east side of TA-3-287 containing a buried 32-gal. drum filled with gravel and fitted with a screen. "There is a pipe running into the pit with the screen and pebbles below it. The area around the pit appeared oily. An employee indicated that the pit was used to discharge liquids from the air compressor system at TA-3-287. This pit has been inactive since 1989, when the drum, pebbles, and surrounding soil was [sic] removed by the user group" (LANL 1990, 0145). Further investigation by Laboratory personnel indicates that the pit was actually on the north side of the building, rather than the east. The pit was used to bleed condensate and seal oil leakage from the air compressor tank. The air intake for the compressor system was outside the building, so the only substances in the bleed-off were water and seal oil. The air compressor uses a pure petroleum-based (no detergent or additives) oil as the seal fluid. This oil is equivalent to a 30W viscosity-type motor oil. The pit was removed by Johnson Controls in 1990 (Laboratory construction project No. 12545-03). In 1991 the area was graded and paved as part of a parking lot constructed between TA-3-105 and TA-3-287.

SWMU 3-020(b) was a pit, now covered, adjacent to the southeast corner of TA-3-70 that was used to catch residue from steam-cleaning small engines. The pit was a 1-in.-deep metal box about 10 x 15 ft that was recessed into asphalt paving. It was filled with sand and covered with a metal grate. Small engines were placed on the grate to be steam cleaned. Oil and grease from the engines, as well as the condensed water and detergent from the steam cleaner, drained into the pit and were absorbed into the sand. As the sand became saturated, it was removed and discarded at the municipal landfill. The pit was refilled with dry sand. In November 1991, the pit was cleaned, refilled with dry sand, and covered with 4 in. of asphalt as part of a general repaving of the lot.

6.1.4.1.3.4 Asphalt Releases Aggregate

SWMUs 3-036(a), 3-036(c), and 3-036(d) are all located near the asphalt plant, TA-3-70, and store asphalt materials. Soil staining in these PRSs resulted from spills of oils, asphalt emulsions, and hot asphalt from storage tanks associated with the plant. The tanks have all been removed, and all soil was excavated from around and under each tank (McVey 1989, 17-582). The area is an active site used for aggregate storage and mixing for feed to the asphalt plant. In 1992, the NMED issued a citation to the Laboratory for leakage of asphalt into Sandia Canyon. A VCA resulting from this citation is described in Subsection 6.1.3.2.

Four SWMUs, 3-036(a,b,c,d), are located at the asphalt batch plant, TA-3-70. All are related to activities conducted at the plant. Although four PRSs describing seven tanks are identified in the SWMU Report (LANL 1990, 0145), further investigation indicates that there are only three PRSs involving five tanks. The tanks described in the SWMU Report for SWMUs 3-036(c) and 3-036(d) appear to be the same tanks. This finding is supported by the CEARP Report (DOE 1987, 0264).

SWMU 3-036(a) is the former site of two large, circular storage tanks, TA-3-75 and TA-3-76. They were located within a soil-bermed secondary containment area about 225 ft southwest of TA-3-70. The tanks were used to store asphalt emulsion. From examination of an aerial photograph (34-155) taken in 1974 and a photograph (RN 84-18839), taken in 1984, it appears that each tank was 25 to 30 ft in diameter and 8 to 12 ft high, with a capacity of 30 000 to 50 000 gal. Each tank was within a separate bermed containment area approximately 50 ft in diameter. The tanks were in place as early as 1974. Operations resulted in some small spills from these tanks; however, these spills were contained within the berms. One large spill of 1 500 gal. was attributed to the reclamite tanks, SWMU 3-036(e), but was actually the result of a rupture near the base of tank TA-3-75. The spill was contained within the bermed area, mixed with sand, and deposited in the Los Alamos municipal landfill (Barnett 1987, 17-346).

Between October 1988 and April 1989 both tanks were removed, cut up, and deposited in the Los Alamos municipal landfill. All soil around and under the two tanks was removed, mixed with sand, hardened, and also deposited at the Los Alamos municipal landfill (McVey 1989, 17-582). The area is currently used for storage and preparation of crack-sealing machines.

SWMUs 3-036(c,d) are described in the 1990 SWMU Report as two tanks for cooled asphalt and two tanks for hot asphalt emulsion storage (LANL 1990, 0145). However, the 1987 CEARP Phase I Draft Report, Vol. 1 lists only one tank for each function, as does the report of an inspection by Roy F. Weston, Inc. personnel in 1989 These tanks, TA-3-178 and TA-3-335, were dug up at that time and sent to salvage; inspection revealed that they had never leaked (McVey 1989, 17-582).

SWMU 3-036(e) is soil containing small spills from a 5 000-gal. above-ground tank in the work area near the asphalt batch plant, TA-3-70. The tank, TA-3-1969, was used for reclamite storage. During the May 1989 inspection, the tank showed no evidence of leaks, nor were there any reports of spills (McVey 1989, 17-582). The tank was emptied and removed from service in 1986 or 1987 and remains on site approximately 225 ft west of TA-3-70. The 1990 SWMU Report also noted that the reclamite storage tank had ruptured and spilled 1 500 gal. of oil emulsion in 1987 but, as discussed above, that spill was actually from tank TA-3-75 [SWMU 3-036(a)].

The reclamite storage tank was used to store heavy oil used to recondition asphalt. Reclamite is not a TCL material, as it is solely petroleum based. The tank is currently empty and inactive. There is no visual evidence, either on the tank or on the ground around the tank, that there were ever any spills from this tank. This is corroborated by a 1989 inspection (McVey 1989, 17-582).

Rationale for Recommendation: The PRSs in this aggregate are proposed for NFA for the following reasons: the tanks stored product rather than waste; the tanks and contaminated soil have been removed; the area is an active site performing the same functions as when the tanks were in use; the Laboratory is planning remediation for the entire area that will address off-site migration of hazardous substances; and, the entire area will be subject to a cleanup plan when the asphalt plant is decommissioned.

6.1.4.1.3.5 Septic Units Aggregate

Concerning the following PRSs, Laboratory documentation indicates that the cesspool at TA-3-16 was never used and that the septic tank at TA-59 has been so totally removed that no reasonable sampling points remain. In addition, neither was associated with operations that generated significant amounts of hazardous waste. For these reasons NFA is recommended under Step 4, since the units pose no threat to receptors.

SWMU 3-018 is a cesspool installed in 1952 during the original construction of the Van de Graaff Building, TA-3-16, as illustrated in Engineering Drawings ENG-C 1890 and ENG-C 7400. The cesspool is located directly south of the building and was constructed of concrete with a height of approximately 5 ft and a manhole approximately 4 ft in diameter. It is currently located beneath an asphalt parking lot.

The cesspool was never connected to sewer lines or acid waste lines. When the facility began operating in 1952, the building was connected to both a sanitary sewer line to the TA-3 waste water treatment plant and an industrial waste line to TA-45 and subsequently to TA-50, as illustrated by Engineering Drawings ENG-C 7384, ENG-C 7389, ENG-C 7398, and ENG-C 7400. The Laboratory and Pan Am History Book maintained by ENG-7 indicates that the cesspool was never used and was subsequently filled with soil and abandoned in place in July 1964 (LASL no date, 0402). Therefore, no releases occurred.

SWMU 59-001 was a septic system, now removed, that included a tank with two compartments and a drain field (previously referred to as structure TA-3-239 and later as TA-59-04) that was part of the original design and construction of TA-59-1. The system was disconnected in 1979 when the building was tied into a sanitary sewer line as illustrated in Engineering Drawing ENG-C 43442. Since construction in 1964, an industrial waste line has transported laboratory wastes from the building to the treatment facility located at TA-50, indicating that the septic system handled only sanitary waste. A photograph processing laboratory was located on the first floor of Building TA-59-1 and wastes from this lab may have been discharged to the septic system, although there are no documented instances of such discharges. The photograph processor has been used sparingly since its initial operation in 1977. Sludge was removed with the septic tank in 1979 (LANL 1991, 17-727).

Engineering Drawing ENG-C 43442 illustrates excavation plans for the parking lot and road to the Occupational Health Office Building, TA-59-3, including locations of the septic tank and associated drain field. The drawing indicates that the septic tank and associated manhole were removed and the excavation filled with earth from the adjacent embankment. The drawing also indicates that approximately 7 ft of overburden was excavated at the site of the drain field. There are no records of EM-8 sampling and analyzing sludge or surrounding soils when the tank was removed in 1979 (LANL 1992, 17-693). Additionally, there are no records documenting where soil from the parking lot and road excavation was taken, but it is assumed that it was used as fill under TA-59-3 and associated structures. The area presently consists of an asphalt-paved parking lot 10 ft to 15 ft below the grade of the former septic tank.

6.2 Non-Listed PRSs Recommended for No Further Action or Deferred Action

The following PRSs are not listed on Module VIII but are recommended for NFA or DA following the four-step criteria summarized in Table 6-9. Table 6-10 shows all non-listed PRSs proposed for NFA or DA, giving the PRS identification number and the subsection in which the PRS is discussed. The third column indicates which of the four steps for evaluating candidacy for NFA or DA is applicable to the relevant PRSs. The fourth column lists the

TABLE 6-9

FOUR-STEP CRITERIA FOR NFA OR DA

STEP	SUBSECTION	CRITERIA
Step 1 NFA	6.2.1.1 6.2.1.2	PRS has undergone regulatory closure SWMU Report is inaccurate
Step 2 NFA	6.2.2.1	PRS is an approved accumulation area
Step 3 DA	6.2.3.1	PRS is active site with no credible off-site pathways
Step 4 NFA	6.2.4.1	PRS poses no threat to on-site or off-site workers, the general public, or to the environment

rationale within that step. A table in Subsection 6.3 lists all PRSs from the 1990 SWMU Report that are recommended for NFA.

TABLE 6-10

NON-LISTED PRSs RECOMMENDED FOR NFA OR DA

SWMU ID	DESCRIPTION	SUBSECTION	STEP	RATIONALE
3-026(d)	Sump/lift station	6.2.3.1	3, DA	Active
3-043(e)	UST	6.2.1.1	1, NFA	Closure
3-055(b)	Outfall	6.2.4.1	4, NFA	No threat
3-056(a)	Oil storage	6.2.3.1	3, DA	Active
30-001	Electronics site	6.2.4.1	4, NFA	No threat
59-002	Drum storage	6.2.4.1	4, NFA	No threat
59-003	Sumps	6.2.4.1	4, NFA	No threat
60-001(b)	Storage area	6.2.4.1	4, NFA	No threat
60-001(c)	Satellite accumulation	6.2.2.1	2, NFA	SAA
60-001(d)	Pesticide shed	6.2.4.1	4, NFA	No threat
60-003	Oil-water separator	6.2.4.1	4, NFA	No threat
60-004(a)	Material storage	6.2.4.1	4, NFA	No threat
60-005(b)	Drilling mud pit	6.2.4.1	4, NFA	No threat
60-006(b)	Septic system	6.2.4.1	4, NFA	No threat
60-006(c)	Septic system	6.2.1.2	1, NFA	Duplicate
61-003	Alleged burn pit	6.2.1.2	1, NFA	Non-existent
61-004(a,b,c)	Septic systems	6.2.4.1	4, NFA	No threat
64-001	Satellite accumulation	6.2.2.1	2, NFA	SAA*

* SAA = satellite accumulation area

6.2.1 Non-Listed PRSs Recommended for NFA Under Step One

6.2.1.1 Rationale: PRS Has Undergone Closure

SWMU 3-043(e) was TA-3-36-1, an underground tank located at the service station, TA-3-36. The tank was removed under RCRA regulations in 1989 and cut up for scrap (McInroy 1989, 17-630).

6.2.1.2 Rationale: SWMU Report Inaccurate

SWMU 60-006(c) is listed as an inactive septic system located at the Nevada Test Site (NTS) Test Rack Fabrication facility (LANL 1990, 0145). This PRS is a duplicate of SWMU 60-006(a) (see Subsection 5.6).

SWMU 61-003 is an alleged burn pit. The SWMU Report states that aerial photographs taken in the 1940s show a burn pit on East Jemez Road near the present location of the Royal Crest Trailer Court. Aerial photographs from 1946 (photograph LAHM-P 1990-40-1-3030) and 1947 (photograph 7473-1 aerial view tube #70,C3,TD19) of the same area show what might be mistaken for a burn pit but is not. Burn pits are large, bermed features easily identified in aerial photos.

Scrutiny through a high-power magnifier shows the PRS to be trees. Several walking trips through the possible site of the burn pit were made by the 1114 Operable Unit Project Leader and team members in the spring of 1992. No evidence was found that a burn pit ever existed.

6.2.2 Non-Listed PRSs Recommended for NFA Under Step Two

6.2.2.1 Rationale: PRS is a Satellite Accumulation Area

SWMU 60-001(c) consists of two satellite accumulation areas that began operations in 1990. They are located inside buildings at the NTS Test Fabrication Facility located on Sigma Mesa approximately one-half mile east of TA-60-2.

SWMU 64-001 is several satellite accumulation areas located inside the Central Guard facility, TA-64-1, built in October 1986. Satellite accumulation areas and less-than-ninety-day accumulation areas were established at OU 1114 in conformance with 40 CFR 262, Standards Applicable to Generators of Hazardous Waste, and are currently regulated under 3004(a) of RCRA. The EPA and the Laboratory have agreed that registered accumulation areas are not PRSs to be regulated under the HSWA Module (Twombly 1992, 17-741) provided that they have no history of release and have no credible pathway to the environment. This PRS meets these criteria and is currently on the Laboratory list of satellite and less-than-ninety-day accumulation areas (McInroy 1992, 17-748).

6.2.3 Non-Listed PRSs Recommended for DA Under Step Three

6.2.3.1 Rationale: Active Sites with no Credible Pathways

The following non-HSWA PRSs are currently active operations with no credible off-site pathways resulting in historic contamination.

SWMU 3-026(d) is an active sump/lift station located in Room 50 in the basement of the Van de Graaff facility, constructed in 1952. As part of an addition in 1962, the sump was installed to handle sanitary waste water from bathrooms plus floor and sink drains in the lower level of the building. The sump is still in use. The waste water is pumped to a waste water treatment plant via sewer lines. There is no documentation indicating that the integrity of the sump has failed.

SWMU 3-056(a) is an active, used-oil accumulation facility built in 1986. The structure is 12 x 45 ft and is located approximately 15 ft north of TA-3-271. It has a concrete floor that slopes toward a sump and is surrounded on all sides with a concrete berm. The structure has a roof but the sides are open. There have been no spills from the bermed area into the environment (Griggs 1992, 17-684).

6.2.4 Non-Listed PRSs Recommended for NFA Under Step Four

6.2.4.1 Rationale: No Threat to Receptors

There is no evidence that any PRS listed in Table 6-11 contained material that might present a threat to human health or the environment. No operations conducted at these buildings or their vicinity generated hazardous waste. The following PRSs meet the criteria for a Step 4 evaluation: they present no danger to potential receptors.

6.2.4.1.1 *Miscellaneous Aggregate*

SWMU 3-055(b) is an inactive outfall located west of TA-3-30. It was the discharge point for an emergency shower in warehouse TA-3-30. The outfall drained into the upper end of a small tributary that drops steeply into the main branch of Twomile Canyon. The channel has eroded to bedrock tuff.

A battery charging and refilling shop was located in the northwest corner of Building 30 from 1968 to 1975. Batteries were filled with virgin sulfuric acid,

TABLE 6-11

PRSs THAT PRESENT NO DANGER TO POTENTIAL RECEPTORS

SWMU ID	LOCATION	DESCRIPTION	STATUS
3-055(b)	TA-3-30	Outfall	Inactive
30-001	NW of TA-3-142	Small building	Decommissioned
59-002	TA-59-1	Drum storage	Active
59-003	TA-59-1	Sumps	Active
60-001(b)	TA-60-7	Storage	Active
60-001(d)	TA-60-29	Pesticide storage	Active
60-003	TA-60-1	Oil-water separator	Active
60-004(a)	Sigma Mesa west	Storage yard	Active
60-005(b)	Sigma Mesa east	Drilling mud pit	Inactive
Septic System Aggregate			
60-006(b)	Sigma Mesa	Septic system	Inactive
61-004(a)	TA-61-23	Septic system	Inactive
61-004(b)	East Jemez Rd.	Septic system	Inactive
61-004(c)	TA-61/landfill	Septic tank	Inactive

which often was spilled during the operation. A fume hood and emergency shower were installed for worker safety but have since been deactivated (LANL 1990, 0145). Only clean sulfuric acid was used to fill batteries with a low liquid content. Spent battery acid was not handled in this shop (Sobojinski 1992 17-721). The small amounts of spilled acid were diluted by the rinse water and quickly neutralized in the alkaline environment of Los Alamos (Martell 1992, 17-759). This unit does not present any hazard to human health or to the environment.

SWMU 30-001 was TA-30, a small site now abandoned, approximately 500 ft north of the intersection of West Road and West Jemez Road and about 15 ft north of the intersection of West Road and the old Anchor Ranch Road. It was established in 1945 as an electronics test area. An area approximately 40 x 80 ft was cleared to erect a single electronics test building 16 ft square. Engineering Drawing A5-R35 from 1947 indicates that the building contained only a bench and an oil stove. There was no sink. An oil storage tank was located outside of the building. Aerial photographs show that the site was cleared before December 1947. The site is now covered with grasses, a few ponderosa pines, and a small scrub oak thicket. Only a few pieces of gravel indicate that the site was ever used. About 150 ft to the north is a pile of gravel that contains cured asphalt chunks; this may be the "landfill uphill from the site" as mentioned in the SWMU Report (LANL 1990, 0145).

There is no indication that hazardous materials were used at this site. Fuel oil is not a TCL material. While small amounts of volatile solvents may have been used to clean electronic components, the building contained no sink to release solvents to the environment. Solvents evaporate quickly in use. Concerning the potential of a landfill, visual inspection of the pile of gravel reveals that it contains only small pieces of cured asphalt less than 3 in. in diameter. There is no evidence of any material that might present a threat to human health or the environment.

SWMU 59-002 is recorded as a waste accumulation area outside TA-59-1. An active container accumulation area is located on the south-side loading dock at the main floor level, and a loading access door is on the east end at the basement level. At one time the south-side dock was used for drum storage. Presently, there are only gas cylinders and other items stored in cages.

A field survey found debris and drums stored at several outside locations in TA-59. Some of the drums were marked as radioactive (LANL 1990, 0145). All of the drums have since been removed.

TA-59-1 houses both offices and laboratories in a two-story structure. According to TA-59-1 operating personnel, the only drums or containers marked as containing radioactive waste are located inside the count trailers on the south side of the building. These containers are used for the disposal of collected samples counted in trailers. When the waste containers are full, they are immediately moved to the locked dumpster on the east end of TA-59-1 for storage. The contents of the dumpster is disposed of at TA-54. Until approximately 1989, one of the count trailers was located near the southwest corner of TA-59-1. Periodically, drums of debris with unknown contents were left near the count trailer from unknown sources. When this happened, the drum contents were sampled, analyzed, and disposed of in accordance with applicable regulatory requirements. Drums of hazardous or radioactive waste have never been stored on the loading dock at TA-59-1. There have been no documented releases of hazardous or radioactive waste on, or in the vicinity of, the loading dock (LANL 1992, 17-761).

SWMU 59-003 consists of three sumps in the basement of TA-59-1. The 100-gal. capacity sump and lift station in Room B-7 is constructed of cast iron and has been tied to the sanitary sewer line since the building was constructed in 1951. Engineering Drawings ENG-C 43430, and ENG-R 5300 show that the two sump pumps in Rooms B-8F and B-8J are constructed of acid-resistant plastic with a capacity of 5 gal. The two sump pumps sit on the concrete floor and are tied to the acid waste line.

The three sumps (SWMU 59-003) in the basement of TA-59-1 were included in the SWMU Report (LANL 1990, 0145) because of their potential to handle radioactive and hazardous wastes. However, the sump and lift station located in Room B-7 handle only sanitary waste water and has been connected to the sanitary sewer since the building was constructed (LANL 1992, 17-725). The sump pumps in Rooms B-8F and B-8J were installed approximately five years ago to handle waste water from laboratory operations that were relocated to the basement of TA-59-1.

SWMU 60-001(b) is an active storage structure, TA-60-7, a corrugated-metal shed with a concrete floor, located in the northeast corner of the TA-60-2 materials storage yard. Materials stored in TA-60-7 include 1- and 5-gal. containers of paints, paint remover, lacquer thinner, methyl ethyl ketone, paint thinner, and concrete primer. After December 1992, TA-60-7 was no longer be used for the storage of these constituents. Additionally, one 85-gal. overpack drum containing one absorbent pillow and two bags of absorbent material is located in the center of the shed. What appear to be oil or grease stains were observed on the concrete floor between the large center door and small door near the northwest corner of the structure. These stains were created by a small forklift that periodically leaked oil. The forklift was parked in the area of the shed but has not been used in several years.

When the SWMU Report was written, TA-60-7 was designated as an active satellite waste and hazardous materials accumulation area (LANL 1990, 0145). Johnson Controls personnel have since confirmed that no waste was ever handled or stored at TA-60-7, and there has been no record of spills or releases of paints, thinners, or solvents since its construction in 1978 (LANL 1992, 17-665).

SWMU 60-001(d) is the pesticide storage shed, TA-60-29, located approximately 650 ft east of the NTS Test Fabrication Facility. TA-60-29 is a corrugated metal structure constructed in 1988 and currently operated by Johnson Controls. A bermed concrete pad is attached to the north side of the structure to contain any spills that may occur during the mixing and/or filling of pesticide-spraying equipment. No wastes are stored in the shed (LANL 1992, 17-691), although the unit is listed as a RCRA satellite accumulation area.

SWMU 60-003 is an active oil-water separator located approximately 30 ft east of the northeast corner of TA-60-1. Installed in 1986, the separator measures approximately 8 to 10 ft deep and approximately 4 ft in diameter. It is constructed from a pre-formed, reinforced concrete manhole set upright in a poured bed of reinforced concrete.

From 1978 to 1986, process waste from steam cleaning operations at TA-60-1 discharged directly into a large storm water drainage ditch leading to Sandia Canyon. During the first quarter of 1986, an oil-water separator was installed to collect all liquid waste produced by the steam cleaning process. The separator operates on gravity and the natural propensity of oil and water to separate; oil rests on top and the underlying water discharges into the sanitary sewer system. The oil is periodically skimmed from the bottom of the separator tank. When this occurs, the tank is effectively cleaned and the water is replaced.

SWMU 60-004(a) is a storage area that appeared to contain old equipment and general debris (LANL 1990, 0145). It is located three-tenths of a mile east of the locked entrance gate on Sigma Mesa. The PRS site is actually a 2.5 acre, active storage yard for equipment and supplies used by Johnson Controls. Stored items include 20 x 10 ft concrete forms, electrical equipment, a unit substation transformer, wooden cable reels, light poles, and 4 x 6 in.

lumber posts. There are several 100 ft-long electric poles, electrical insulators, and 4-in. conduit of various lengths (Griggs 1992, 17-671). Blue stickers on the electrical equipment state that they contained no PCBs. HSE-7 verified that the transformers have been tested and contain no PCBs (Holm-Hansen no date, 17-554).

SWMU 60-005(b) [formerly SWMU 3-030(a)] is a 60 x 120 ft rectangular pit located at the eastern end of Sigma Mesa. Half the pit is 20 ft deep with a level floor; the remainder is inclined and leads up to the level of the mesa. The north (shallow) end of the pit is now used as a storage area for topsoil, sand, gravel, asphalt chunks, rebar, and some rubble.

The pit was in use between July and September 1979, when an experimental geothermal well was drilled at this site. East of the pit were staging and drilling areas for the project. These areas are described in Subsection 5.7. Bentonite clay and additives were mixed on site in 1 000-gal. tanks prior to use (Martell 1992, 17-600). The contractor's, Moran Bros, Inc., daily drilling report records indicate that the additives were water, soda ash, and commercial gel products (Quickgel, Benex, A-gel, and M-gel) (Moran 1979, 17-815). The pit was used as a settling area to recycle water from the spent mud. The SWMU Report states that the pit was once lined, but the lining lasted only a short time (LANL 1990, 0145). Some drilling mud remains in the pit.

According to 40 CFR 261.4, which addresses exclusions to the identification and listing of hazardous waste, "Drilling fluids, produced waters, and other wastes associated with the exploration, development, or production of crude oil, natural gas or geothermal energy" are included in Part B as "Solid wastes which are not hazardous wastes." They are exempt from RCRA Subtitle C regulations. Moran used proprietary products as additives. In addition, the hole frequently lost circulation and most of the drilling fluids were not brought to the surface and recovered.

6.2.4.1.2 Septic Units Aggregate

SWMU 60-006(b) is an inactive septic system installed in 1979 to serve temporary trailers for personnel at the geothermal drilling site. The tank is located approximately 10 ft east of the utility pole that served the trailers.

The associated seepage pit appears to be located beneath a small mound of dirt. A white, 4-in. PVC pipe protrudes from the center of the mound. The drilling operation was discontinued in approximately 1981 and the area has been periodically used for equipment storage since that time. The septic system was abandoned in place when the drilling operations ceased (LANL 1992, 17-695).

SWMU 61-004(a) is reported to be an inactive septic system located northeast of the radio repair shop, TA-61-23 (LANL 1990, 0145). The existence of the system is questionable, but would logically be on the downslope, southeast side. The septic system is not included on Laboratory engineering drawings for TA-61-23 (formerly TA-3-282). There is no record of a septic system being removed or abandoned in place at this location. What were initially believed to be septic system clean-out pipes located south of the building were pipes installed to clean an adjacent sewer line when tree roots interfered with operation of that line (LANL 1992, 17-747).

Building TA-61-23, currently known as the radio repair shop, was occupied by Motorola in the 1950s for radio repairs. During the 1960s, small models of various Laboratory operations were assembled out of wood and plastic for inclusion in museum exhibits and project planning. Since the early 1970s, radio and audio repair operations have been performed in the building (LANL 1992, 17-732). There is no record of hazardous or radioactive material being used at TA-61-23.

SWMU 61-004(b) is an abandoned septic tank that was encountered during trenching activities conducted as part of a PCB cleanup in September 1989. The cinder block structure was discovered approximately 1 ft below the surface on the south side of East Jemez Road. The site is located approximately eight-tenths of a mile east of the intersection of East Jemez Road and Diamond Drive. The structure is approximately 6 x 8 x 6 ft deep, with a corrugated tin roof covered with concrete. At the time of discovery, there was a 6-in. feeder pipe protruding from the top and a 6-in. effluent pipe protruding from the side wall, leading to the conclusion that the structure was probably a septic tank. The northwest corner of the tank was cracked open by the trenching equipment. Visual inspection indicated that the tank was dry (LANL 1992, 17-694).

The septic tank was used for disposal of sanitary wastes generated by contracting firms operating in the vicinity, as documented in historical aerial photographs of the area (LANL 1992, 17-692). Operations conducted in the buildings did not generate hazardous waste. The tank was never removed.

SWMU 61-004(c) was an abandoned septic tank. In February 1991, a discarded septic tank including the lines, lift station, and old foundation was uncovered at the Los Alamos municipal landfill, TA-61. At that time, buried structures were excavated to ascertain the nature and extent of contamination, if any (Nunes 1991, 17-293).

EM-8 collected liquid samples from the tank. Analytical results indicated the presence of one SVOC at trace levels: benzoic acid at less than 16 parts per billion (ppb). Target VOCs and RCRA TCLP metals were all below action levels found in 40 CFR 261.24. Gross alpha and gamma activity were below maximum contaminant levels for drinking water. Although levels of beta activity were elevated (six times above the screening level guideline of 5 pCi/L) for drinking water, the effluent was well below the DOE-derived concentration guidelines of 1 000 pCi/L for uncontrolled areas. Strontium-90 was detected in trace amounts (Nunes 1991, 17-293).

The liquid in the lift station and tank was removed and the tank was excavated while being monitored for radioactivity. Soil samples were collected from the tank, excavation, and surrounding area for analysis of the same suite of compounds listed above. Analytical results revealed no radioactive, organic, or metal contamination. The tank, lines, lift station, and old foundation were disposed of in the municipal landfill.

6.3 Summary: PRSs Recommended for NFA or DA

Table 6-12 is a summary of all the PRSs (listed numerically) recommended for NFA or DA.

TABLE 6-12

PRSs PROPOSED FOR NO FURTHER ACTION OR DEFERRED ACTION FOR OU 1114

LISTED	SWMU ID	LOCATION	DESCRIPTION	SUB-SECTION	STEP	RATIONALE
x	3-001(a)	TA-3-39	Less than 90 days storage	6.1.2.1	2, NFA	Regulated storage
x	3-001(b)	TA-3-39	Satellite accumulation area	6.1.2.1	2, NFA	Regulated storage
x	3-001(c)	TA-3-102	Less than 90 days storage	6.1.2.1	2, NFA	Regulated storage
x	3-001(k)	TA-3-16	Decommissioned drum storage	6.1.4.1.3.2	4, NFA	No threat
x	3-001(m)	TA-3-41	Satellite accumulation area	6.1.2.1	2, NFA	Regulated storage
x	3-001(p)	TA-3-37	Satellite accumulation area	6.1.2.1	2, NFA	Regulated storage
x	3-001(r)	TA-3-409	Satellite accumulation area	6.1.2.1	2, NFA	Regulated storage
x	3-002(b)	TA-3-1966	Inactive satellite storage	6.1.2.1	2, NFA	Regulated storage
x	3-003(c)	TA-3-287	Storage	6.1.4.1.3.2	4, VCA	No threat
x	3-009(a)	TA-3-73	Surface disposal	6.1.4.1.2	4, NFA	No threat
x	3-009(b)	TA-3-41	Surface disposal	6.1.4.1.2	4, NFA	No threat
x	3-009(c)	South of TA-3-66	Abandoned cement fence post bases	6.1.4.1.2	4, NFA	No threat
x	3-009(d)	South of TA-3-40	Asphalt and metal disposal	6.1.4.1.2	4, NFA	No threat
x	3-009(e)	Southeast of TA-3-29 into Mortandad Canyon	Canyon fill	6.1.4.1.2	4, NFA	No threat
x	3-009(f)	North of TA-3-16	Road construction	6.1.4.1.2	4, NFA	No threat
x	3-009(g)	South of Twomile Bridge	Borrow pit	6.1.4.1.2	4, NFA	No threat
x	3-009(h)	Duplicate of 60-002	Storage	6.1.1.2	1, NFA	Duplicate
x	3-010(a)	TA-3-30	Mercury surface disposal	6.1.3.2	3, DA	VCA
x	3-010(b)	North side of TA-3-29	Vacuum pump oil	6.1.4.1.3.1	4, NFA	No threat
x	3-010(c)	North of TA-3-216	Vacuum pump oil	6.1.4.1.3.1	4, NFA	No threat
x	3-010(d)	TA-3-141	Vacuum pump oil	6.1.4.1.3.1	4, NFA	No threat
x	3-012(a)	South of TA-3-66	Bifluoride release	6.1.4.1.3.2	4, NFA	No threat
x	3-013(c)	West of TA-3-38	Cable cleaning	6.1.4.1.3.2	4, NFA	No threat
x	3-013(d)	West of TA-3-38	Hydraulic bender	6.1.4.1.3.2	4, NFA	No threat
x	3-013(e)	TA-3-36	Antifreeze spill	6.1.4.1.3.2	4, NFA	No threat
x	3-013(f)	East side of TA-3-66	Tar melting	6.1.4.1.3.2	4, NFA	No threat
x	3-013(g)	Northeast of TA-3-316	Dumpster site	6.1.4.1.3.2	4, NFA	No threat
x	3-013(h)	South of TA-3-39	Storage	6.1.4.1.3.2	4, NFA	No threat
x	3-018	TA-3-16	Cesspool	6.1.4.1.3.5	4, NFA	No threat
x	3-020(a)	North of TA-3-287	Pit	6.1.4.1.3.3	4, NFA	No threat
x	3-020(b)	Southeast of TA-3-70	Pit	6.1.4.1.3.3	4, NFA	No threat
	3-026(d)	TA-3-16	Sump/lift station	6.2.3.1	3, DA	Active, no pathway
x	3-028	TA-3-73	Surface impoundment	6.1.3.1.4	3, DA	Active, no pathway
x	3-029(b)	South of TA-3-271	Asphalt for fill	6.1.3.2	3, DA	VCA
x	3-035(a)	TA-3-36 service station	Underground storage tank	6.1.1.1	1, NFA	Undergone closure
x	3-035(b)	TA-3-440	Underground storage tank	6.1.3.1.3	3, DA	Active, no pathway
x	3-036(a)	TA-3-70	Asphalt storage	6.1.4.1.3.4	4, NFA	No threat
x	3-036(c)	TA-3-70	Asphalt storage	6.1.4.1.3.4	4, NFA	No threat
x	3-036(d)	TA-3-70	Asphalt storage	6.1.4.1.3.4	4, NFA	No threat
x	3-036(e)	TA-3-70	Asphalt storage	6.1.4.1.3.4	4, NFA	No threat

TABLE 6-12 (continued)

PRSs PROPOSED FOR NO FURTHER ACTION OR DEFERRED ACTION FOR OU 1114

LISTED	SWMU ID	LOCATION	DESCRIPTION	SUB-SECTION	STEP	RATIONALE
x	3-037	TA-3-66	Holding tank	6.1.3.1.3	3, DA	Active, no pathway
x	3-038(a)	TA-3-700	Acid neutralizing and pumping building	6.1.3.1.2	4, NFA	No threat
x	3-038(b)	TA-3-738	Acid retention tank (waste)	6.1.3.1.2	4, NFA	No threat
x	3-039(a)	TA-3-43	Silver recovery unit	6.1.4.1.1	4, NFA	Inactive, disrupts active
x	3-039(b)	TA-3-28	Silver recovery unit	6.1.4.1.1	4, NFA	Active, no pathway
x	3-039(c)	TA-3-40	Silver recovery unit	6.1.4.1.1	4, NFA	Inactive, disrupts active
x	3-039(d)	TA-3-32	Silver recovery unit	6.1.4.1.1	4, NFA	Active, no pathway
x	3-039(e)	TA-3-409	X-ray processing unit	6.1.4.1.1	4, NFA	Active, no pathway
	3-043(e)	TA-3-36	Underground storage tank	6.2.1.1	1, NFA	Closure
x	3-044(a)	TA-3-70	Decommissioned drum storage	6.1.3.1.1	3, DA	Active, no pathway
x	3-044(b)	TA-3-102	Decommissioned storage	6.1.2.1	2, NFA	Approved storage
	3-055(b)	West of TA-3-30	Outfall	6.2.4.1.1	4, NFA	No threat
	3-056(a)	TA-3-271	Oil storage	6.2.3.1	3, DA	Active
x	3-056(b)	TA-3-70	Decommissioned drum storage	6.1.3.1.1	3, DA	Active, no pathway
	30-001	North of TA-3-142	Electronics site	6.2.4.1.1	4, NFA	No threat
x	59-001	TA-59-1	Septic system	6.1.4.1.3.5	4, NFA	No threat
	59-002	TA-59-1	Drum storage	6.2.4.1.1	4, NFA	No threat
	59-003	TA-59-1	Sumps	6.2.4.1.1	4, NFA	No threat
x	60-001(a)	TA-60-1	Active container storage	6.1.2.1	2, NFA	Approved storage
	60-001(b)	TA-60-2	Storage area	6.2.4.1.1	4, NFA	No threat
	60-001(c)	TA-60-2	Satellite accumulation area	6.2.2.1	2, NFA	Regulated storage
	60-001(d)	TA-60-29	Pesticide shed	6.2.4.1.1	4, NFA	No threat
x	60-002	Sigma Mesa	Storage	6.1.4.1.2	4, NFA	No threat
	60-003	TA-60-1	Oil-water separator	6.2.4.1.1	4, NFA	No threat
	60-004(a)	Sigma Mesa	Material storage	6.2.4.1.1	4, NFA	No threat
	60-005(b)	Sigma Mesa	Drilling operations	6.2.4.1.1	4, NFA	No threat
	60-006(b)	Sigma Mesa	Septic system	6.2.4.1.2	4, NFA	No threat
	60-006(c)	TA-60	Septic system	6.2.1.2	1, NFA	Duplicate
x	61-002	TA-61-23	PCB storage area	6.1.1.2	1, NFA	Duplicate SWMU
	61-003	E. Jemez Rd.	Alleged burn pit	6.2.1.2	1, NFA	Nonexistent
	61-004(a)	TA-61-23	Septic system	6.2.4.1.2	4, NFA	No threat
	61-004(b)	0.8 mi east of E. Jemez Rd. and Diamond Dr.	Septic system	6.2.4.1.2	4, NFA	No threat
	61-004(c)	TA-61 Landfill	Septic system	6.2.4.1.2	4, NFA	No threat
x	61-005	TA-61 Landfill	County landfill	6.1.3.1.2	3, DA	Active, no pathway
x	61-006	TA-61 Landfill	Waste oil	6.1.3.1.2	3, DA	Active, no pathway
x	61-007	E. Jemez Rd.	PCB oil contamination	6.1.1.1	1, NFA	Undergone closure
	64-001	TA-64-1	Satellite accumulation area	6.2.2.1	2, NFA	Regulated storage

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Annex I

Project Management Plan

- Technical Approach
- Schedule
- Reporting
- Budget
- Organization

1.0 PROJECT MANAGEMENT PLAN

This annex presents the technical approach, organizational structure, schedule, budget, and reporting milestones for implementation of the Operable Unit (OU) 1114 Resource Conservation and Recovery Act (RCRA) facility investigation (RFI) work plan. This plan is an extension of the Environmental Restoration (ER) Program Project Management Plan in Annex I of the Installation Work Plan (IWP) (LANL 1992, 0768). The OU 1114 RFI work plan does not contain any deviations from the IWP. This annex addresses the project management requirements of the Hazardous and Solid Waste Amendments (HSWA) Module (Task II, E, p. 39) of the Laboratory's RCRA Part B Permit (EPA 1990, 0306).

1.1 Technical Approach

The technical approach employed for the OU 1114 RFI work plan is described in Chapter 4. This approach is based on the ER Program's overall technical approach to the RFI process as described in Chapter 3 of the IWP (LANL 1992, 0768). The following key features characterize the ER Program approach:

- 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 process as a general philosophical framework; and,
- integration of RCRA; Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA); National Environmental Policy Act (NEPA); Atomic Energy Act (AEA); and other applicable regulations.

The general philosophy is to develop and iteratively define the nature and extent of contamination at OU 1114 through a planned, phased investigation and data interpretation. An objective is to support voluntary corrective action (VCA) or a corrective measures study (CMS) using the minimum data necessary.

The technical objectives of the phased RFI, as detailed throughout this work plan, are to:

- identify contaminants present at each potential release site (PRS);
- determine the vertical and lateral extent of contamination at each PRS;
- 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; and,
- provide the basis for planning detailed corrective measures studies.

1.1.1 Implementation Rationale

Scheduling of investigations is based on the following rationale and priorities.

Initial efforts are focused on obtaining OU-wide environmental data that form the basis for understanding contaminant transport processes. These investigations, described in Chapter 4, include:

- geomorphic characterization of drainage channels to determine locations for representative sampling of mobile sediments, surface geophysics measurements to locate buried pipes, and radiation surveys to define areas contaminated by radioactive elements; and,
- measurement of contaminant levels in surface soils as a basis for determining if low levels of contaminants detected at individual PRSs are indicative of releases from individual PRSs or only represent the presence of OU-wide contamination.

Generic investigations include surface sampling at individual PRSs, 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 VCAs, are addressed separately.

Scheduling priorities are based on the following:

- Basic information and data obtained from OU-wide characterization are needed as a basis for comparison and must be available before evaluations can be made of PRS-specific data.
- Subsurface investigations will require the next level of effort.
- Characterization of surface-contamination PRSs can be secondary to the other priorities.

1.2 Schedule

The schedule for the entire RFI process at OU 1114 is provided in Table I-1.

Where possible, fieldwork has not been scheduled between November 15 and March 15 each year, to avoid inclement weather.

TABLE I-1

PROJECTED SCHEDULE FOR CORRECTIVE ACTION PROCESS OPERABLE UNIT 1114

MILESTONE	DATE
Submit EPA/NMED work plan	06/18/93
Start RFI	10/01/93
Start RFI report	01/07/98
Complete draft Phase I RFI phase report	01/14/00
Complete RFI fieldwork	07/25/00
Complete draft RFI report	06/13/01
Complete RFI	11/30/01
Complete assessment	09/28/12

1.3 Reporting

Results of RFI fieldwork will be presented in four 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 OPERABLE UNIT 1114 RFI

REPORT TYPE	EPA	DOE	DATE DUE
Monthly reports	X	X	25th of the following month
Quarterly reports	X		February 15, yearly
	X		May 15, yearly
	X		August 15, yearly
Annual reports	X	X	November 15, yearly
Phase reports			
Draft RFI work plan	X	X	06/24/94
Draft Phase I report	X	X	01/14/00
Draft RFI report	X	X	06/13/01

1.3.1 Quarterly Technical Progress Reports

As the OU 1114 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 Reports/Work Plan Modifications

RFI phase reports/work plan modifications will be submitted for work conducted on aggregates of PRSs or on individual PRSs. These phase reports will serve as partial RFI Phase I reports summarizing the results of initial site characterization activities, and as partial RFI Phase II work plans describing the follow-on activities being planned (including any modifications to field sampling plans suggested by initial findings).

1.3.3 RFI Report

The RFI report will summarize all fieldwork conducted during the five-year duration of the RFI. As required by the HSWA Module (Task V, D, p. 46), the Laboratory will submit an RFI report within 60 days of completion of the RFI. As stated in Subsection 3.5.1.2 of the IWP (LANL 1992, 0768), the RFI report will describe the procedures, methods, and results of field investigations, and will include information on the type and extent of contamination, sources and migration pathways, and actual and potential receptors. The report will also contain adequate information to support justification for no further action and corrective action decisions for PRSs.

1.4 Budget

The schedule presented above is based on fixed budgets for the first two years of the RFI. The fixed budgets in fiscal years 1993 and 1994 (FY93 and FY94) are based on expected Department of Energy (DOE) funding levels. DOE funding requests are set two years in advance: thus, the first year in which the RFI is not constrained by past budget estimates will be FY95. Funding requests for FY95 and beyond will reflect the cost and schedule that most efficiently complete the RFI plans. Table ES-1, Executive Summary, presents a cost estimate for the OU 1114 RFI. Schedules and costs will be updated through DOE change control procedures, with revisions submitted to the Environmental Protection Agency (EPA) for approval.

1.5 Organization

The organizational structure for the ER Program is presented in Section 3.0, Annex I of the IWP (LANL 1992, 0768). Organization of the ER Program is presented in Fig. 3-2 of the IWP.

This section details the management organization for the OU 1114 RFI. A list of contributors to the OU 1114 RFI Work Plan is in Appendix C.

The following are the responsibilities of the program manager, programmatic project leader, technical team, field team leaders, and field teams.

Program Manager (PM)

- ensures that the Laboratory's ER activities are consistent with the goals and objectives of the Environmental

Management (EM) Division Leader, DOE, EPA, New Mexico Environment Department (NMED), and others, as appropriate;

- ensures compliance with the HSWA Module;
- ensures compliance with change control procedures;
- evaluates costs, schedules, and performance;
- submits monthly and quarterly reports to DOE, EPA, and NMED;
- tracks deliverables and milestones established by DOE, EPA, and NMED;
- ensures the establishment and implementation of the quality, health and safety, records management, and community relations programs; and,
- ensures that policies, guidance, and relevant information are communicated to ER personnel by
    - periodically conducting meetings;
    - distributing essential guidance memoranda and letters, using a receipt acknowledgment system when necessary;
    - ensuring the preparation and controlled distribution of administrative procedures; and,
    - establishing a standard routing system for routine guidance.

Programmatic Project Leader (PPL)

The programmatic project leader provides technical and administrative programmatic guidance to operable unit project leaders (OUPLs) and technical team leaders (TTLs), including:

- regulatory compliance requirements (especially RCRA and CERCLA), RFI, document content, administrative and technical standard operating procedures, quality assurance and health and safety requirements, and general policies and requirements for doing business in the Laboratory's ER Program;

- defining the allocation of resources to Laboratory and contractor personnel to accomplish required technical and management activities, and tracking progress and fiscal spending;
- assisting OUPLs and TTLs in obtaining appropriate and sufficient resources to perform their assigned duties;
- performing technical and policy reviews of documents prepared for the ER Program by OUPLs, TTLs, and affiliated staff;
- reviewing and recommending management action as appropriate for scopes of work, proposals, or requests for work to be supported by the ER Program;
- reviewing progress of OUPLs and TTLs;
- recommending to management corrective or enhancement actions, as appropriate, to expeditiously meet ER Program goals;
- working closely with other programmatic project leaders and group leaders to ensure proper integration of program activities and fiscal responsibility and compliance with applicable federal and state regulations;
- interacting with federal and state regulatory agencies; and,
- providing input to monthly, quarterly, and/or annual progress reports as required.

OU 1114 Project Leader (OUPL)

- 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 milestones and final reports;
- interfaces with the ER quality program project leader to resolve quality concerns and to coordinate with the quality assurance (QA) staff for audits;
- complies with the Laboratory ER Program health and safety, records management, and community relations requirements;
- oversees RFI fieldwork and manages the field teams manager; and,
- complies with the Laboratory's technical and QA requirements for the ER Program.

Technical Team Members

Technical team members are responsible for providing technical input for their discipline throughout the RFI process. They have participated in the development of this work plan and the individual field sampling plans, and will participate in the fieldwork, data analysis, report preparation, work plan modifications, and planning of subsequent investigations as necessary.

The primary disciplines currently represented on the technical team are hydrogeology, statistics, geochemistry, and health physics. The composition of the technical team may change 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, and
- manages field team members.

Field Team Leader (FTL)

The field teams manager will assign 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 each 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
- practitioners of 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.

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Annex II

Quality Assurance Project Plan

- Approval for Implementation
- Project Organization and Responsibility
- Quality Control Samples
- Sample Representativeness
- Field Quality Assurance Reports to Management

Annexes

Appendixes

1.0 APPROVAL FOR IMPLEMENTATION

1. NAME: Robert Vocke
   TITLE: ER Program Manager, Los Alamos National Laboratory

   SIGNATURE: ______________________ DATE: ____________

2. NAME: Ted Norris
   TITLE: Acting Quality Program Project Leader, ER Program, Los Alamos National Laboratory

   SIGNATURE: ______________________ DATE: ____________

3. NAME: Craig Leasure
   TITLE: Group Leader, Health and Environmental Chemistry Group (EM-9), Los Alamos National Laboratory

   SIGNATURE: ______________________ DATE: ____________

4. NAME: Margaret Gautier
   TITLE: Quality Assurance Officer, Health and Environmental Chemistry Group (EM–9), Los Alamos National Laboratory

   SIGNATURE: ______________________ DATE: ____________

5. NAME: Barbara Driscoll
   TITLE: Geologist, Region 6, Environmental Protection Agency

   SIGNATURE: ______________________ DATE: ____________

6. NAME: Alva Smith
   TITLE: Chief of Office of Quality Assurance, Region 6, Environmental Protection Agency

   SIGNATURE: ______________________ DATE: ____________

7. NAME: Ed Griggs
   TITLE: Operable Unit Project Leader, CLS-DO, Los Alamos National Laboratory

   SIGNATURE: ______________________ DATE: ____________

Distribution of Official Copies

A list of the recipients of the official copies of this plan and any subsequent revisions will be developed and maintained as a document control activity.

INTRODUCTION

This Quality Assurance Project Plan (QAPjP) for the Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) Work Plan for Operable Unit (OU) 1114 was written as a matrix report (Table II-1) that is based on the Los Alamos National Laboratory (the Laboratory) Environmental Restoration (ER) Program's generic Quality Assurance Project Plan. The generic QAPjP is Appendix T in the Installation Work Plan (IWP) (LANL 1991, 0553).

The Laboratory ER Program generic QAPjP describes the format for the individual OU QAPjPs. In the generic QAPjP, Section 1.0 is the Approval For Implementation, which is included in the front of this annex. Section 2.0 of the generic QAPjP is the Table of Contents, which was omitted from this annex because the OU 1114 QAPjP is presented as a matrix. Section 3.0 of the generic QAPjP is the Project Description, and Subsection 3.1 is the Introduction. This introduction will serve as the equivalent of Subsection 3.1 and the matrix (Table II-1) will begin with Subsection 3.2, Facility Description.

The OU 1114 QAPjP matrix (Table II-1) lists the generic QAPjP criteria in the first column; these criteria correspond to the sections of the generic QAPjP. The second column lists the specific requirements of the generic QAPjP that the OU 1114 QAPjP must meet; the subsection titles and numbers in the second column correspond directly with those contained in generic QAPjP. Sections of the generic QAPjP that do not contain specific requirements are not included in the matrix, e.g., 3.4. The third column lists the location in the IWP and/or the OU 1114 Work Plan of information that fulfills the requirements in the generic QAPjP. If OU 1114 will follow the requirements in the generic QAPjP and no further information is necessary, the column contains the phrase "generic QAPjP accepted." In some cases, a standard operating procedure (SOP) and/or a clarification note is included.

Note 1: **Section 4.0 Project Organization and Responsibility**

The organizational structure of the ER Program is presented in Section 2.0 of the LANL ER Quality Program Plan (QPP) to the project leader (PL) level, including quality assurance functions. The OU 1114 work plan, Annex I, describes the organizational structure from the PL level down.

TABLE II-1

OU 1114 QAPjP MATRIX

GENERIC QAPjP CRITERIA	GENERIC QAPjP REQUIREMENTS BY SUBSECTION	OU 1114 INCORPORATION OF GENERIC QAPjP REQUIREMENTS
Project description	3.2 Facility Description	Los Alamos National Laboratory (LANL) ER Program IWP (LANL 1992, 0768), Chapter 3, and OU 1114 Work Plan, Chapter 2
	3.3 ER Program	LANL ER Program IWP, Subsection 3.2
	3.4.1 Project Objectives	OU 1114 Work Plan, Chapters 1, 5, and 6
	3.4.2 Project Schedule	OU 1114 Work Plan, Annex I
	3.4.3 Project Scope	OU 1114 Work Plan, Chapters 1 and 5
	3.4.4 Background Information	OU 1114 Work Plan, Chapters 1, 2, and 3
	3.4.5 Data Management	OU 1114 Work Plan, Annex IV, and LANL ER Program IWP, Annex IV
Project organization	4.1 Line Authority	OU 1114 Work Plan, Annex I
	4.2 Personnel Qualifications, Training, Resumes	Maintained as records within OU 1114 record system
	4.3 Organizational Structure	LANL-ER-QPP, Section 2.0, *Note 1.*
Quality assurance objectives for measurement data in terms of precision, accuracy, representativeness, completeness, and comparability	5.1 Level of Quality Control	Generic QAPjP accepted
	5.2 Precision, Accuracy, and Sensitivity of Analyses	Generic QAPjP accepted
	5.3 QA Objectives for Precision	Generic QAPjP accepted
	5.4 QA Objectives for Accuracy	Generic QAPjP accepted
	5.5 Representativeness, Completeness, and Comparability	Generic QAPjP accepted
	5.6 Field Measurements	Generic QAPjP accepted
	5.7 Data Quality Objectives	OU 1114 Work Plan, Chapter 5
Sampling procedures	6.0 Sampling Procedures	OU 1114 Work Plan, Appendix D
	6.1 Quality Control Samples	Generic QAPjP accepted including ER Program SOP-01.05. See also *Note 2.*
	6.2 Sample Preservation During Shipment	Generic QAPjP accepted including ER Program SOP-01.02
	6.3 Equipment Decontamination	Generic QAPjP accepted including ER Program SOP-01.06
	6.4 Sample Designation	Generic QAPjP accepted including ER Program SOP-01.04
Sample custody	7.1 Overview	Generic QAPjP accepted including ER Program SOP-01.04
	7.2 Field Documentation	Generic QAPjP accepted including ER Program SOP-01.04
	7.3 Sample Management Facility	Generic QAPjP accepted
	7.4 Laboratory Documentation	Generic QAPjP accepted
	7.5 Sample Handling, Packaging, and Shipping	Generic QAPjP accepted including ER Program SOP-01.03
	7.6 Final Evidence File Documentation	Generic QAPjP accepted
Calibrations procedures and frequency	8.1 Overview	Generic QAPjP accepted
	8.2 Field Equipment	Generic QAPjP accepted
	8.3 Laboratory Equipment	Generic QAPjP accepted

TABLE II-1 (continued)

OU 1114 QAPjP MATRIX

GENERIC QAPjP CRITERIA	GENERIC QAPjP REQUIREMENTS BY SUBSECTION	OU 1114 INCORPORATION OF GENERIC QAPjP REQUIREMENTS
Analytical procedures*	9.1 Overview	Generic QAPjP accepted
	9.2 Field Testing and Screening	Generic QAPjP accepted including ER Program SOP-06.02
	9.3 Laboratory Methods	Generic QAPjP accepted. Sampling plans are described in OU 1114 Work Plan, Chapter 5
Data reduction, validation, and reporting	10.1 Data Reduction	Generic QAPjP accepted
	10.2 Data Validation	Generic QAPjP accepted
	10.3 Data Reporting	Generic QAPjP accepted
Internal quality-controlled checks	11.1 Field Sampling Quality Control Checks	Generic QAPjP accepted
	11.2 Laboratory Analytical Activities	Generic QAPjP accepted
Performance and system audits	12.0 Performance and System Audits	Generic QAPjP accepted
Preventive maintenance	13.1 Field Equipment	Generic QAPjP accepted
	13.2 Laboratory Equipment	Generic QAPjP accepted
Specific routine procedures used to assess data precision, accuracy, representativeness, and completeness	14.1 Precision	Generic QAPjP accepted
	14.2 Accuracy	Generic QAPjP accepted
	14.3 Sample Representativeness	Generic QAPjP accepted See also *Note 3.*
	14.4 Completeness	Generic QAPjP accepted
Corrective action	15.1 Overview	Generic QAPjP accepted including LANL-ER-QP-01.3Q
	15.2 Field Corrective Action	Generic QAPjP accepted
	15.3 Laboratory Corrective Action	Generic QAPjP accepted
Quality assurance reports to management	16.1 Field Quality Assurance Reports to Management	Generic QAPjP accepted. See also *Note 4.*
	16.2 Laboratory Quality Assurance Reports to Management	Generic QAPjP accepted
	16.3 Internal Management Quality Assurance Reports	Generic QAPjP accepted

* Although the generic QAPjP criteria are accepted, special sampling limits, parameters, and analyses will be established for operable unit-specific cases (refer to Appendix D). See the note at the top of page 9-2, Generic QA Project Plan (LANL 1991, 0553).

Note 2: **Section 6.1 Quality Control Samples**

Quality assurance (QA) and quality control (QC) sampling for RFI Phase I in OU 1114 will provide samples to address variability in the sampling and analytical procedures. Most of these will be prescribed generically as follows:

- Rinsate samples (in general, one per day) will be collected if on-site decontamination of sampling equipment is being performed.

- A trip blank (one per sample delivery group) will be included whenever volatile organic compounds are a potential contaminant at the site.

- Field reagent blanks will be submitted only if reagents are brought in bulk to the site and measured out on site.

- The Sample Coordination Facility (SCF) will add blanks, surrogate spikes, and other QA samples to each batch following its standard practices. (Batch sizes will be determined by the SCF and will vary depending on the type of analyses to be performed. The SCF will attempt to keep samples from a sample delivery group together as much as possible when batching samples for the analytical laboratories.)

- The analytical laboratories will report analyses of instrument blanks, calibration standards, and other QC samples as specified in their contracts with the SCF.

- Field instrument calibration checks will be performed as specified in the SOPs controlling the use of those instruments. The results will be recorded in the field documentation of the survey.

- The field laboratories will provide laboratory splits, replicate analyses, and calibration checks as specified by their SOPs or QC programs. The results will be documented and reported to the field team leader daily.

In general, the QA/QC samples listed above are at most single blind samples.

The only types of QA sampling that are described in site-specific detail in Chapter 5 are double blind collocated samples, field splits, and field duplicates to be prepared in the field for both field and off-site laboratories. We define these as follows:

- A collocated sample is a second sample collected next to the first sample, as close as practicable (usually 1 to

2 ft away), using the same method as the first (another spade or scoop sample, another manual shallow core, etc.). In general, subsamples for the collocated sample are prepared for each proposed analysis as for the first sample.

- A field split is a second subsample collected in the field from a prepared (e.g., homogenized) sample for a designated type of analysis. This can be appropriate for inorganic, radionuclide, and most semivolatile organic analyses, but in general is not useful for volatile organic analyses.
- A field duplicate is a second subsample collected for a minimally disturbed field sample (usually a core) for a designated type of analysis. Field duplicates are used in place of field splits for volatile compounds.

Collocated samples provide an estimate of "total study error" (apart from overall population variability, which is captured by taking a number of samples from the site). Field splits and field duplicates are used to estimate incremental error introduced by imperfect homogenization, handling, transport, and analysis. Field duplicates and collocated samples provide estimates of micro-scale variability of contaminants such as radionuclides in sediments and dioxins in soil.

Note 3: Section 14.3 Sample Representativeness

The field sampling plans presented in the OU 1114 Work Plan, Chapter 5, were developed to meet the sample representativeness criteria described in Subsection 14.3 of the Laboratory ER Program generic QAPjP (Appendix T) (LANL 1991, 0553).

Note 4: Section 16.1 Field Quality Assurance Reports to Management

The OU field teams leader or a designee will provide a monthly field progress report to the ER PL. This report will consist of the information identified in Subsection 16.1 of the ER Program generic QAPjP (Appendix T) (LANL 1991, 0553).

REFERENCE

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

LANL (Los Alamos National Laboratory), November 1992. "Installation Work Plan for Environmental Restoration," Revision 2, Los Alamos National Laboratory Report LA-UR-92-3795, Los Alamos, New Mexico. **(LANL 1992, 0768)**

Executive Summary

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Annex III

Health and Safety Project Plan

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1.0 INTRODUCTION

1.1 Purpose

The purpose of this Operable Unit Health and Safety Project Plan (OUHSP) is to recognize potential safety and health hazards, describe techniques for their evaluation, and identify control methods. The goals are to eliminate injuries and illnesses; to minimize exposure to physical, chemical, biological, and radiological agents during environmental restoration (ER) activities; and, to provide contingencies for events that may occur while these efforts are under way.

Project managers, health and safety professionals, Laboratory managers, and regulators are to use this OUHSP as a source for information about health and safety programs and procedures as they relate to this operable unit (OU). Detailed site-specific health and safety plans (SSHSPs) and procedures will be prepared subsequent to this document.

The Health and Safety Division Hazardous Waste Operations Program establishes Laboratory policies for health and safety activities at ER sites. The hierarchy of health and safety documents for the Los Alamos National Laboratory (the Laboratory) ER Program is as follows:

1. Installation Work Plan, Health and Safety Program Plan (IWPHSPP) (LANL 1992, 0768)

2. Operable unit work plan, Health and Safety Project Plan

3. Site-specific health and safety plan

The first document is more general, while the others become increasingly more specific and detailed. While each document is written so that it can stand alone, the contents of and references to these and other documents should always be considered when making decisions.

1.2 Applicability

Adherence to these provisions is mandatory for all on-site personnel and visitors conducting work for the ER Program at OU 1114. There are no exceptions.

These requirements apply to all personnel at this ER site. This includes Laboratory employees, contractors, subcontractors, regulators, and visitors.

1.3 Regulatory Requirements

Government-owned, contractor-operated facilities must comply with Occupational Safety and Health Administration (OSHA) regulations, US Environmental Protection Agency (EPA) regulations, and US Department of Energy (DOE) orders. The following is a brief synopsis of hazardous waste-related requirements.

The first federal effort to address hazardous waste problems came with the passage of the Resource Conservation and Recovery Act of 1976 (RCRA). RCRA mandated the development of federal and state programs for the disposal and resource recovery of waste materials. RCRA regulates those engaged in the generation, treatment, storage, disposal, and transportation of hazardous waste.

Many hazardous waste sites were abandoned. Congress enacted the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, commonly known as "Superfund," to clean up and reclaim these sites.

The treatment and disposal of hazardous wastes posed health and safety risks to the workers engaged in these operations. These risks and the need for protecting workers engaged in hazardous waste site operations are addressed in the Superfund Amendments and Reauthorization Act of 1986 (SARA).

Under SARA, the Secretary of Labor is required to promulgate worker protection regulations. After consulting with many organizations, including EPA, OSHA, the US Coast Guard, and the National Institute for Occupational Safety and Health (NIOSH), a set of regulations was published in March 1989, 29 CFR 1910.120, Hazardous Waste Operations and Emergency Response (HAZWOPER) (OSHA 1991, 0610).

DOE Orders 5480.4 and 5483.1A require DOE employees and contractors to comply with OSHA regulations (DOE 1990, 0733; DOE 1983, 0058). DOE Order 5480.11 sets radiation protection standards for all DOE activities

(DOE 1990, 0732). The DOE Radiological Control Manual established practices for the conduct of radiological control activities at all DOE sites and is used by DOE to evaluate the performance of contractors.

The Laboratory Director's policies "Environment, Safety, and Health" and "Environmental Protection and Restoration," both dated September 1991, require compliance with federal regulations, DOE orders, and state and local laws.

1.4 Variances From Health and Safety Requirements

When special conditions exist, the site safety officer (SSO) may submit to the health and safety project leader (HSPL) a written request for variance from a specific health and safety requirement. If the HSPL agrees with the request, it will be reviewed by the operable unit project leader (OUPL) or a designee. Higher levels of management may be consulted as appropriate. The condition of the request will be evaluated, and, if appropriate, the HSPL will grant a written variance specifying the conditions under which the requirements may be modified. The variance will become part of the SSHSP.

1.5 Review and Approval

This document will be effective after it has been reviewed and approved by the appropriate Laboratory subject matter experts. Signatures of approval are required.

This document will be revised at least annually. Revisions will reflect changes in the scope of work, site conditions, work procedures, site data, contaminant monitoring, visual information technology, policies and/or procedures. Changes must be approved by the HSPL and OUPL. A complete review will be conducted should feasibility studies or remediation be necessary.

2.0 ORGANIZATION, RESPONSIBILITY, AND AUTHORITY

This section describes general and individual responsibilities for health and safety, roles in the field organization, and organizational structure. The health and safety oversight mechanism is also provided.

2.1 General Responsibilities

The Laboratory's *Environment, Safety, and Health* (ES&H) Manual delineates managers' and employees' responsibilities for conducting safe operations and providing for the safety of contract personnel and visitors. The general safety responsibilities for ER activities are summarized in the Installation Work Plan (IWP) (LANL 1992, 0768). Line management is responsible for implementing health and safety requirements.

An observer of an operation that presents a clear and imminent danger to the environment or to the safety and health of employees, subcontractors, visitors, or the public has the authority to initiate a stop-work action. The requirements, responsibilities, and basis for stop-work actions and the restart of activities are established in Laboratory Procedure (LP) 116-01.0. Any individual observing or performing operations that meet the criteria for stop-work actions shall follow the procedural steps as described in LP 116-01.0. Those with stop-work authority include employees, subcontractors or visitors performing the affected work, ES&H discipline experts, and line managers responsible for the operation. Any other individual who observes work being performed that presents a clear and imminent danger shall follow reporting requirements as specified in LP 116-01.0. Upon initiation of stop-work actions, related activities are documented on the stop-work report form and the log for stop-work reports.

Personnel conducting work for the ER Program shall comply with the Laboratory's stop-work policy and the requirements of LP 116-01.0. In addition, upon initiation of stop-work actions ER Program personnel shall notify the SSO, the ER Program HSPL, and the OUPL.

2.1.1 Kick-Off Meeting

A health and safety kick-off meeting will be held before fieldwork begins. The purpose of the meeting is to reach a consensus on responsibility, authority, lines of communication, and scheduling. The HSPL will organize the meeting and has the authority to delay fieldwork until the kick-off meeting is held.

2.1.2 Readiness Review

A field readiness review must be completed by the OUPL before field activities begin. The HSPL is responsible for approving the health and safety section of the readiness review.

2.2 Individual Responsibilities

Laboratory employees and contract personnel are responsible for health and safety during ER Program activities.

2.2.1 Environmental Management and Health and Safety Division Leaders

The Environmental Management (EM) and Health and Safety (HS) Division leaders are responsible for addressing programmatic health and safety concerns. They shall promote a comprehensive health and safety program that includes radiation protection, occupational medicine, industrial safety, industrial hygiene, criticality safety, waste management, and environmental protection and preservation.

2.2.2 Environmental Restoration Program Manager

The ER program manager (EM-13) is responsible for implementing the overall heath and safety program plan. The program manager provides for the establishment, implementation, and support of health and safety measures.

2.2.3 Health and Safety Project Leader

The HSPL is responsible for preparing and updating the IWPHSPP (LANL 1992, 0768). The HSPL helps the OUPL to identify resources to be used for the preparation and implementation of the OUHSP. Final approval of the IWPHSPP, OUHSP, and SSHSP is the responsibility of the HSPL. In conjunction with the field team leaders, the HSPL oversees daily health and safety activities in the field, including scheduling, tracking deliverables, and resource utilization. The HSPL is also responsible for reviewing contractor HS plans to ensure that they meet the requirements of the OUHSP.

2.2.4 Operable Unit Project Leader

The OUPL is responsible for all investigation activities for his/her assigned OU. Specific health and safety responsibilities include:

- preparing, reviewing, implementing, and revising OUHSPs;
- interfacing with the HSPL to resolve health and safety concerns; and,
- notifying the HSPL of schedule and project changes.

2.2.5 Operable Unit Field Team Leader

The OU field team leader is responsible for:

- scheduling tasks and manpower,
- conducting site tours,
- overseeing engineering and construction activity at the sites, and,
- overseeing waste management.

2.2.6 Field Team Leader

The field team leader is responsible for implementing the sampling and analysis plan, the OUHSP, and the project-specific Quality Assurance Project Plan (Annex II). He/she may also serve as the SSO. Safety responsibilities include:

- ensuring the health and safety of the field team members,
- implementing emergency response procedures and fulfilling notification requirements, and,
- notifying the HSPL of schedule changes.

2.2.7 Site Safety Officer

An SSO other than the field team leader may be assigned depending on the potential hazards. Contractors must assign their own SSO.

The SSO is responsible for ensuring that trained and competent personnel are on site. This includes industrial hygiene and health physics technicians and first aid/CPR responders. The SSO may fill any or all of these roles.

The SSO has the following responsibilities:

- advising the HSPL and OUPL of health and safety issues;
- performing and documenting initial inspections for all site equipment;
- notifying proper Laboratory authorities of injuries or illnesses, emergencies, or stop-work orders;
- evaluating the analytical results for health and safety concerns;
- determining protective clothing (PC) requirements;
- determining personal dosimetry requirements for workers;
- maintaining a current list of telephone numbers for emergency situations;
- providing an operating radio transmitter/receiver in the event that telephone service is not available;
- maintaining an up-to-date copy of the SSHSP for work at the site;
- establishing and enforcing the safety requirements to be followed by visitors;
- briefing visitors on health and safety issues;
- maintaining a logbook of workers entering the site;
- determining whether workers can perform their jobs safely under prevailing weather conditions;

- controlling emergency situations in collaboration with Laboratory personnel;
- ensuring that all personnel are trained in the appropriate safety procedures and are familiar with the SSHSP;
- ensuring that all requirements are followed during OU activities;
- conducting daily health and safety briefings for field team members;
- stopping work when unsafe conditions develop or an imminent hazard is perceived; and,
- maintaining first aid supplies.

2.2.8 Field Team Members

Field team members are responsible for following safe work practices, notifying their supervisor or the SSO if unsafe conditions exist, and immediately reporting any injury, illness, or unusual event that could impact the health and safety of site personnel.

2.2.9 Visitors

Site access will be controlled so that only verified team members and previously approved visitors will be allowed in work areas or areas containing potentially hazardous materials or conditions. Special passes or badges may be issued. There are two types of visitors: those who collect samples and those who do not.

Any visitors who are on site to collect samples or split samples must meet all the health and safety requirements of any field sampling team for that site. Visitors must comply with the provisions of the SSHSP and sign an acknowledgment agreement to that effect. In addition, visitors will be expected to comply with relevant OSHA requirements, such as medical monitoring, training, and respiratory protection.

The following rules govern the conduct of site visitors who will not be collecting samples. The site visitor will:

1. Report to the SSO upon arrival at the site.

2. Log in/out upon entry/exit to the site.

3. Receive abbreviated site training from the SSO on the following topics:

    - site-specific hazards,
    - site protocol,
    - emergency response actions, and
    - muster areas.

4. Not be permitted to enter the exclusion zone or the contamination reduction zone.

5. Receive escort from SSO or other trained individuals at all times.

If a visitor does not adhere to these requirements, the SSO will request that the visitor leave the site. All nonconformance incidents will be recorded on the site log.

2.2.10 Contractors

All subcontractors used during site investigations will be responsible for developing health and safety plans that cover their specific project assignments. At a minimum, the plans shall conform to the requirements of this OUHSP. Deficiencies in the subcontractor's health and safety plan will be resolved before the subcontractor is authorized to proceed.

Subcontractors will adhere to the requirements of all applicable health and safety plans. Laboratory personnel will monitor the subcontractors to ensure that this is done. Failure of the subcontractor to adhere to these requirements can cause work to stop until compliance is achieved.

Contractors will provide their own health and safety functions unless other contractual agreements have been arranged. Such functions may include, but are not limited to, providing qualified health and safety officers for site work, imparting a corporate health and safety environment to their employees, providing calibrated industrial hygiene and radiological monitoring equipment, enrolling in an approved medical surveillance program, supplying approved respiratory and personal protective equipment (PPE), providing safe work practices, and providing training for hazardous waste workers.

2.3 Personnel Qualifications

The HSPL will establish minimum training and competency requirements for on-site personnel. These requirements will meet or exceed 29 CFR 1910.120 (OSHA 1991, 0610).

2.4 Health and Safety Oversight

Oversight will be maintained to ensure compliance with regulatory requirements. The Health and Safety Division is responsible for developing and implementing the oversight program. The frequency of field verifications will depend on the characteristics of the site, the equipment used, and the scope of work.

2.5 Off-Site Work

The HSPL and OUPL will review health and safety requirements and procedures for off-site work. Alternate approaches may be used if they are in the best interest of the public and the Laboratory; they will be handled on a case-by-case basis.

3.0 SCOPE OF WORK

3.1 Comprehensive Work Plan

The IWP targets OU 1114 for investigation. The initial phase is the investigation and characterization, involving environmental sampling and field assessment of the areas. This OUHSP addresses the tasks in the Phase I study. Tasks for additional phases will be addressed in revisions to this document.

3.2 Operable Unit Description

OU 1114 consists of 53 PRSs that are solid waste management units. Thorough descriptions and histories of these sites can be found in Chapter 5. Table III-1 is an aggregation of the applicable PRSs into 10 categories, based on similarities. The table also lists the work planned at this time and the potential hazards.

TABLE III-1

SUMMARY OF PRSs, OU 1114

DESCRIPTION	TASKS	POTENTIAL CONTAMINANTS OF CONCERN	RADIONUCLIDES OF CONCERN
Decommissioned storage, 1 PRS	Surface sampling	Pesticides, herbicides	None
Motor pool, 2 PRSs	Surface sampling	SVOCs, PCBs, waste oil	None
Outfalls, 2 PRSs	Surface and subsurface sampling	Metals, SVOCs, radionuclides, depleted uranium	Depleted uranium
Point/spot spills, 1 PRS	Surface and wipe samples	Cyanides, metals	None
Sanitary treatment system, 34 PRSs	Surface and subsurface sampling	Radionuclides, metals, VOCs, SVOCs, pesticides, herbicides	Plutonium, uranium, polonium, tritium, cesium, strontium
Septic tank, 1 PRS	Sludge sampling, subsurface soil sampling	VOCs, SVOCs, metals	None
Sigma Mesa east, 4 PRSs	Surface sampling	PCBs, waste oil	None
Sigma Mesa solar pond, 2 PRSs	Surface and subsurface sampling	VOCs, SVOCs, tritium and other low level radionuclides, metals, cyanide, PCBs	Tritium, cesium, strontium, plutonium, uranium, polonium
Storm drains, 2 PRSs	Subsurface sampling	Metals	None
Waste oil storage areas, 4 PRSs	Surface sampling	VOCs, SVOCs, PCBs, waste oil, metals	None

4.0 HAZARD IDENTIFICATION

4.1 Identification of Hazards

The SSO will monitor field conditions and personnel exposure to physical, chemical, biological, and radiological hazards. If a previously unidentified hazard is discovered, the SSO will contact the field team leader and the HSPL, and address the hazard. A safety analysis that identifies the potential harm, the likelihood of occurrence, and measures to reduce the risk will be performed. The analysis will be documented, and will be reviewed and approved by the HSPL and OUPL. Appropriate field team leaders and field team members will receive copies of the analysis, and it will be discussed in a tailgate meeting or other appropriate forum. The approved analysis will be added to this plan as an amendment.

4.2 Physical Hazards

Physical hazards often cause injuries. These may be minor or major events. Injuries can be prevented using recognition, evaluation, and control practices. This subsection outlines the potential physical hazards and some preventive measures. Table III-2 summarizes potential physical hazards.

4.2.1 Noise

Many activities for this field investigation have the potential for high noise levels. Drill rigs and backhoes, for example, can produce noise levels above established standards. Administrative Requirement (AR) 8-2 describes the Laboratory's hearing conservation policy and will be used to control exposure to below occupational exposure limits (OELs). The hearing conservation policy is based on US Air Force Regulation 161-35, Hazardous Noise Exposure, as specified in the DOE Albuquerque Operations Office Order 5480.4, Environmental Protection, Safety, and Health Protection Standards (DOE 1984, 0059), and 29 CFR 1910.95, Occupational Noise Exposure (LANL 1990, 0335).

The OUPL is responsible for compliance with the policy. The SSO is responsible for having a noise hazard investigation conducted for any operation where excessive noise is suspected, whether it be steady state or impulse/impact noise. If levels in excess of OELs are measured, appropriate control measures must be implemented.

4.2.2 Pinch Points

Pinch points are sometimes present in tools or equipment with turning or moving parts such as a drill rig, backhoe, or small hand tools. Moving parts should be equipped with guards. If guards are present, periodic inspections must be performed to ensure that the guards have not been removed. A guard is generally removed by field personnel when it 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. Follow-up

TABLE III-2

PHYSICAL HAZARDS OF CONCERN, OU 1114

HAZARD DESCRIPTION	PPE*	PREVENTION METHODS	MONITORING METHODS
Noise	Ear plugs and muffs	Engineering controls, mufflers, noise absorbers, PPE	Sound level meter, noise dosimeter
Vibration	Gloves, absorbing materials	Prevention or attenuation, isolation, increasing distance from source, PPE	Accelerometers and mechano-electrical transducers with electronic instrumentation
Energized equipment	Gloves, safety shoes, safety glasses	Lockout/tagout of equipment, PPE	Circuit test light/meter, grounding stick
Confined space entry	Gloves, boots, full-body suit, supplied-air or self-contained breathing apparatus, safety glasses, life line	Ventilation, oxygen, combustible gas monitoring, confined space permit, PPE	Combustible gas meter, oxygen monitors
Trenching	Hard hats, safety shoes, safety glasses	Protective shoring, proper excavation access, egress, PPE	Visual, oxygen meter, determining soil type
Fire/explosion	Hard hat, gloves, face shield, fire-resistant full-body suit	Ventilation, containment of fuel source, isolation/insulation from ignition source or heat, PPE	Combustible gas meter
High explosives	Latex gloves, safety glasses, blast shields	Identification of contaminated areas, field screening, following procedures, PPE	Visual inspection, screening tests
Welding/ cutting/ brazing	Fire-resistant gloves and clothing (aprons, coverall, leggings), welding helmets or goggles	Ventilation, PPE	Personal sampling for metal fumes
Compressed gas cylinders	Face shield, safety shoes, gloves	PPE. Cylinders should be stored in areas protected from weather. Cylinders should be secured and stored with protective caps in place. Regulators are not to be left on stored cylinders	Visual, combustible gas meter, photoionization detector
Material handling	Hard hat, safety shoes, gloves	Lifting aids, correct lifting procedure, work/rest periods, PPE	Weigh or estimate weight of typical materials and set limits for lifting
Walking/ working surfaces	Safety shoes	Clean and dry surface, nonskid surfacing material , PPE	Visual inspection
Pinch points/ mechanical hazards	Face shield, gloves, safety shoes	Guard interlocks, maintain guards in good condition, PPE	Visual monitoring, observation of work practices
Motor vehicle accidents	Seat belt	Defensive driving training, reduced speed during adverse conditions, PPE	Observation of work practices
Heavy equipment	Hard hat, safety shoes, gloves	Operator training. Stay clear of energized sources, PPE, back-up alarm, orange vest	Observation of work practices

TABLE III-2 (continued)

PHYSICAL HAZARDS OF CONCERN, OU 1114

HAZARD DESCRIPTION	PPE*	PREVENTION METHODS	MONITORING METHODS
Heat stress	Hat, cooling vest	ACGIH work/rest regimens, PPE	Wet bulb glove thermometer
Cold stress	Hat, gloves, insulated boots, coat, face protection	ACGIH work/warm-up schedule, heated shelters, PPE	Thermometer and wind speed measurement, wind chill chart
Sunburn	Hat, safety sunglasses, full-body protection	Cover body with clothing or sunscreen, PPE	Solar load chart
Altitude sickness	None	Acclimatization ascent/descent schedule, PPE	Self-monitoring for symptoms
Lightning	None	Grounding all equipment, stop work during thunderstorms and seek shelter	Weather reports and visual observation
Flash floods	None	Seek shelter on high ground	Weather reports and visual observation

*PPE = personal protective equipment
NIOSH et al. 1985, 0414
Plog 1988, 0943
OSHA 1989, 0946

investigations should be conducted to identify who removed the protective device. Appropriate disciplinary action should be taken.

Hydraulic mechanisms and tools are encountered in larger equipment. Injuries from hydraulic equipment can be severe due to the amount of force. Initial inspections, identification of hazards, and education of field team members are important. Routine inspections should 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 provided by the SSO.

OSHA requires that most equipment be thoroughly inspected periodically (e.g., yearly). This inspection is often conducted by the manufacturer or its representative. These inspections should be documented and the records kept with other equipment maintenance records.

4.2.3 Slip, Trip, and Fall

Injuries from slip, trip, and fall hazards are common around drill rigs, backhoe operations, and uneven terrain. Injuries occur because of poor housekeeping, bad weather conditions, or uneven terrain caused by soil excavation. Safe work procedures can help reduce the likelihood of slip, trip, and fall injuries. The SSO must enforce good housekeeping. This includes storing tools in accessible but out-of-the-way places, keeping the work area free of soil piles when possible, reminding personnel of uneven terrain, keeping personnel 5 ft from the mesa edge, and marking trench and borehole boundaries.

4.2.4 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 activity in which flammable or combustible gases could collect in an enclosed area.

Flammable work will be conducted according to AR 6-5, Flammable and Combustible Liquids, and Technical Bulletins 601, Flammable Liquids; 602, Flammable Gases; 603, Solvents; and 604, Epoxies.

Explosion potential will be measured in the enclosed space or downhole for drilling using a combustible gas indicator/oxygen meter (CGI). If the CGI measures concentrations greater than 20% of the 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 SSO to determine when work can resume.

Oxygen levels will be measured in enclosed or confined spaces. If oxygen levels fall below 19.5%, the area must be evacuated or supplied-air respirators furnished to personnel at risk. Oxygen-rich atmospheres create an increased potential for fire. Therefore, if levels exceed 25%, the area will be evacuated. If evacuation becomes necessary, the area will be ventilated and the SSO will continue monitoring oxygen levels to determine when it is safe to resume work.

4.2.5 High Explosives

Areas that may contain high explosives will be clearly identified. 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 fieldwork.

1. The location will be monitored before sampling with an appropriate radiation detection and/or organic vapor monitor.

2. The ground will be sprayed or saturated with water before sampling to minimize the potential for sparks or particulate dispersion.

3. A nonsparking sampling device will be pushed into the ground with a minimum amount of turning during surface sampling.

4. All samples will contain at least 10% moisture before being sealed in containers.

5. All samples will be screened by trained personnel using high explosives screening procedures.

6. Sample containers will be shipped in paint cans padded with vermiculite and placed in a cooler with ice packs.

7. Samples will be handled only in well-ventilated areas, and their exposure to light and heat will be minimized.

8. Latex gloves and safety glasses will be worn during sample collection.

9. 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 field team leader and the SSO. The HSPL shall be notified before field activities are resumed.

4.2.6 Heat Stress

Heat stress occurs when the body's physiological processes fail to maintain a normal body temperature because of excessive heat. This failure is enhanced when PC is worn during hot summer months. Acclimatization to heat is the most effective way to prevent heat stress, but drinking plenty of water, avoiding alcohol consumption, and taking frequent cooling breaks are also effective. When the body cooling system starts failing, a number of symptoms occur. Subsection 4.2.6.1 lists the physical reactions that can occur; they range from mild to fatal.

4.2.6.1 Heat-Related Illness

- Heat rash is caused by exposure to heat and humid air, and is aggravated by changing clothes. It decreases the ability to tolerate heat and becomes a nuisance. If heat rashes occur, it is best to keep that area of the body cool and dry.

- Heat cramps are caused by profuse sweating with inadequate fluid intake and chemical replacement (especially salts and potassium). Signs are muscle spasms and pain in the extremities and abdomen. If heat cramps occur, it is best to drink plenty of fluids (especially water), add slightly more salt to food, and replace potassium by eating bananas.

- Heat exhaustion is caused by an increased heat stress to the body and the inability of various organs to meet the increased demand to cool the body. Signs are shallow breathing; pallor; cool, moist skin; profuse sweating; dizziness; and lassitude. If heat exhaustion occurs, it is best to go to a cool, shady area (not in air conditioning) and allow the body to cool slowly. Drink plenty of fluids. Depending on the severity, one should wait a while before returning to the hot area.

- Heat stroke is the most severe of the heat-related injuries. This is when the body's cooling system shuts down completely. Signs are red, hot, dry skin; lack of perspiration; nausea; dizziness and confusion; strong rapid pulse; and coma. To prevent severe injury and/or death, the body must be cooled immediately and the person sent to the nearest hospital for immediate medical attention.

4.2.6.2 Work/Rest Schedule

When working in protective clothing (PC), 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)

where:

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

4.2.7 Cold Exposure

Persons working outdoors in temperatures at or below freezing (32°F) 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. The physical reactions to cold exposure are listed in Subsection 4.2.7.1.

4.2.7.1 Cold-Related Illness

- Frost nip or incipient frostbite is characterized by a sudden whitening of the skin. If this occurs, warm the affected part slowly and get the 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 to 105°F). Do not rub the affected part. Get medical attention as soon as possible after the affected part has been warmed.

- Deep frostbite is characterized by cold, pale, solid skin tissue; it may be blistered. Blisters should not be popped, and the victim should be warmed in the same manner as for superficial frostbite.

- Systemic hypothermia is 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 respiration; 4) freezing of the extremities; and, 5) death. Get the victim to a warm place, into warm, dry clothing, and get medical attention as soon as possible.

The best cure for cold-related injuries is prevention, which includes dressing in layers of warm, insulated garments. If the potential exists for getting wet, wear an outer shell and layers of wool clothing and take frequent warming breaks.

4.2.8 Electric Shock

The potential for exposure to electric shock exists during drilling, trenching, and sampling activities. The source of this hazard may be from overhead or underground utilities, use of portable equipment, or digging and/or hand augering into underground utilities. In addition to health and safety standard operating procedures, the following requirements apply. Compliance can significantly reduce the risk of electric 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 Laboratory's utilities manager before drilling activities begin.

6. Any cord with the grounding stem removed or otherwise damaged will be taken out of service and repaired or thrown away.

7. Ground fault interrupters will be used on all portable electrical equipment.

4.3 Chemical Hazards

This section identifies and provides information on chemical contaminants that are known or are suspected to be present at this OU. Field screening techniques are provided for identifying known contaminants. These same techniques may identify some of the unknowns. When the unknowns are identified, they will be added to the work plan's list of chemical contaminants of concern. The SSO will be responsible for adding chemicals to this table and for notifying field personnel as needed.

The SSHSP will provide information for known contaminants and will include the following: American Conference of Governmental Industrial Hygienists (ACGIH) threshold limit value (TLV); immediately dangerous to life and health (IDLH) concentrations; exposure symptoms; ionization potential and relative response factor for commonly used instruments (reevaluated when the particular instrument is selected); and the best instrument for screening.

Table III-3 lists the chemical contaminants of concern. Potential pesticides and herbicides are currently under evaluation and will be added to the table when the evaluation is complete.

TABLE III-3

CHEMICAL CONTAMINANTS OF CONCERN

CONTAMINANT	EXPOSURE LIMIT	IDLH	SYMPTOMS OF EXPOSURE	ROUTES OF EXPOSURE	IP(EV)	MONITORING INSTRUMENT	RELATIVE RESPONSE
Aluminum	10 mg/m^3	N/A	Weakness, fatigue, respiratory distress	Inhalation, ingestion	N/A	Filter, ICP	N/A
Asbestos	0.2 fibers/ cm^3	Ca	Dyspnea, fibrosis, restricted pulmonary function	Inhalation, ingestion	N/A	FAM	N/A
Beryllium	0.002 mg/m^3	Ca	Dermatitis, pneumonitis, dyspnea, chronic cough, weight loss, weakness, chest pain	Inhalation, ingestion, skin contact	N/A	Filter, ICP	N/A
Cadmium	0.05 mg/m^3	Ca	Pulmonary edema, dyspnea, cough, tight chest, chills, nausea, vomiting, muscle aches, diarrhea	Inhalation, ingestion	N/A	Filter, AA	N/A
Chromium	0.05 mg/m, 0.05 mg/m^3 (hexavalent compounds)	N/A, Ca 30 mg/m^3	Fibrosis, dermatitis, perforation of nasal septum, respiratory system irritation	Inhalation, ingestion	N/A	Filter, AA or IC	N/A
Copper	0.2 mg/m^3 (fume), 1.0 mg/m^3 (dust and mist)	N/A	Fever, chills, nausea, muscle aches, cough, weakness, eye irritation, dermatitis	Inhalation, ingestion, skin contact	N/A	Filter, AA	N/A
Ethylene glycol	0.1 mg/m^3 (skin)	500 mg/m^3	Throbbing head, dizziness, nausea, vomiting, abdominal pain, hypotension, flush, palpitations, methemoglobinemia, delirium, CNS depression, angina, skin irritant	Inhalation, absorption, ingestion, skin contact	N/A	Sampling pump and sorbent tubes	N/A
Hydrochloric acid	Ceiling 5 ppm, 7 mg/m^3	100 ppm	Inflamed nose, throat, cough, burns throat, choking, burns eyes and skin	Inhalation, ingestion, skin contact	N/A	Detector tube	N/A
Lead	0.05 mg/m^3	700 mg/m^3	Weakness, insomnia, constipation, abdominal pain, tremor, anorexia	Inhalation, ingestion, skin contact	N/A	Filter, AA	N/A
Mercury	0.01 mg/m^3 (alkyl compounds), 0.05 mg/m^3 (all forms except alkyl vapor), 0.1 mg/m^3 (aryl and inorganic forms)	10 mg/m^3, 28 mg/m^3	Cough, chest pains, tremor, insomnia, weakness, excessive salivation, dizziness, nausea, vomiting, constipation	Inhalation, ingestion, skin contact	N/A	Jerome mercury monitor	N/A
Nickel	0.1 mg/m^3 soluble compounds; 1 mg/m^3 metal and insoluble compounds	Ca	Headache, vertigo, nausea, vomiting, epigastric pain, cough, hyperpnea, cyanosis, weakness, pneumonitis, delirium, convulsions	Ingestion, inhalation, skin contact	N/A	RAM, sampling pump and filter	N/A

TABLE III-3 (continued)

CHEMICAL CONTAMINANTS OF CONCERN

CONTAMINANT	EXPOSURE LIMIT	IDLH	SYMPTOMS OF EXPOSURE	ROUTES OF EXPOSURE	IP(eV)	MONITORING INSTRUMENT	RELATIVE RESPONSE
Nitric acid	5 mg/m^3 2 ppm	100 ppm	Nausea, salivation, abdominal pain, vomiting, diarrhea, headache, dizziness, disturbed hearing and vision, confusion, weakness, paroxysmal atrial fibrillation, convulsions, dyspnea	Inhalation, absorption, ingestion, skin contact	N/A	Detector tube	N/A
Polychlorinated biphenyls	1 mg/m^3	Ca, 10 mg/m^3	Irritated eyes, chloracne, liver damage	Inhalation, absorption, ingestion, skin contact	N/A	Sampling pump and sorbent tubes	N/A
Silver	0.01 mg/m^3 (metal), 0.01 mg/m^3 (soluble forms)	N/A	Throat and skin irritation, skin ulceration, gastrointestinal irritation, blue-gray eyes and patches on skin	Inhalation, ingestion, skin contact	N/A	Filter, ICP	N/A
Sodium cyanide	5 mg/m^3	50 mg/m^3	Asphyxiation and death can occur, weakness, headache, confusion, nausea, vomiting, increased rate of respiration, irritated eyes and skin	Ingestion, absorption, inhalation, skin contact	N/A	Detector tube	N/A
Sodium hydroxide	Ceiling 2 mg/m^3	250 mg/m^3	Irritated nose, pneumonitis, burns eyes, skin, temporary loss of hair	Inhalation, ingestion, skin contact	N/A	Detector tube	N/A
Zinc	5 mg/m^3 (fume), 10 mg/m^3 (dust)	N/A	Cough, chills, fever, tight chest, blurred vision, dyspnea, nausea, vomiting, cramps	Inhalation	N/A	Filter, x-ray diffraction	N/A
Antimony	0.5 mg/m^3	80 mg/m^3	Irritation of nose, throat, and mouth; cough, dizziness, headache, nausea, cramps	Inhalation, skin contact, ingestion	N/A	Sampling pump and filter	N/A
Barium	0.5 mg/m^3	1100 mg/m^3	Upper respiratory tract irritation, gastroenteritis, irritation of eyes and skin	Inhalation, ingestion, skin contact	N/A	Sampling pump and filter	N/A
Benzene	1 ppm	Ca	Irritation of eyes, nose, and respiratory system, headache, giddiness, nausea	Inhalation, ingestion, skin contact		Sampling pump and charcoal tube	
Polycyclic aromatic hydrocarbons (e.g., BAP)	0.2 mg/m^3	Ca	Dermatitis, lung cancer	Inhalation, skin contact, ingestion	N/A	Sampling pump and filter	N/A
Thallium	0.1 mg/m^3	20 mg/m^3	Nausea, diarrhea, tremors, chest pain	Inhalation, skin contact, ingestion	N/A	Sampling pump and filter	N/A

AA = atomic absorption
Ca = potential human carcinogen
FAM = fibrous aerosol monitor
IC = ion chromotography
ICP = inductively coupled plasma
IDLH = immediately dangerous to life and health
IP(eV) = ionization potential electron volts (eV)
N/A = not available
PID = photoionization detector
RAM = real-time aerosol monitor

ACGIH 1992, 0858
Clayton and Clayton 1981, 0939
Eller 1984, 0944
OSHA 1991, 0610
NIOSH 1990, 0941

4.4 Radiological Hazards

There are four principal pathways by which individuals may be exposed to radioactivity during field investigations:

- inhalation or ingestion of radionuclide particles or vapors
- dermal absorption of radionuclide particulates or vapors through wounds
- dermal absorption through intact skin; and
- exposure to direct gamma radiation from contaminated materials.

Table III-4 provides the specific properties of the radionuclides of concern in this OU, including type of emission and half-life. As concentrations of these radionuclides are determined and as new radionuclides are discovered, the table will be updated. The SSO will be responsible for adding radionuclides to this table and for notifying field personnel as needed.

4.5 Biological Hazards

Table III-5 summarizes some of the potential biological hazards for this OU. Field team members are also likely to encounter sanitary waste while sampling. Therefore, pathogenic microorganisms and parasites are potential hazards. Exposures (airborne or via skin contact and ingestion) may result in flu-like symptoms and gastrointestinal illnesses. The Centers for Disease Control (CDC) has stated that HIV is not transmitted through human waste products.

4.6 Task-by-Task Risk Analysis

29 CFR 1910.120 requires a task-by-task risk analysis; these tasks are related to operations or activities in the field investigation (OSHA 1991, 0610). The preceding sections identify the physical, chemical, radiological, and biological hazards known or suspected to be present. This section analyzes some tasks that will probably be undertaken at this OU. However, the SSHSP should analyze each site-specific task and document the potential hazards and likelihood of exposure.

TABLE III-4

RADIONUCLIDES OF CONCERN

RADIONUCLIDE	MAJOR RADIATION	DAC (μCi/mL)	RADIOACTIVE HALF-LIFE	MONITORING INSTRUMENT
Plutonium-238	Alpha, gamma	3×10^{-12}	87.7 years	Alpha scintillometer, FIDLER
Plutonium-239	Alpha, gamma	2×10^{-12}	2.4×10^{4} years	Alpha scintillometer, FIDLER
Plutonium-240	Alpha, gamma	2×10^{-12}	6 537 years	Alpha scintillometer, FIDLER
Tritium	Beta	2×10^{-5}	12.26 years	Liquid scintillation counter
Uranium-235	Alpha, gamma	2×10^{-11}	7×10^{8} years	Alpha scintillometer, FIDLER
Uranium-238	Alpha, gamma	2×10^{-11}	4.5×10^{9} years	Alpha scintillometer, FIDLER
Polonium-210	Alpha, gamma	3×10^{-10}	138.4 days	Alpha scintillometer
Cesium-137	Gamma	5×10^{-5}	30 years	Geiger-Müeller survey meter
Strontium-90	Beta	2×10^{-9}	27.7 years	Liquid scintillation counter

DAC = derived air concentration (DOE Order 5480.11)
FIDLER = field instrument for the detection of low-energy radiation

4.6.1 Task: Drilling

Likelihood of Exposure: High

Associated Hazards: In drilling, there is a potential for physical injury. There are opportunities for entanglement and pinch points in many parts of a drilling rig. Injuries are generally minor, but there is the potential for amputation of fingers. Other severe injuries may occur from failure of a wire rope under extreme stress. If the rope breaks under high tension, it will act as a whip and could decapitate workers. Extreme caution must be exercised when drilling near electrical power lines. Electrocution is a distinct possibility if the rig touches an overhead power line.

TABLE III-5

BIOLOGICAL HAZARDS OF CONCERN, OU 1114

HAZARD DESCRIPTION	PPE	PREVENTION METHODS
Snake bites (rattlesnake)	Long pants, snake leggings, boots	Wear PPE where footing is difficult to see. Avoid blind reaches
Animal bites (dog, cat, coyote, mountain lion)	Long pants, boots	Avoid wild or domestic animals; do not approach or attempt to feed
Ticks (may cause Lyme disease or tick fever)	Long pants, long sleeved shirts, boots	Perform tick inspections of team members after working in brushy or wooded areas
Rodents (prairie dogs and squirrels may carry plague infected fleas)	Long pants, boots	Do not handle live or dead rodents
Human sewage (may contain pathogenic bacteria)	Disposable coveralls and gloves	When sampling in septic systems, wear protective gear and dispose of properly. Wash hands thoroughly after contact
Blood-borne pathogens (blood, blood products, and human body fluids may contain Hepatitis B virus or HIV)	Latex gloves, mouth guards, protective eyewear	Only trained personnel should perform first aid procedures. Follow Laboratory blood-borne pathogen control procedures
Poisonous plants (poison ivy)	Gloves, long pants, long-sleeved shirts, boots	Recognize plants, avoid contact, wash hands and garments thoroughly after contact
Waterborne infection agents (stream water may contain giardia)	None	Drink water only from potable sources
Spiders (brown recluse, black widow)	Gloves, long pants, long-sleeved shirt, boots	Use caution when in wood piles or dark, enclosed places

Chemical and radiological hazards occur when drilling disturbs or penetrates a contaminated pocket of soil, which happens quite frequently. The rig will stir dust, generate heat, and volatilize organics in the soil. These factors combine to enhance the potential for exposure to chemicals or radionuclides.

4.6.2 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 still presents operator entanglement and pinch point hazards but to a lesser degree than drilling. Electrocution potential is greatly reduced, but underground power lines can still be encountered. With a nonpowered hand auger, the probability of physical injury is greatly reduced.

4.6.3 Task: Trenching

Likelihood of Exposure: High

Associated Hazards: Some trenches may qualify as confined spaces; if so, confined space entry procedures should be followed. Physical hazards associated with trenching operations are related to the use of heavy equipment and cave-ins. 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 equipment is operating. Cave-ins occur when the spoils are too close to the trench, heavy equipment is too close to the trench, the excavation is not shored, or the angle of repose is too large for the type of soil. Cave-ins can occur in trenches of all depths. Physical injuries, as a result of cave-ins, are often fatal.

Chemical/radiological hazards are likely to be encountered while trenching is in progress. Hazards include inhalation of airborne dusts, volatiles, and alpha particle-emitting radionuclides. 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. Vapors may accumulate inside the trench after the trench has been completed. Air monitoring is critical.

4.6.4 Task: Canyon-Side Sampling

Likelihood of Exposure: Moderate to high

Associated Hazards: There is the potential for slip and fall injuries from this task. 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 life lines and safety harnesses will be required for activities in these areas.

5.0 SITE CONTROL

5.1 Initial Site Reconnaissance

Initial site reconnaissance may involve surveyors, archaeologists, biological resource personnel, etc. Health and safety concerns that may be present must be identified by the OUPL and HSPL, and will be addressed to protect personnel.

5.2 Site-Specific Health and Safety Plans

Each site within an OU requires an SSHSP. Planning, special training, supervision, protective measures, and oversight needs are different at each site, and the SSHSP addresses this variability.

The OUHSP provides detailed information to project managers, Laboratory managers, regulators, and health and safety professionals about health and safety programs and procedures as they relate to an OU. The SSHSP addresses the safety and health hazards of each phase of site operations and includes requirements and procedures for employee protection. All SSHSPs in that OU derive from the OUHSP.

The standard outline for an SSHSP follows OSHA requirements and serves as a guide for best management practice. Those performing the fieldwork are responsible for completing the plan.

Changes to the SSHSP must be made in writing. The HSPL shall approve changes, and site personnel shall be updated through daily tailgate meetings. Records of SSHSP approvals and changes will be maintained by the SSO.

5.3 Work Zones

Maps identifying work zones will be included with each SSHSP. Markings used to designate each zone boundary (red or yellow tape, fences, barricades, etc.) will be discussed in the plan. Evacuation routes should be up- or cross-wind of the exclusion zone. A muster area must be designated for each evacuation route. The following subsections discuss the work zones.

5.3.1 Exclusion Zone

An exclusion zone is the area where contamination is either known or likely to be present or, because of work activities, will present a potential hazard to personnel. Entry into the exclusion zone requires the use of PPE.

5.3.2 Decontamination Zone

A decontamination zone is the area where personnel conduct personal and equipment decontamination. This zone provides a buffer between contaminated areas and clean areas. Activities in the decontamination zone require the use of PPE as defined in the decontamination plan. Section 11.0 contains details of the decontamination plan.

5.3.3 Support Zone

A support zone is a clean area where contact with hazardous materials or conditions is minimal. PPE other than safety equipment appropriate to the tasks performed (e.g., safety glasses, protective footwear, etc.) is not required.

5.4 Secured Areas

Secured areas shall be identified and shown on the site maps. Procedures and responsibilities for maintaining secured areas must be described. Standard Laboratory security procedures should be followed for accessing secured areas.

All contractors and visitors must be processed through the badge office before entering secured areas. It is the responsibility of the OUPL to see that contractor personnel have badges. It is the responsibility of all Laboratory employees to enforce security measures.

5.5 Communications Systems

Portable telephones, CB radios, and two-way radios may be used for on-site communications.

5.6 General Safe-Work Practices

Workers will be instructed in safe work practices to be followed when performing tasks and operating equipment needed to complete a project.

Daily safety tailgate meetings will be conducted at the beginning of each shift to brief workers on proposed activities and special precautions.

The following requirements are necessary to protect field workers and will be iterated in SSHSPs. Depending on the site-specific conditions, items may be added or deleted.

- The buddy system will be used. Hand signals will be established and used.
- During site operations, each worker shall consider himself a safety back-up to his partner. All personnel should be aware of dangerous situations that may develop.
- Visual contact must be maintained between on-site partners.
- Eating, drinking, chewing gum or tobacco, smoking, or any practice that increases the probability of hand-to-mouth transfer and ingestion of potentially-contaminated material is prohibited in any area designated as contaminated.
- Prescription drugs should not be taken by personnel where the potential for contact with toxic substances exists, unless specifically approved by a qualified physician.
- Alcoholic beverage intake is prohibited during the work day.
- Disposable clothing will be used whenever possible to minimize the risk of cross-contamination.
- The number of personnel and amount of equipment in any contaminated area should be minimized, but effective site operations must be allowed for.
- Work areas for various operational activities (equipment testing, decontamination, etc.) will be established.

- Extended work schedules must be approved by the OUPL and HSPL.
- Motorized equipment will be inspected to ensure that brakes, hoists, cables, and other mechanical components are operating properly.
- Procedures for leaving any contaminated area will be planned and reviewed before contaminated areas are entered.
- Work areas and decontamination procedures will be established based on prevailing site conditions and will be subject to change.
- On-site wind direction indicators will be strategically located.
- Contact with contaminated or potentially-contaminated surfaces should be avoided. Whenever possible, do not walk through puddles, mud, or discolored ground surface; do not kneel on the ground; and do not lean, sit, or place equipment on drums, containers, vehicles, or the ground.
- No personnel will be allowed to enter the site without the proper safety equipment.
- Proper decontamination procedures will be followed before leaving the site, except in medical emergencies.
- Any medical emergency supersedes routine safety requirements.
- Housekeeping will be emphasized to prevent injury from tripping, falling objects, and accumulation of combustible materials.
- All personnel must comply with established safety procedures. Any staff member or visitor who does not comply with the safety policy established by the field

safety coordinator will be dismissed from the site immediately.

5.7 Specific Safe-Work Practices

5.7.1 Electrical Safety-Related Work Practices

The most effective way to avoid accidental contact with electricity is to de-energize the system or maintain a safe distance from the energized parts/line. OSHA regulations require minimum distances from energized parts. A person working near power lines must maintain a minimum 10 ft clearance from overhead lines of 50 kilovolts (kV) or less. The clearance includes any conductive material the person may be using. For voltages over 50 kV, the 10 ft clearance is increased 4 in. for every 10 kV over 50 kV.

5.7.2 Grounding

Grounding is a secondary form of protection that ensures there is a path of low resistance to ground if there is an electrical equipment failure. A properly installed ground wire becomes the path for electrical current if the equipment malfunctions. Without proper grounding, a person could become the path to ground if he/she touches the equipment. An assured electrical grounding program or ground fault circuit interrupter is required.

5.7.3 Lockout/Tagout

All site workers shall follow a standard operating procedure for control of hazardous energy sources (Laboratory AR 8-6, Procedure 106-01.1). Lockout/tagout procedure is used to control hazardous energy sources. Energy sources can be in the form of electricity, potential energy, thermal energy, chemical corrosivity, chemical toxicity, or hydraulic or pneumatic pressure.

5.7.4 Confined Space

Entry and work to be conducted in confined spaces shall adhere to procedures proposed in the Laboratory Confined Space Entry Program. These procedures require that a Confined Space Entry Permit be obtained and posted at the work site. Prior to entry, the atmosphere shall be tested for oxygen content, flammable vapors, carbon monoxide, and other hazardous gases. Continuous monitoring for these constituents shall be performed if conditions or activities have the potential to adversely affect the atmosphere.

5.7.5 Handling Drums and Containers

Drums and containers used during cleanup shall meet US Department of Transportation, OSHA, and EPA regulations. Work practices, labeling requirements, spill containment measures, and precautions for opening drums and containers shall be in accordance with 29 CFR 1910.120 (OSHA 1991, 0610). Drums and containers that contain radioactive material must also be labeled in accordance with AR 3-5, Shipment of Radioactive Materials; AR 3-7, Radiation Exposure Control; and Article 412, Radioactive Material Laboratory of the DOE Radiological Control Manual. Provisions for these activities shall be clearly outlined in the SSHSP, if applicable.

5.7.6 Illumination

Illumination shall meet the requirements of Table H-120.1, 29 CFR 1910.120 (OSHA 1991, 0610). Table III-6 lists the foot-candles of illumination for specific areas of operation.

TABLE III-6

ILLUMINATION LEVELS

FOOT-CANDLES	AREAS OF OPERATION(S)
5	General site areas
3	Excavation and waste areas, access ways, active storage areas, loading platforms, refueling areas, field maintenance areas
5	Indoors (warehouses, corridors, hallways, exits)
5	Tunnels, shafts, and general underground work areas. (Exception: a minimum of 10 ft-candles is required at tunnel and shaft heading during drilling, mucking, and scaling. Bureau of Mines-approved cap lights shall be acceptable for use in the tunnel heading.)
10	General shops (e.g., mechanical and electrical equipment rooms, active storerooms, barracks or living quarters, locker or dressing rooms, dining areas, indoor toilets, and workrooms)
30	First aid stations, infirmaries, offices

5.7.7 Sanitation

An adequate supply of potable water shall be provided at the site. Nonpotable water sources shall be clearly marked as not suitable for drinking or washing. There shall be no cross-connections between potable and nonpotable water systems.

At remote sites, at least one toilet facility shall be provided, unless the crew is mobile and has transportation readily available to nearby toilet facilities.

Adequate washing facilities shall be provided when personnel are potentially exposed to hazardous substances. Washing facilities shall be in areas where exposures to hazardous materials are below permissible exposure limits and employees may decontaminate themselves before entering clean areas. When showers and change rooms are required, they shall be provided and meet the requirements of 29 CFR 1910.141 (OSHA 1991, 0610). In this instance, employees shall be required to shower when leaving the decontamination zone.

5.7.8 Packaging and Transport

The OUPL shall contact the Waste Management Group (EM-7) to determine requirements for storing and transporting hazardous waste to ensure that practices for storage, packaging, and transportation comply with ARs 10-2 and 10-3. Disposal of hazardous wastes generated from a project will be handled by EM-7.

5.7.9 Government Vehicle Use

Only government vehicles can be driven onto contaminated sites. All personnel must wear a seat belt when in a moving vehicle.

5.7.10 Extended Work Schedules

Scheduled work outside normal work hours must have the prior approval of the OUPL and SSO.

5.7.11 Remote Fieldwork

Work at locations remote from an established base of operations shall be conducted in accordance with AR 15-1. The OUPL must outline provisions for communications and emergency procedures in the SSHSP.

5.8 Permits

Excavation permits must be obtained several weeks in advance. Confined space entry, lockout/tagout, radiation work, and special work permits can be obtained in 24 hours.

5.8.1 Excavation

Any excavation at OU sites must be conducted in accordance with AR 1-12, Excavation or Fill Permit Review. Field team leaders will be responsible for determining when excavation permits are required. The OUPL and field team leader are responsible for requesting the excavation permit (Form 70-10-00.1) from the support services contractor. At the top of the form, indicate that this is an ER Program activity. The permit is reviewed by HS and EM Divisions for environmental health and safety concerns.

5.8.2 Radiation Work Permits

At any OU site involving areas of known or potential radioactive contamination, the OUPL and field team leader must prepare a Special Work Permit for Radiation Work, HS Form 3-1B, using information specific to the site, and must submit it to the Health Physics Operations Group (HS-1) for review. HS-1 will approve the form by signing in the appropriate block. The OUPL must obtain full approval for this permit before initiating work at the site.

5.8.3 Special Work Permit for Spark/Flame-Producing Operations

When there are spark/flame-producing operations, the OUPL and field team leader must prepare a Special Work Permit, HS Form ES&H 8-4A. Information must be specific to the site and submitted to the Health and Safety Division, which will review and approve the form by signing in the appropriate block. The OUPL must obtain full approval for this permit before initiating the work.

5.8.4 Confined Space Entry

For any confined space entry, the OUPL and field team leader must prepare a Confined Space Entry Permit. The OUPL must obtain full approval for this permit before initiating the entry.

5.8.5 Lockout/Tagout

At any OU site involving lockout/tagout operations, the OUPL and field team leader must prepare a Special Work Permit for Control of Hazardous Energy. The OUPL must obtain full approval for this permit before initiating work.

6.0 PERSONAL PROTECTIVE EQUIPMENT

6.1 General Requirements

Personal protection equipment (PPE) shall be selected, provided, and used in accordance with the requirements of this section. Contractors shall provide their own PPE.

If engineering controls and work practices do not provide adequate protection against hazards, PPE may be required. Use of PPE is required by OSHA regulations in 29 CFR 1910 Subpart I (Table III-7) (OSHA 1991, 0610). These regulations are reinforced by EPA regulation 40 CFR 300, which requires private contractors working on Superfund sites to conform to applicable OSHA provisions and any other federal or state safety requirements deemed necessary by the lead agency overseeing the activities (EPA 1990, 0559).

TABLE III-7

OSHA STANDARDS FOR PPE USE

TYPE OF PROTECTION	REGULATION
General	29 CFR 1910.132 29 CFR 1910.1000 29 CFR 1910.1001-1045
Eye and face	29 CFR 1910.133(a)
Hearing	29 CFR 1910.95
Respiratory	29 CFR 1910.134
Head	29 CFR 1910.135
Foot	29 CFR 1910.136
Electrical protective devices	29 CFR 1910.137

In addition, the use of PPE for radiological protection shall be governed by the Radiation Work Permit (or Safety Work Permits/RW). AR 3-7 and Article 325, Article 461, Table 3.1, and Appendix 3C of the DOE Radiological Control Manual (DOE 1992, 17-838) contain guidelines for the use of PC during radiological operations. Efforts should be made to keep disposable PPE used for radiological work from becoming contaminated with hazardous chemicals, which would generate unnecessary mixed waste. In sites where both types of contaminants are present, this may not be possible.

6.1.1 General PPE Program Elements

PPE programs protect workers from health and safety hazards and prevent injuries as a result of incorrect use and/or malfunction of PPE. Hazard identification, medical monitoring, training, environmental surveillance, selection criteria, uses, maintenance, and decontamination of PPE are the essential program elements.

6.1.2 Medical Certification

Medical approval may be required before donning certain PPE. See Section 9.0 of this annex for more details.

6.2 Levels of PPE

The individual components of clothing and equipment must be assembled into a full protective ensemble that protects the worker from the site-specific hazards and minimizes the hazards and drawbacks of the PPE. Attachment 1 lists ensemble components based on the widely-used EPA levels of protection (Levels A, B, C, and D). These lists can be used as a starting point for ensemble creation; however, each ensemble must be tailored to the specific situation in order to provide the most appropriate level of protection. For example, if work is being conducted at a highly-contaminated site or if the potential for contamination is high, it may be advisable to wear a disposable covering, such as Tyvek coveralls or PVC splash suits, over the protective ensemble. It may be necessary to slit the back of these disposable suits to fit around the bulge of an encapsulating suit and self-contained breathing apparatus.

The type of equipment used and the overall level of protection should be reevaluated periodically as information about the site increases and as workers are required to perform different tasks. Personnel should be able to upgrade or downgrade their level of chemical protection with the concurrence of the SSO. The level of radiological PPE may only be changed as specified in the Radiation Work Permits (or Safety Work Permits/RW). The following are reasons to upgrade:

- known or suspected presence of dermal hazards;
- occurrence or likely occurrence of gas or vapor emission;
- change in work task that will increase contact, or potential contact, with hazardous materials; or
- request of the individual performing the task.

The following are reasons to downgrade:

- new information indicates that the situation is less hazardous than was originally thought,
- change in site conditions that decreases the hazard, or
- change in work task that will reduce contact with hazardous materials.

6.3 Selection, Use, and Limitations

Selection of PPE for a particular activity will be based on an evaluation of the hazards anticipated or previously detected at a work site. The equipment selected will provide protection from chemical and/or radiological materials that are known or suspected to be present and that exhibit any potential for worker exposure.

6.3.1 Chemical Protective Clothing

Chemical PC will be selected based on an evaluation of the performance characteristics of the clothing relative to site requirements and limitations, task-specific conditions and duration of wear, and potential hazards identified at the site.

6.3.2 Radiological Protective Clothing

PC as prescribed by the Radiological Work Permit should be selected based on the contamination level in the work area, the anticipated work activity, worker health considerations, and regard for nonradiological hazards that may be present. Table III-8 provides general guidelines for selection. A full set of PC includes coveralls, cotton glove liners, gloves, shoe covers, rubber overshoes, and a hood. A double set of PC includes two pairs of coveralls, cotton glove liners, two pairs of gloves, two pairs of shoe covers, rubber overshoes, and a hood.

1. Cotton glove liners may be worn inside standard gloves for comfort but should not be worn alone or considered a layer of protection.

2. Shoe covers and gloves should be sufficiently durable for their intended use. Leather or canvas work gloves should be worn in lieu of, or in addition to, standard gloves for work activities requiring additional strength or abrasion resistance.

3. Use of hard hats in contamination areas should be controlled by the Radiological Work Permit. Hard hats designated for use in contamination areas should be distinctly colored or marked.

TABLE III-8

GUIDELINES FOR SELECTING RADIOLOGICAL PROTECTIVE CLOTHING

WORK ACTIVITY	REMOVABLE CONTAMINATION LEVELS		
	LOW (1 TO 10 TIMES TABLE III-10 VALUES)	MODERATE (10 TO 100 TIMES TABLE III-10 VALUES)	HIGH (>100 TIMES TABLE III-10 VALUES)
Routine	Full set of PC	Full set of PC	Full set of PC, double gloves, double shoe covers
Heavy work	Full set of PC, work gloves	Double set of PC, work gloves	Double set of PC, work gloves
Work with pressurized or large volume liquids, closed system breach	Full set of non-permeable PC	Double set of PC (outer set non-permeable), rubber boots	Double set of PC, nonpermeable outer clothing, rubber boots

6.3.3 Protective Equipment

Protective equipment including protective eye wear and shoes, head gear, hearing protection, splash protection, life lines, and safety harnesses must meet American National Standards Institute (ANSI) standards.

6.4 Respiratory Protection Program

When engineering controls cannot maintain airborne contaminants at acceptable levels, appropriate respiratory protective measures shall be instituted. The Health and Safety Division administers the respiratory protection program, which defines respiratory protection requirements; verifies that personnel have met the criteria for training, medical surveillance, and fit testing; and maintains the appropriate records.

All contractors and subcontractors shall submit written documentation of a respiratory protection program to the Industrial Hygiene Group (HS-5) for review and signature approval before using respirators on site. The respiratory protection program may be submitted as part of the written PPE program also required under OSHA, or as a stand-alone document. Contractors are to provide their own NIOSH-approved equipment. Both program documentation and equipment must be approved by HS-5 before field activities begin. HS-5 will audit contractors' respiratory protection program, records, operating procedures, and on-site use of such equipment.

7.0 HAZARD CONTROLS

7.1 Engineering Controls

OSHA regulations state that, when possible, engineering controls should be used as the first line of defense for protecting workers from hazards. Engineering controls are mechanical means for reducing hazards to workers, such as guarding moving parts on machinery and tools or using a ventilation hood in a laboratory to remove contaminant vapors. Unfortunately, engineering controls are not easily initiated in an uncontrollable environment, such as outdoors. However, the following are suggestions that should be used while working in the field.

7.1.1 Engineering Controls for Airborne Dust

Airborne dust can be a hazard when it is a nuisance dust (standards are established at 10 mg/m^3) and when radionuclides and/or hazardous substances attach 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 generated, a small garden sprayer containing water or water amended with surfactants may be used to wet the soil to suppress the dust. However, these sprayers do not discharge a large amount of water, and spraying must be repeated often.

A wind screen may also be effective to reduce dust from relatively small earth-moving operations. In extreme cases, a temporary enclosure can be constructed to control dust, but this method is the most expensive control and may increase the level of PPE required for workers in the enclosure.

Where there are high winds in an area of little or no vegetation or a large, dusty area, a water truck may be used to wet the area to suppress dust. To be effective, frequent spraying will be required. Other materials may be considered for dust suppression. Positive air pressure cabs are an effective method for controlling dust exposure to equipment operators. In any case, the amount of water applied needs to be carefully controlled so that enough is used to be effective without spreading contamination by runoff or as mud tracked off site on vehicle tires.

7.1.2 Engineering Controls for Airborne Volatiles

Drilling, trenching, and soil and tank sampling activities may produce gases, fumes, or mists that may be inhaled or ingested by unprotected workers. Engineering controls may be implemented to reduce exposure to these hazards. Natural ventilation (wind) can be an effective control measure; workers should be located upwind of the activity whenever possible.

Mechanical ventilation is more desirable in closed or confined spaces. The fan or blower may be attached to a large hose to push or, more effectively, pull the contaminant from the confined space. Pulling air from the space is more effective at removing vapors, whereas forcing air into the confined area ensures 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 methods in each situation.

7.1.3 Engineering Controls For Noise

Engineering controls for noise can be difficult to design for an uncontrolled environment. Drilling and trenching are likely to produce high noise levels. 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. Additional barriers may be constructed if high noise levels are encountered. Equipment operators may be exposed to high noise levels. Insulated cabs usually reduce noise to an acceptable level (Berger et al. 1988, 0940).

7.1.4 Engineering Controls for Trenching

Trenching often presents field personnel with slip, trip, fall, and crushing hazards. In most cases, entry into an excavation deeper than 5 ft is avoided. However, it is sometimes necessary to enter trenches to obtain needed information. OSHA regulations for trenches and excavations require engineering controls to prevent cave-ins. These controls include the use of shoring, sloping, and benching. Benching is a series of steps dug around the excavation at a specified angle of repose. The angle of repose is determined by the soil type. 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 soil type. This method is generally used for medium-sized excavations. In general, neither of these soil stabilization methods is a convenient technique for exploratory trenches.

The last method that OSHA suggests is shoring, in which 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.

7.1.5 Engineering Controls for Drilling

Working with and around drilling rigs presents workers with a number of hazards. Hazards are a result of the number of moving parts and the power of the equipment. Engineering controls for drilling rigs include installing guards where possible to prevent crushing injuries and, more importantly, an inspection program to ensure replacement of worn or broken parts. Inspections should be performed at the beginning of the job and periodically during the project.

7.2 Administrative Controls

Administrative controls are necessary when hazards are present and engineering controls are not feasible. Administrative controls are methods for controlling the degree of exposure (e.g., how long or how close to the hazard the worker remains). Administrative controls may be instituted easily in most cases and are effective measures in decreasing personnel exposure.

7.2.1 Administrative Controls for Airborne Chemical and Radiological Hazards

Chemical and radiological hazards are to be monitored during performance of duties in the exclusion zone. If the concentration of radionuclides or toxic materials exceeds the action levels, personnel may be removed from the area until natural or mechanical ventilation brings the levels to background. If appropriate air monitoring is conducted, the need for PPE may be reduced. In addition, personnel should only enter the exclusion zone when required.

7.2.2 Administrative Controls for Noise

Administrative controls for noise include both time and distance. The ACGIH has formally-established administrative controls. Although the principle of sound reduction by distance was not discussed earlier, it is an effective method of reducing noise intensity. The time the worker is allowed to be at the noise source decreases and the distance between the worker and the source of the noise increases in relation to the intensity of the noise. 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 decibels (dB), and the person doubles the distance or is 20 ft from the source, the sound level drops to 92 dB.

Increasing distance is probably better for reducing the level of noise. If neither of these methods is possible, PPE must be worn.

7.2.3 Administrative Controls for Trenching

The basic philosophy behind administrative controls for trenching is to not 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 of less than 5 ft if possible. Monitoring inside the trench and a 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.

Although 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 a trench. Therefore, any time there are personnel in a trench, the operator must shut down the equipment until the excavation is 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.

7.2.4 Administrative Controls for Working Near the Mesa Edge

Slip, trip, and fall hazards exist around the mesa edge. These hazards may be avoided by good housekeeping in the work area near the edge of the mesa. Additionally, personnel shall 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 is required to be tied to a life line before being allowed to descend over the edge. When working with a life line, an attendant must always be present (Parmeggiani 1983, 0945).

8.0 SITE MONITORING

This section describes the requirements for chemical and physical agent monitoring to identify, evaluate, and control these hazards. This information will be used to delineate work zone boundaries, select the appropriate level of personal protection, ensure the effectiveness of decontamination procedures, and protect public health and safety.

A monitoring program that meets the requirements of 29 CFR 1910.120 will be implemented for each OU (OSHA 1991, 0610). Contractors will be responsible for providing their own monitoring equipment and for determining their employees' occupational exposures to hazardous chemical and physical agents. The Laboratory will perform oversight duties during these activities. A detailed monitoring strategy will be incorporated into each SSHSP. The strategy will describe the frequency, duration, and type of samples to be collected.

If exposures exceed acceptable limits, the ER Program Manager and HSPL will be notified. An investigation of the source, exposures to personnel working in the OU and in adjoining areas, any bioassay or other medical evaluations needed, and an assessment of environmental impacts, shall be initiated as soon as possible under the guidance of the Health and Safety Division.

8.1 Chemical Air Contaminants

DOE has, as a matter of policy, adopted OSHA permissible exposure limits (PELs) and ACGIH threshold limit values (TLVs) as standards for defining acceptable levels of exposure. The more stringent of the two limits applies.

8.1.1 Personal Monitoring

The site history should be used to determine the need for monitoring for specific chemical agents. Instruments that monitor for a wide range of chemicals, such as the organic vapor analyzer, combustible gas meter, and HNU, may be used for screening purposes.

Initial air monitoring shall be performed to characterize the exposure levels at the site and to determine the appropriate level of personal protection needed. In addition, periodic monitoring is required when:

- work is initiated in a different part of the site,
- unanticipated contaminants are identified,

- a different type of operation is initiated (i.e., soil boring versus drum opening), or
- a container spill or leak is discovered.

Instrument readings should be taken in or near the workers' breathing zone. Individuals working closest to the source have the greatest potential for being exposed to concentrations above acceptable limits. Monitoring strategies will emphasize worst-case conditions if monitoring each individual is inappropriate.

8.1.2 Perimeter Monitoring

Perimeter monitoring should be performed to characterize airborne concentrations in adjoining areas. If results indicate that contaminants are moving off site, control measures must be reevaluated. The perimeter is defined as the boundary of the OU.

8.2 Physical Hazards

Physical hazards such as noise, heat stress, and cold stress will be monitored as necessary to prevent worker impairment. The SSO will assess the conditions on an ongoing basis to determine whether climate factors present a hazard. The use of mechanized equipment, explosives, and other sources of noise will be monitored as needed. Direct reading instruments will be used as screening tools and to determine whether full-shift monitoring is necessary.

8.3 Radiological Hazards

When radiological hazards are known or suspected, workplace monitoring shall be performed as necessary to ensure that exposures are within the requirements of DOE Order 5480.11 and are as low as reasonably achievable (ALARA) (DOE 1990, 0732). Workplace monitoring consists of monitoring for airborne radioactivity, external radiation fields, and surface contamination. The Laboratory's workplace monitoring program is described in AR 3-7, Radiation Exposure Control. The success of the monitoring program in controlling exposures is measured by the personnel dosimetry and bioassay programs. Chapter 3, Part 7, of the DOE Radiological Control Manual provides additional guidelines for radiological control during construction and restoration projects (DOE 1992, 17-838). All monitoring instruments shall meet the Laboratory's requirements for sensitivity, calibration, and quality assurance. In addition, all monitoring shall be carried out in accordance with approved procedures.

8.3.1 Airborne Radioactivity Monitoring

Air monitoring shall be performed in occupied areas with the potential for airborne radioactivity. Air monitoring may include the use of portable high and low volume samplers, continuous air monitors, and personnel breathing zone samplers. In areas where concentrations are likely to exceed 10% of any derived air concentration listed in DOE Order 5480.11, real-time continuous air monitoring shall be provided. Action levels based on air monitoring results shall be established to increase dust suppression activities, upgrade PPE, or stop work (DOE 1990, 0732).

8.3.2 Area Monitoring for External Radiation Fields

Area monitoring for external radiation fields shall be carried out with portable survey instruments capable of measuring a wide range of beta/gamma dose rates. In areas where dose rates above a preset action level are expected, the monitoring should be continuous. Additional action levels shall be established based on external radiation monitoring results.

8.3.3 Monitoring for Surface Contamination

Area monitoring for surface contamination during operations shall be conducted whenever a new surface is uncovered in a suspected radioactively-contaminated area (i.e., the levels may exceed the surface contamination limits in DOE Order 5480.11 (DOE 1990, 0732). Personnel and equipment shall be monitored whenever there is reason to suspect contamination and upon exit from a suspected radioactively-contaminated area. Action levels for decontamination shall be established.

8.3.4 Personnel Monitoring for External Exposure

Personnel dosimetry shall be provided to OU workers who have the potential to exceed any one of the following annual doses from external sources (in accordance with DOE Order 5480.11) (DOE 1990, 0732):

- 100 mrem (0.001 sievert) annual effective dose equivalent to the whole body
- 5 rem (0.05 sievert) annual dose equivalent to the skin
- 5 rem (0.05 sievert) annual dose equivalent to any extremity
- 1.5 rem (0.015 sievert) annual dose equivalent to the lens of the eye

Normally, workers meeting the above criteria will be monitored with thermoluminescent dosimeters (TLDs). TLDs shall either be provided by the Laboratory or shall meet DOE requirements if provided by the subcontractor. Section 10.0 discusses personnel monitoring for internal exposure.

8.3.5 ALARA Program

ALARA considerations in the workplace are best served by near real-time knowledge of personnel exposures and frequent workplace monitoring to establish adequate administrative control of exposure conditions. Consequently, for the OU site projects, ALARA efforts consist of two integrated approaches described in the following sections.

8.3.5.1 Workplace ALARA Efforts

Judicious application of basic time, distance, and physical controls, as well as PPE principles, will be used to limit exposures to ALARA levels. To verify that established control is adequate, workplace monitoring for radioactive materials and field instrument detectable chemicals will be conducted in direct proportion to expected and/or observed levels of exposure. Activities that result in unexpectedly high potential exposures will be terminated until provisions that permit work to proceed in acceptable ALARA fashion are made.

8.3.5.2 Programmatic ALARA Efforts

External and internal exposures of record are comprised of TLD badge data and bioassay data, respectively. Field dose calculation, direct-reading pocket meters, and event-based lapel air sampling data are used to maintain estimates of personnel exposures to both radioactive materials and hazardous chemicals. These estimates are correlated with job-specific activities (work location and work category) and individual-specific activities (job function).

Periodic reviews of personnel exposure estimates are conducted to identify unfavorable trends and unexpectedly high potential exposures. Activities that indicate unfavorable trends will be investigated, and recommendations will be made for additional appropriate administrative and/or physical controls.

All unfavorable trends and unexpectedly high potential exposures must be reported to the HSPL, who will make recommendations for corrective action.

9.0 MEDICAL SURVEILLANCE AND MONITORING

9.1 General Requirements

A medical surveillance program shall be instituted to assess and monitor the health and fitness of workers engaged in hazardous waste operations. Medical surveillance is required for personnel who are or may be exposed to hazardous substances at or above established PELs for 30 days in a 12-month period as detailed in 29 CFR 1910.120 (OSHA 1991, 0610). Medical surveillance is also required for personnel with duties that require the use of respirators or with symptoms indicating possible overexposure to hazardous substances.

Contractors are responsible for medical surveillance of their employees. The Health and Safety Division will audit contractor programs.

9.2 Medical Surveillance Program

All field team members who participate in ER Program investigations shall participate in a medical surveillance program. The program shall conform to DOE Order 5480.10 (DOE 1985, 0062), 29 CFR 1910.120 (OSHA 1991, 0610), AR 2-1, and any criteria established by the Laboratory's Occupational Medicine Group (HS-2). The program shall provide for initial medical evaluations to determine fitness for duty and subsequent medical surveillance of persons engaged in hazardous waste operations. At a minimum, the program shall include the following.

- **Surveillance.** An occupational and medical history, a baseline exam prior to employment, periodic medical exams, and termination exams shall be included. The frequency of medical exams may vary because of the exposure potential at hazardous waste sites. The frequency of exams will be determined by the physician.

- **Treatment**. Immediate consultation shall be made available to any employee who develops signs or symptoms of exposure or who has been exposed at or above PELs in an uncontrolled or emergency situation.

- **Recordkeeping**. All medical records are considered confidential information. This information will be maintained by the physician and will not be released to any person without written authorization from the employee.

- **Program review.** Contractor and subcontractor personnel shall provide a medical surveillance program for their hazardous waste workers. Contractors must provide adequate documentation that their program complies with all applicable standards, DOE orders, and Laboratory requirements. This documentation must be submitted for review and approval before work begins. Line management is responsible for identifying employees for inclusion in the surveillance program.

  For Laboratory employees, HS-2 determines the level of participation in the medical surveillance program. To initiate the process of enrolling workers in medical surveillance, line managers must complete Form 1492, "Hazardous Waste or Emergency Response Worker Surveillance Questionnaire." The completed form is then sent to HS-2: 1) prior to assignment of duties as a hazardous waste worker; 2) annually thereafter, as long as these duties continue; and, 3) at reassignment or termination of duties.

9.2.1 Medical Surveillance Exams

AR 2-1 from the Laboratory's ES&H Manual specifies that medical surveillance examinations are required for employees who work with asbestos, beryllium, carcinogens, hazardous waste, high noise, lasers, and other appropriate categories. As specified above, Laboratory employees who work with hazardous waste must undergo periodic special examinations by HS-2.

The content and frequency of medical exams is dependent on site conditions, current and expected exposures, job tasks, and medical history of the workers.

9.2.2 Certification Exams

In addition to the above medical surveillance requirements, medical certification is required for employees whose work assignments include respirator use, Level A chemical PC, and/or operation of cranes and heavy equipment. To become certified and maintain certification, medical evaluations as specified by HS-2 are required.

9.3 Fitness for Duty

The examining physician shall provide a report to the OUPL indicating:

- approval to work on hazardous waste sites,
- approval to wear respiratory protective equipment, and,
- a statement of work restrictions.

This fitness for duty determination will be made for each site worker.

9.4 Emergency Treatment

In the event of an on-the-job injury, HS-2 will implement required reporting and recordkeeping procedures. Section 12.0 describes the actions to be taken by the employee at the time of the injury/illness.

9.5 Records

An accurate record of medical surveillance shall be retained by the physician for 30 years as specified in 29 CFR 1910.20. Access to employee exposure and medical records will be controlled in accordance with 29 CFR 1910.20 (OSHA 1991, 0610).

HS-2 maintains medical histories of all Laboratory personnel. Documentation of the contractor's individual medical histories are retained by the contractor's physician. In addition, as HS-2 reviews and approves the contractor's medical surveillance programs, those written approvals are maintained by HS-2 and the contractor's physician.

10.0 BIOASSAY PROGRAM

The OU site field characterization efforts will include intrusive investigations of areas of unknown but highly probable contamination potential. Given the uncertainties associated with this type of fieldwork, the project internal exposure monitoring program is based on the assumption that personnel will be exposed to significant quantities of radioactive and/or hazardous chemical contaminants. Accordingly, the project internal dosimetry program will be conducted in accordance with the provisions of the Health Physics Group (HS-12). These provisions are outlined in the following sections. Monitoring and control of internal contamination from hazardous chemical contaminants is included in the medical surveillance program.

10.1 Baseline Bioassays

Individuals who are assigned to field activities or who have reason to visit or inspect field activities are assigned one of the following job categories:

I. Work involving full-time on-site activities.

II. Work involving support activities (e.g., supervision or inspection).

III. Work involving routine or frequent visits (e.g., observing, auditing).

IV. Work involving nonroutine or infrequent visits (e.g., management observations).

All such individuals (except individuals in Category IV) must submit urine samples and submit to whole body counting prior to participation in field activities. The baseline urine samples are analyzed for the solubility Class D and Class W compounds that could reasonably be expected to be encountered at the Laboratory. Whole body counting analyzes for the gamma-emitting radionuclides that could reasonably be expected to be encountered at the Laboratory.

Results of the baseline bioassay analyses are evaluated by the health physics specialist for evidence of previous exposure. Individuals exhibiting evidence of previous internal contamination will not be permitted to enter OU sites until an evaluation of the previous exposure indicates that additional, planned radiation exposure will not result in doses in excess of applicable regulatory limits. This evaluation may include additional, rigorous sampling and/or counting to establish the physical and temporal parameters necessary to adequately assess the committed effective dose equivalent.

10.2 Routine Bioassays

The routine bioassay program is used as a measure of the effectiveness of the respiratory protection program. As such, the bioassay frequency will be a function of potential exposure to airborne radioactive materials and will be determined by the health physics specialist.

Evidence of inadequate respiratory protection will be cause for an investigation of the responsible field operation(s). The ER Program Manager is responsible for investigating and identifying probable causes of the respiratory protection program failure and for recommending corrective actions.

11.0 DECONTAMINATION

11.1 Introduction

Decontamination is the process of removing or neutralizing contaminants that have accumulated on personnel or equipment and is critical to health and safety at hazardous waste sites. Decontamination protects workers from hazardous substances that may contaminate and eventually permeate the PC, respiratory equipment, tools, vehicles, and other equipment used on site. Decontamination protects all site personnel by minimizing the transfer of harmful materials to clean areas; helps prevent mixing of incompatible chemicals; and protects the community by preventing uncontrolled transportation of contaminants from the site.

All personnel and equipment exiting an exclusion zone will be monitored to detect possible contamination. Monitoring will verify that all personnel and equipment are free of significant contamination prior to exiting the exclusion zone. Personnel monitoring shall be performed in accordance with Health and Safety Division requirements.

If monitoring indicates that an employee is contaminated with chemicals, biological agents, or radioactive materials, the employee's immediate supervisor shall notify the SSO, who shall record the details of the incident, determine whether any personal injury is involved, notify the OUPL and HSPL when necessary, and initiate decontamination. All contamination incidents shall be reported immediately following the Occurrence Reporting Program requirements to ensure that prompt procedural notifications and appropriate emergency response actions are taken.

11.1.1 Site Decontamination Plan

A site decontamination plan is mandatory. The site decontamination plan shall be part of the SSHSP and must include:

- the number and layout of decontamination stations,
- the decontamination equipment needed,
- appropriate decontamination methods,
- procedures to prevent contamination of clean areas,
- methods and procedures to minimize worker contact with contaminants during removal of personal PC, and
- methods for disposing of clothing and equipment that are not completely decontaminated.

The plan should be revised whenever the type of personal PC or equipment changes, the site conditions change, or the site hazards are re-assessed based on new information.

11.1.2 Facilities

The SSO will verify that decontamination facilities are maintained in acceptable condition and that supplies of decontaminating agents and other materials are available. Personnel decontamination facilities shall be equipped with showers, clean work clothing, decontamination agents, and, when necessary, a decontamination area where Health and Safety Division personnel can assist in decontaminating individuals. All wash solutions shall be retained for appropriate disposal. Clean areas shall be separate from contaminated areas and materials.

11.1.3 General Decontamination Methods

The details of decontamination techniques shall be included in the site decontamination plan (Subsection 11.1.1). The following are some decontamination methods.

Removal

- Contaminant removal
  - water rinse using pressurized or gravity flow
  - chemical leaching and extraction
  - evaporation/vaporization
  - pressurized air jets
  - scrubbing/scraping (using brushes, scrapers, or sponges and water-compatible solvent cleaning solutions)
  - steam jets
- Removal of contaminated surfaces
  - disposal of deeply-permeated materials (e.g., clothing, floor mats, and seats)
  - disposal of protective coverings/coatings

Inactivation

- Chemical detoxification
  - halogen stripping
  - neutralization
  - oxidation/reduction
  - thermal degradation
- Disinfection/sterilization
  - chemical disinfection
  - dry heat sterilization
  - gas/vapor sterilization
  - irradiation
  - team sterilization

11.1.3.1 Physical Removal

In many cases, gross contamination can be removed by dislodging/ displacement, rinsing, wiping, and evaporation. Physical methods involving high pressure and/or heat should be used only as necessary and with caution because they can spread contamination and cause burns. Contaminants that can be removed by physical means can be categorized as follows.

- **Loose contaminants.** Dusts and vapors that cling to equipment and workers or become trapped in small openings, such as the weave of clothing fabrics, can be removed with water or a liquid rinse. Removal of electrostatically-attached materials can be enhanced by coating the clothing or equipment with antistatic solutions. These are available commercially as wash additives or antistatic sprays.

- **Adhering contaminants.** Some contaminants adhere by forces other than electrostatic attraction. Adhesive qualities vary greatly with the specific contaminants and temperature. For example, contaminants such as glues, cements, resins, and muds have much greater adhesive properties than elemental mercury, and consequently are difficult to remove by physical means. Physical removal methods for gross contaminants include scraping, brushing, and wiping. Removal of adhesive contaminants can be enhanced through certain methods such as solidifying, freezing (e.g., using dry ice or ice water), adsorption or absorption (e.g., with powdered lime or ground clay), or melting.

- **Volatile liquids**. Volatile liquid contaminants can be removed from PC or equipment by evaporation followed by a water rinse. Evaporation of volatile liquids can be enhanced by using steam jets. With any evaporation or vaporization process, care must be taken to prevent worker inhalation of the vaporized chemicals.

11.1.3.2 Chemical Removal

Physical removal of gross contamination should be followed by a wash/ rinse process using cleaning solutions. These cleaning solutions normally use one or more of the following methods.

- **Dissolving contaminants**. Chemical removal of surface contaminants can be accomplished by dissolving them in a solvent. The solvent must be chemically compatible with the equipment being cleaned. This is particularly important when decontaminating personal PC. In addition, care must be taken in selecting, using, and disposing of any organic solvents that may be flammable or potentially toxic. Organic solvents include alcohols, ethers, ketones, aromatics, straight-chain alkanes, and common petroleum products.

  Halogenated solvents are generally incompatible with PPE and are toxic. They should only be used for decontamination in extreme cases, when other cleaning agents will not remove the contaminant.

Table III-9 provides a general guide to the solubility of several contaminants in four types of solvents: water, dilute acids, dilute bases, and organic solvents. Because of the potential hazards, decontamination using chemicals should only be performed if recommended by an industrial hygienist or other qualified health professional.

TABLE III-9

GENERAL GUIDE TO CONTAMINANT SOLUBILITY

SOLVENT	SOLUBLE CONTAMINANTS
Water	Low-chain hydrocarbons, inorganic compounds, salts, some organic acids and other polar compounds
Dilute acids	Basic (caustic) compounds, amines, hydrazines
Dilute bases detergent soap	Acidic compounds, phenols, thiols, some nitro and sulfonic compounds
Organic solvents[a] alcohols ethers ketones aromatics straight-chain alkanes (e.g., hexane) common petroleum products (e.g., fuel oil, kerosene)	Nonpolar compounds (e.g., some organic compounds)

[a]WARNING: Some organic solvents can permeate and/or degrade protective clothing.

- **Surfactants**. Surfactants augment physical cleaning methods by reducing adhesion forces between contaminants and the surface being cleaned, and by preventing redeposit of the contaminants. Household detergents are among the most common surfactants. Some detergents can be used with organic solvents to improve the dissolving and dispersal of contaminants into the solvent.

- **Solidification.** Solidifying liquid or gel contaminants can enhance their physical removal. The mechanisms of solidification are: 1) moisture removal through the use of adsorbents such as ground clay or powdered lime; 2) chemical reactions via polymerization catalysts and chemical reagents; and, 3) freezing using ice water.

- **Rinsing.** Rinsing removes contaminants through dilution, physical attraction, and solubilization. Multiple rinses with clean solutions remove more contaminants than a single rinse with the same volume of solution. Continuous rinsing with large volumes will remove even more contaminants than multiple rinsings with a lesser total volume.

- **Disinfection/Sterilization.** Chemical disinfectants are a practical means of inactivating infectious agents. Unfortunately, standard sterilization techniques are generally impractical for large equipment and for personal PC and equipment. For this reason, disposable PPE is recommended for use with infectious agents.

Many factors such as cost, availability, and ease of implementation influence the selection of a decontamination method. From a health and safety standpoint, two key questions must be addressed:

- Is the decontamination method effective for the specific substances present?

- Does the method itself pose any health or safety hazards?

11.1.4 Emergency Decontamination

In the event of personnel contamination with highly caustic, strongly acidic, and/or high levels of radioactive materials (100 mrad/hour), emergency shower facilities shall be used as a first level decontamination. These facilities shall be adequate to treat a minimum of two contaminated individuals at one time. Appropriate medical and radiation safety personnel will be relied upon to assist as needed. These facilities shall be used in accordance with Health and Safety Division requirements.

11.2 Personnel

All personnel leaving the exclusion zone of a site must be decontaminated to remove any harmful chemicals or infectious organisms that may have adhered to them. Decontamination methods 1) physically remove contaminants; 2) inactivate contaminants by chemical detoxification or disinfection/sterilization; or, 3) remove contaminants by a combination of both physical and chemical means.

The SSO is responsible for enforcing the decontamination plan.

11.2.1 Radiological Decontamination

Personnel exiting contamination areas, high contamination areas, airborne radioactivity areas, or radiological buffer areas established for contamination control shall be frisked for contamination. This does not apply to personnel exiting areas containing only radionuclides, such as tritium, that cannot be detected using hand-held or automatic frisking equipment.

Monitoring for contamination should be performed using frisking equipment that under laboratory conditions can detect total contamination of at least the values specified in Table III-10. Use of automatic monitoring units that meet the above requirements is encouraged.

Personnel found with detectable contamination on their skin or personal clothing, other than inert gases or natural background radioactivity, should be promptly decontaminated.

11.2.2 Chemical Decontamination

The decontamination of chemically-contaminated personnel will be detailed in the site decontamination plan. Subsection 11.1.3 provides guidance on chemical decontamination.

11.3 Equipment Decontamination

11.3.1 Responsibilities and Authorities

The SSO is responsible for ensuring that tools and equipment are surveyed for contamination before they are removed from the site. The SSO is also responsible for ensuring that tools and equipment are decontaminated to acceptable levels prior to release for unrestricted use.

TABLE III-10

SUMMARY OF CONTAMINATION VALUES

NUCLIDE[a]	REMOVABLE (dpm/100 cm ^{2})[b,c]	TOTAL (FIXED + REMOVABLE) (dpm/100 cm ^{2})
Natural uranium, uranium-235, uranium-238, and associated decay products	1 000 alpha	5 000 alpha
Transuranics, radium-226, radium-228, thorium-230, thorium-228, protactinium-231, actinium-227, iodine-125, and iodine-129	20	500
Natural thorium, thorium-232, strontium-90, radium-223, radium-224, uranium-232, iodine-126, iodine-131, and iodine-133	200	1 000
Beta-gamma emitters (nuclides with decay modes other than alpha emission or spontaneous fission) except strontium-90 and others noted above (includes mixed fission products containing strontium-90)	1 000 beta-gamma	5 000 beta-gamma
Tritium organic compounds, surfaces contaminated by HT, HTO, and metal tritide aerosols	10 000	10 000

[a] The values in this table apply to radioactive contamination deposited on, but not incorporated into, the interior of the contaminated item. Where contamination by both alpha- and beta-gamma-emitting nuclides exists, the limits established for the alpha- and beta-gamma-emitting nuclides apply independently.

[b] The amount of removable radioactive material per 100 cm ^{2} of surface area should be determined by swiping the area with dry filter or soft absorbent paper while applying moderate pressure and then assessing the amount of radioactive material on the swipe with an appropriate instrument of known efficiency. For objects with a surface area less than 100 cm ^{2}, the entire surface should be swiped and the activity per unit area should be based on the actual surface area. Except for transuranics, radium-228, actinum-227, thorium-228, thorium-230, protactinium-231, and alpha emitters, it is not necessary to use swiping techniques to measure removable contamination levels if direct scan surveys indicate that the total residual contamination levels are below the values for removable contamination.

[c] The levels may be averaged over 1 m ^{2} provided the *maximum activity* in any area of 100 cm ^{2} is less than three times the guide values.

11.3.2 Facilities

Prior to release from the site, tools and equipment contaminated with removable radioactive and chemical materials in excess of applicable limits will be manually decontaminated at the field location.

Tools and equipment that cannot be field decontaminated to below applicable limits may be appropriately packaged and removed to a decontamination facility. Transportation of contaminated tools or equipment off site must be approved by the HSPL.

11.3.3 Radiological

A surface shall be considered contaminated if either the removable or total radioactivity is detected above the levels in Table III-10. If an area cannot be decontaminated promptly, it shall be posted as specified in Article 2235 of the DOE Radiological Control Manual (DOE 1992, 17-838).

Surfaces exceeding the values of Table III-10 for total contamination may be covered with a fixative coating to prevent the spread of contamination. However, reasonable efforts should be made to decontaminate an area before a coating is applied. A fixative coating shall not be applied without the approval of the radiological control manager.

11.3.4 Chemical

Chemical decontamination is performed in accordance with the product labels. Random sampling and analysis of final rinse solutions may be performed to check the effectiveness of the decontamination procedures.

11.4 Waste Management

Fluids and materials resulting from decontamination processes will be contained, sampled, and analyzed for contaminants. Those materials determined to be contaminated in excess of appropriate limits are packaged in approved containers and disposed of in accordance with EM Division procedures.

12.0 EMERGENCIES

12.1 Introduction

Emergency response, as defined by OSHA regulation 29 CFR 1910.120, will be handled by Laboratory personnel (OSHA 1991, 0610). ER contractors are responsible for developing and implementing their own emergency action plans as defined in OSHA regulation 29 CFR 1910.38a.

12.2 Emergency Action Plan

An emergency action plan provides emergency information for contingencies that may arise during the course of field operations. The plan provides site personnel with instructions in the appropriate sequence of responses in the event of either site emergencies or non-site emergencies. The following elements, at a minimum, shall be included in the written plan:

- emergency escape procedures and emergency escape routes,
- procedures to be followed by personnel who remain to operate critical equipment before they evacuate,
- procedures to account for all employees after evacuation,
- rescue and medical duties for those who are to perform them,
- names of those who can be contacted for additional information on this plan,
- alarm system that conforms with 29 CFR 1910.165,
- types of evacuation to be used,
- training to assist in evacuation,
- dissemination of an emergency action plan to employees initially and whenever the plan changes, and,
- agreement with local medical facilities to treat injuries/ illnesses.

12.3 Emergency Response Plan

This subsection describes the emergency response plan, contingency plans for specific types of emergencies, actions required by the Laboratory in the event of a release of radioactive and/or toxic materials, and requirements for notification and documentation of emergencies. Additional references for this section include AR 1-1, Accident/Incident Reporting; AR 1-2, Emergency Preparedness; AR 1-8, Working Alone; and Technical Bulletin (TB) 101, Emergency Preparedness.

The SSO, with assistance from the field team leader, will have the responsibility and authority for coordinating all emergency response activities until the proper authorities arrive and assume control. A copy of the emergency response plan will be available at the site at all times, and all personnel working at the site will be familiar with the plan.

The following subsections describe the elements of the emergency response plan for this OU. The detailed plan will be included in the SSHSP.

12.3.1 Emergency Contacts

The names of persons and services to contact in case of emergency will be provided in the SSHSPs. This emergency contact form will be completed by the SSO before fieldwork begins and will be copied and posted at the site in prominent locations. Two-way radio communication will be maintained at remote sites when possible.

12.3.2 Site Map

A copy of the site map will be modified to indicate the following areas of importance in the emergency response plan:

- hazardous areas (especially potential IDLH atmospheres),
- site terrain (topography, buildings, barriers),
- site accessibility by road and air (indicating current detours),
- work zones/work crew locations,
- surrounding population/environment,
- shelters and muster areas, and,
- evacuation routes.

Current maps of evacuation and emergency facilities will be included in the SSHSPs and will be posted on site at conspicuous locations.

12.3.3 Site Security and Control

In an emergency, the field team leader (or a designee) is responsible for controlling the entry of personnel into hazardous areas and accounting for all individuals on site. Depending on the nature and size of the area, a checkpoint will be established in advance. The buddy system will remain in effect at all times for on-site personnel. If a security problem occurs, one short blast will be sounded from an air horn, and field team members will remain in place to await instructions from personnel responsible for security.

12.3.4 Communications

Internal communication refers to communication between field team members. The objectives of internal communication are to alert workers to danger, convey safety information, and maintain site control. Routine communications will depend on the area represented by the work zones and the tasks associated with that area. Where there is substantial distance between the workers providing support and the workers conducting sampling activities, two-way radio communication will be employed. A set of predetermined hand signals will be used if radio communication fails. This contingency is especially important for workers wearing Levels A, B, and C protective equipment.

Emergency communication will also be established for the site. Three long blasts from an air horn will notify field team members of the following conditions:

- major fire,
- major release of hazardous substances,
- minor fire or release, or
- security problem.

A description of all signals will be posted at the site in a prominent location.

External communication will be necessary to request assistance or to notify the authorities about hazardous conditions that may impact public or environmental safety. The names and phone numbers of contacts will be posted in a prominent location. A cellular telephone will be available on site. All site personnel must be informed of its location.

Communication protocols will be explained at the daily tailgate safety meetings and reviewed at least once a week for the duration of sampling activities.

12.3.5 Evacuation Routes and Procedures

If a fire, explosion, or release of potentially hazardous materials occurs, field team members may need to retreat to a muster area or evacuate the site. Procedures for evacuation will depend on the nature and size of the area under investigation. Field team members will assemble at a predesignated muster site if an evacuation is necessary.

If the area is relatively small and/or unconstrained, field team members will be able to exit the exclusion zone at the most convenient point, preferably in the upwind direction. Areas that are expected to be safe will be indicated on the site map. At sites in which a relatively large exclusion zone exists or in areas that are constrained in some way (e.g., surrounded by a fence, located within a trench, bordered by steep cliffs), evacuation routes will be established in advance and illustrated on the site map. In either case, all field team members will report to a designated checkpoint to be accounted for by the field team leader. All field team members will be informed of the evacuation procedures.

12.3.6 Emergency Equipment and Supplies

The SSO (or designee) will be responsible for maintaining emergency equipment and for restocking supplies. The type and amount of emergency equipment will be selected on the basis of the potential hazards.

12.4 Specific Emergencies

12.4.1 Fire/Explosion

For fires or explosions, evacuation will be signaled by three long blasts. Field team members will report to a specified location (such as evacuation vehicles) and proceed away from the fire. Field team members will meet and be counted at a designated muster area. One individual will locate the nearest telephone at a safe distance and call the Los Alamos County Fire Department at 911. If an explosion occurs, all personnel will be evacuated and no one will re-enter the work area until it has been cleared by Laboratory explosives safety personnel.

12.4.2 Radiation/Chemical Exposures

A release of potentially hazardous materials will be indicated by three long blasts. All personnel will assemble at the designated muster area and be counted by the field team leader (or a designee). The SSO will issue further instructions.

Three long blasts will alert field team members to a major release involving hazardous or radioactive materials. Field team members will meet at a predetermined muster area on the basis of wind direction. A portable wind sock or streamer will be positioned at each site. If the source of the release is directly upwind, field team members will move to the exit and away from the plume. Once the team achieves a safe distance, the field team leader and SSO will account for all site personnel. The SSO will determine a further course of action.

Exposure to radiation and/or chemicals will be reported to HS-2. The Los Alamos County Medical Center will be notified of life-threatening or serious exposures.

12.4.3 Injuries

Trained personnel may treat minor injuries on site. Seriously injured victims will be transported to a medical facility as soon as possible. The Los Alamos County Fire Department provides emergency transport services.

If an injured person has been contaminated with chemicals, decontamination will be performed only if it will not aggravate the injury. Emergency decontamination is discussed in Section 11.0.

12.4.4 Vehicle Accidents/Property Damage

In addition to the required police report, a vehicle accident report must be filed in accordance with DOE. These requirements are described in Subsection 10.4. Injuries incurred in an accident will be treated in the manner described in Section 11.0.

12.5 Provisions for Public Health and Safety

Emergency planning is presented in the Laboratory's ES&H Manual (LANL 1990, 0335). The Laboratory identifies four situations in which hazardous materials may be released into the environment. These categories are founded in part on Emergency Response Planning Guideline (ERPG) concentrations developed by the American Industrial Hygiene Association and on the basis of the maximum concentration of toxic material that can be tolerated for up to one hour.

The types of emergencies are defined as follows.

- **Unusual Event**. An event that has occurred or is in progress that normally would not be considered an emergency but that could reduce the safety of the facility. No potential exists for significant releases of radioactive or toxic materials off site.

- **Site Alert**. An event that has occurred or is in progress that would substantially reduce the safety level of the facility. Off-site releases of toxic materials are not expected to exceed the concentrations defined in ERPG-1.

- **Site Emergency**. An event that has occurred or is in progress that involves actual or likely major failures of facility functions necessary for the protection of human health and the environment. Releases of toxic materials to off-site areas may exceed the concentrations described in ERPG-2.

- **General Emergency**. An event that has occurred or is in progress that substantially interferes with the functioning of facility safety systems. Releases of radioactive materials to areas off site may exceed protective response recommendations, and toxic materials may exceed ERPG-3.

12.6 Notification Requirements

Field team members will notify the SSO of emergency situations, who will notify emergency assistance personnel (e.g., fire department, police, and ambulance), the OUPL, the HSPL, the Laboratory Health and Safety Division

Office according to DOE Order 5500.2B (DOE 1991, 0736), and DOE Albuquerque Field Operations Office (AL) Order 5000.3 (DOE/AL 1986, 0734). The Laboratory Health and Safety Division Office is responsible for implementing notification and reporting requirements according to DOE Order 5484.1, Change 7 (DOE 1990, 0733).

12.7 Documentation

An unusual occurrence is any deviation from the planned or expected behavior or course of events in connection with any DOE or DOE-controlled operation if the deviation has environmental, safety, or health protection significance. Examples of unusual occurrences include any substantial degradation of a barrier designed to contain radioactive or toxic materials, or any substantial release of radioactive or toxic materials.

The Laboratory principal investigator will submit a completed DOE Form F 5484.X for any of the following accidents and incidents, according to Laboratory AR 1-1.

- **Occupational Injury.** An injury such as a cut, fracture, sprain, or amputation that results from a work accident or from an exposure involving a single incident in the work environment. Note: *Conditions resulting from animal* bites, such as insect or snake bites, or from one-time exposure to chemicals, are considered injuries.

- **Occupational Illness.** Any abnormal condition or disorder, other than one resulting from an occupational injury, caused by exposure to environmental factors associated with employment. It includes acute and chronic illnesses or diseases that may be caused by inhalation, absorption, ingestion, or direct contact with a toxic material.

- **Property Damage Losses of $1,000 or More.** Regardless of fault, accidents that cause damage to DOE property or accidents wherein DOE may be liable for damage to a second party are reportable where damage is $1,000 or more including damage to facilities, inventories, equipment, and properly parked motor vehicles but excluding damage resulting from a DOE-reported vehicle accident.

- **Government Motor-Vehicle Accidents With Damages of $150 or More or Involving an Injury.** Unless the government vehicle is not at fault or the occupants are uninjured. Accidents are also reportable to DOE if:

  damage to a government vehicle not properly parked is greater than or equal to $250;

  damage to DOE property is greater than or equal to $500, and the driver of a government vehicle is at fault;

  damage to any private property or vehicle is greater than or equal to $250, and the driver of a government vehicle is at fault; or,

  any person is injured, and the driver of a government vehicle is at fault.

The HSPL will work with the OUPL and the field team leader to ensure that health and safety records are maintained with the appropriate Laboratory group, as required by DOE orders. The reports are as follows:

- DOE-AL Order 5000.3, Unusual Occurrence Reporting System (DOE/AL 1986, 0734)
- DOE Form 5484.3, Supplementary Record of Occupational Injuries and Illnesses, DOE Order 5484.1, Change 7 (DOE 1990, 0733)
- DOE Form 5484.4, Tabulation of Property Damage Experience, Attachment 2, DOE Order 5484.1, Change 7 (DOE 1990, 0733)
- DOE Form 5484.5, Report of Property Damage or Loss, Attachment 4, DOE Order 5484.1, Change 7 (DOE 1990, 0733)
- DOE Form 5484.6, Annual Summary of Exposures Resulting in Internal Body Depositions of Radioactive

Materials, DOE Order 5484.1, Change 7 (DOE 1990, 0733)

- DOE Form 5484.8, Termination Occupational Exposure Report, Attachment 10, DOE Order 5484.1, Change 7 (DOE 1990, 0733)
- DOE Form OSHA-200, Log of Occupational Injuries and Illnesses, Attachment 7, DOE Order 5484.1, Change 7 (DOE 1990, 0733)
- DOE Form EV-102A, Summary of DOE and DOE Contractor Occupational Injuries and Illnesses, Attachment 8, DOE Order 5484.1, Change 7 (DOE 1990, 0733)
- DOE Form F5821.1, Radioactive Effluent/On-site Discharges/Unplanned releases; Attachment 12, DOE Order 5484.1, Change 7 (DOE 1990, 0733)

Copies of these reports will be stored with the appropriate Laboratory group. Specific reporting responsibilities are given in Chapter 1, General Administrative Requirements, of the Laboratory ES&H Manual (LANL 1990, 0335).

13.0 PERSONNEL TRAINING

13.1 General Employee Training and Site Orientation

All Laboratory employees and contractors must successfully complete Laboratory general employee training (GET). GET training is performed by the Health and Safety Division and is offered weekly. The OUPL is responsible for scheduling GET training for contractors.

13.2 Visitors

Visitors to the site shall receive a safety briefing by the SSO. Visitors should not be permitted in the exclusion zone unless they have been trained, fit-tested, and medically approved for respirator use. Other visitors may not enter the exclusion zone. They may observe site conditions from the clean area using binoculars, for example.

13.3 OSHA Requirements

The OSHA HAZWOPER standard (29 CFR 1910.120) regulates the health and safety of employees involved in hazardous waste operations (OSHA 1991, 0610). This standard requires training commensurate with the level and function of the employee. Persons shall not participate in field activities until they have been trained to a level required by their job function and responsibility. The SSO is responsible for ensuring that all persons entering the exclusion zone are properly trained.

13.3.1 Pre-Assignment Training

At the time of job assignment, all general site workers shall receive a minimum of 40 hours of initial instruction off site and a minimum of three days of actual field experience under the direct supervision of a trained, experienced supervisor. Occasional site workers shall receive a minimum of 24 hours of initial instruction. Workers who may be exposed to unique or special hazards shall be provided additional training. The level of training provided shall be consistent with an employee's job function and responsibilities.

13.3.2 On-Site Management and Supervisors

On-site management and supervisors directly responsible for, or who supervise, employees engaged in hazardous waste operations shall receive training as provided in Subsection 13.3.1 and at least 8 hours of specialized training on managing such operations at the time of job assignment.

13.3.3 Annual Refresher

All persons identified in Subsections 13.3.1 and 13.3.2 shall receive 8 hours of refresher training annually.

13.3.4 Emergency Response Personnel

Persons responsible for responding to hazardous emergency situations that may expose them to hazardous substances shall be trained on how to respond to expected emergencies.

13.3.5 Site-Specific Training

Prior to granting site access, personnel must be given site-specific training. Attendance and understanding of the site-specific training must be documented. A weekly health and safety briefing and periodic training (as warranted) will be given. Training should include the topics indicated in Table III-11 in accordance with 29 CFR 1910.120 (i)(2)(ii) (OSHA 1991, 0610).

13.4 Radiation Safety Training

Basic radiation worker training is required for all radiation workers: 1) whose job assignments involve operation of radiation-producing devices; 2) who work with radioactive materials; 3) who are likely to be routinely occupationally exposed above 0.1 rem (0.001 sievert) per year; or, 4) who require unescorted entry into a radiological area. This training is a 4-hour extension to GET for new employees.

Radiation protection training is required for all Laboratory employees, contractors, visiting scientists, and DOE and Department of Defense personnel. This is a one-hour presentation as part of GET.

13.5 Hazard Communication

Laboratory employees shall be trained in accordance with Health and Safety Division requirements. Contractors shall provide training to their employees in compliance with 29 CFR 1910.120 (OSHA 1991, 0610).

13.6 High Explosives Training

At PRSs where high explosives are known or suspected to be present, additional safety training may be required.

13.7 Site-Specific Training

Site-specific training will be provided to all personnel working at the site. Daily tailgate safety meetings will be used to update workers about changes in the OUHSP and to reinforce knowledge of safe work practices.

TABLE III-11

TRAINING TOPICS

INITIAL SITE-SPECIFIC	WEEKLY	PERIODIC AS WARRANTED	TOPIC
X		X	Site health and safety plan, 29 CFR 1910.120(e)(1)
X		X	Site characterization and analysis, 29 CFR 1910.120(i)
X		X	Chemical hazards, Table 1
X		X	Physical hazards, Table 2
X		X	Medical surveillance requirements, 29 CFR 1910.120(f)
X	X		Symptoms of overexposure to hazards, 29 CFR 1910.120(e)(1)(vi)
X		X	Site control, 29 CFR 1910.120(d)
X		X	Training requirements, 29 CFR 1910.120(e)
X	X	X	Engineering and work practice controls, 29 CFR 1910.120(g)
X	X	X	Personal protective equipment, 29 CFR 1910.120(g), 29 CFR 1910.134
X	X	X	Respiratory protection, 29 CFR 1910.120(g), 29 CFR 1910.134, ANSI Z88.2-1980
X		X	Overhead and underground utilities
X	X	X	Scaffolding, 29 CFR 1910.28(a)
X	X		Heavy machinery safety
X		X	Forklifts, 29 CFR 1910.27(d)
X		X	Tools
X		X	Backhoes, front-end loaders
X		X	Other equipment used at site
X		X	Pressurized gas cylinders, 29 CFR 1910.101(b)
X	X	X	Decontamination, 29 CFR 1910.120(k)
X		X	Air monitoring, 29 CFR 1910.120(h)
X		X	Emergency response plan, 29 CFR 1910.120(l)
X	X		Handling drums and other containers, 29 CFR 1910.120(j)
X		X	Radioactive wastes
X		X	Explosive wastes
X		X	Shock sensitive wastes
X		X	Flammable wastes
X	X	X	Confined space entry
X			Illumination, 29 CFR 1910.120(m)
X	X	X	Buddy system, 29 CFR 1910.120(a)
X		X	Heat and cold stress
X		X	Animal and insect bites

13.8 Records

Records of training shall be maintained by the Health and Safety Division and in the project file to confirm that every person assigned to a task has had adequate training for that task and that every employee's training is up-to-date. The SSO or his designee is responsible for ensuring that persons entering the site are properly trained.

Site access will be controlled so that only verified team members and previously-approved visitors will be allowed in work areas or areas containing potentially hazardous materials or conditions. Special passes or badges may be issued. There are two types of visitors: those who collect samples and those who do not.

Any visitors who are on site to collect samples or split samples must meet all the health and safety requirements of any field sampling team for that site. Visitors must comply with the provisions of the SSHSP and sign an acknowledgment agreement to that effect. Visitors are further required to comply with the rules listed in Subsection 2.2.9 of the Health and Safety Project Plan for OU 1114. In addition, visitors will be expected to comply with relevant OSHA requirements such as medical monitoring, training, and respiratory protection.

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ATTACHMENT 1

LEVELS OF PPE

LEVEL OF PROTECTION	EQUIPMENT	PROTECTION PROVIDED	SHOULD BE USED WHEN:	LIMITING CRITERIA
A	Recommended: • Pressure-demand, full-facepiece SCBA or pressure-demand supplied-air respirator with escape SCBA • Fully encapsulating, chemical-resistant suit • Inner chemical-resistant gloves • Chemical-resistant safety boots/shoes • Two-way radio communications Optional: • Cooling unit • Coveralls • Long cotton underwear • Hard hat • Disposable gloves and boot covers	The highest available level of respiratory, skin, and eye protection	• The chemical substance has been identified and requires the highest level of protection for skin, eyes, and the respiratory system based on either: — measured (or potential for) high concentration of atmospheric vapors, gases, or particulates — site operations and work functions involving a high potential for splash, immersion, or exposure to unexpected vapors, gases, or particulates of materials that are harmful to skin or capable of being absorbed through the intact skin • Substances with a high degree of hazard to the skin are known or suspected to be present, and skin contact is possible • Operations must be conducted in confined, poorly-ventilated areas until the absence of conditions requiring Level A protection is determined	• Fully encapsulating suit; material must be compatible with the substances involved

ATTACHMENT 1 (continued)

LEVELS OF PPE

LEVEL OF PROTECTION	EQUIPMENT	PROTECTION PROVIDED	SHOULD BE USED WHEN:	LIMITING CRITERIA
B	Recommended: • Pressure-demand, full facepiece SCBA or pressure-demand supplied-air respirator with escape SCBA • Chemical-resistant clothing (overalls and long-sleeved jacket; hooded, one- or two-piece chemical splash suit; disposable chemical-resistant one-piece suit) • Inner and outer chemical-resistant gloves • Chemical-resistant safety boots/shoes • Hard hat • Two-way radio communications Optional: • Coveralls • Disposable boot covers • Face shield • Long cotton underwear	The same level of respiratory protection but less skin protection than Level A. It is the minimum level recommended for initial site entries until the hazards have been further identified.	• The type and atmospheric concentration of substances have been identified and require a high level of respiratory protection but less skin protection. This involves atmospheres: — with IDLH concentrations of specific substances that do not represent a severe skin hazard — that do not meet the criteria for use of air-purifying respirators • Atmosphere contains less than 19.5% oxygen • Presence of incompletely identified vapors or gases is indicated by direct–reading organic vapor detection instrument, but vapors and gases are not suspected of containing high levels of chemicals harmful to skin or capable of being absorbed through the intact skin	• Use only when the vapor or gases present are not suspected of containing high concentrations of chemicals that are harmful to skin or capable of being absorbed through the intact skin • Use only when it is highly unlikely that the work being done will generate either high concentrations of vapors, gases, or particulates or splashes of material that will affect exposed skin

ATTACHMENT 1 (continued)

LEVELS OF PPE

LEVEL OF PROTECTION	EQUIPMENT	PROTECTION PROVIDED	SHOULD BE USED WHEN:	LIMITING CRITERIA
C	Recommended: • Full-facepiece, air-purifying, canister-equipped respirator • Chemical-resistant clothing (overalls and long-sleeved jacket; hooded, one- or two-piece chemical splash suit; disposable chemical-resistant one-piece suit) • Inner and outer chemical-resistant gloves • Chemical-resistant safety boots/shoes • Hard hat • Two-way radio communications Optional: • Coveralls • Disposable boot covers • Face shield • Escape mask • Long cotton underwear	The same level of skin protection as Level B but a lower level of respiratory protection	• The atmospheric contaminants, liquid splashes, or other direct contact will not adversely affect any exposed skin • The types of air contaminants have been identified, concentrations measured, and a canister is available that can remove the contaminant • All criteria for the use of air-purifying respirators are met	• Atmospheric concentration of chemicals must not exceed IDLH levels • The atmosphere must contain at least 19.5% oxygen

ATTACHMENT 1 (continued)

LEVELS OF PPE

LEVEL OF PROTECTION	EQUIPMENT	PROTECTION PROVIDED	SHOULD BE USED WHEN:	LIMITING CRITERIA
D	Recommended: • Coveralls • Safety boots/shoes • Safety glasses or chemical splash goggles • Hard hat Optional: • Gloves • Escape mask • Face shield	No respiratory protection. Minimal skin protection	• The atmosphere contains no known hazard • Work functions preclude splashes, immersion, or the potential for unexpected inhalation of or contact with hazardous levels of any chemicals	• This level should not be worn in the exclusion zone • The atmosphere must contain at least 19.5% oxygen

Annex IV

Records Management Project Plan

RECORDS MANAGEMENT PROJECT PLAN

This work plan will follow the records management program plan provided in Annex IV of Revision 2 of the Installation Work Plan (LANL 1992, 0768).

REFERENCE

LANL (Los Alamos National Laboratory), November 1992. "Installation Work Plan for Environmental Restoration," Revision 2, Los Alamos National Laboratory Report LA-UR-92-3795, Los Alamos, New Mexico. **(LANL 1992, 0768)**

Annex V

Community Relations Project Plan

- *Fact Sheet*

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COMMUNITY RELATIONS PROJECT PLAN

This work plan will follow the community relations program plan provided in Annex V of Revision 2 of the Installation Work Plan (LANL 1992, 0768). The ER Program's public reading room is located at 1450 Central Avenue, Suite 101, Los Alamos, New Mexico. The community relations project leader can be reached at (505) 665-5000 for additional information.

REFERENCE

LANL (Los Alamos National Laboratory), November 1992. "Installation Work Plan for Environmental Restoration," Revision 2, Los Alamos National Laboratory Report LA-UR-92-3795, Los Alamos, New Mexico. **(LANL 1992, 0768)**

Fact Sheet for Operable Unit 1114 Resource Conservation and Recovery Act Facility Investigation Work Plan

June 1993

The Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) Work Plan is a document that addresses the site characterization activities for all solid waste management units (SWMUs) at Operable Unit (OU) 1114. This document will be submitted to the Environmental Protection Agency (EPA) in June 1993. Characterization activities began in October 1991, and are scheduled to continue through December 1996.

The primary purpose of this work plan is to describe rationale for verification sampling to determine if regulated substances were released to the environment from the SWMUs and areas of concern (AOCs) included in OU 1114, thus satisfying the regulatory requirements of Module VIII addressing Hazardous and Solid Waste Amendments (HSWA) corrective actions of the Los Alamos National Laboratory's RCRA Part B Operating Permit.

Acronyms

AOC
Area of concern
EPA
Environmental Protection Agency
ER
Environmental restoration
HSWA
Hazardous and Solid Waste Amendments
OU
Operable unit
PCBs
Polychlorinated biphenyls
PRS
Potential release site
RCRA
Resource Conservation and Recovery Act
RFI
RCRA facility investigation
SWMU
Solid waste management unit
TA
Technical area
VCA
Voluntary corrective action

Background

Operable Unit 1114 consists of five technical areas (TAs): 3, 30, 59, 60, 61, and 64. TA-30 was decommissioned and removed in 1948. The OU covers 1 216 acres at the western end of South Mesa, which separates Los Alamos Canyon and Twomile Canyon. The mesa slopes gently from west to east, with the western elevation at 7 400 ft and an elevation loss of only about 240 ft in 2 miles. Two canyons, Sandia and Mortandad, originate within OU 1114, dividing the eastern two-thirds of South Mesa into finger-like projections. The middle mesa has been named Sigma Mesa. The entire area is set in a ponderosa pine, piñon, and juniper forest; canyons and some fringe areas are heavily wooded. Core areas within OU 1114 are highly developed.

OU 1114 contains 313 potential release sites (PRSs), including 27 AOCs as defined and listed in the 1990 SWMU Report. SWMU types identified include: surface waste disposal sites, landfills, surface liquid releases, treated and untreated waste outfalls, septic systems, industrial drainage systems, and a decommissioned radioactive liquid waste evaporation pond.

Contaminants and Pathways of Concern

Although the RCRA does not address radionuclides, appropriate OU 1114 samples will be analyzed for both radiological and hazardous contamination because some radioactive materials may have been released in the OU. During the first phase of field investigations, collected samples may be analyzed for one or more of the following suites of constituents:

- radionuclides,
- volatile and semivolatile organic compounds,
- polychlorinated biphenyls (PCBs),
- metals, and,
- pesticides.

The primary release mechanisms in OU 1114 involve surface and subsurface releases to the environment. Potential receptors include humans (i.e., area employees and visitors) and terrestrial and aquatic biota.

Characterization Approach

A system methodology was applied to identify data and information required to perform an assessment of the PRSs. Where appropriate, voluntary corrective actions (VCA) have been incorporated into the RFI field investigation strategy. Any contamination will be compared to the screening action levels delineated in the Environmental Restoration (ER) Programs's Installation Work Plan and, as necessary, evaluated with health-based risk assessments. The sampling plans make use of various aspects of the Laboratory-wide framework studies of contaminant background levels, geology, and hydrology. The PRSs have been grouped into aggregates that take into consideration gaographic proximity, likeness of potential contaminants, and similarity of historical use.

Scope and Schedule of Effort

Because of the large number of PRSs in OU 1114, there will be three RFI work plan efforts extending through December 1996. The RFI fieldwork investigation scheduled to begin in January 1998 requires approximately 2.5 years to complete, ending July 2000.

Reporting

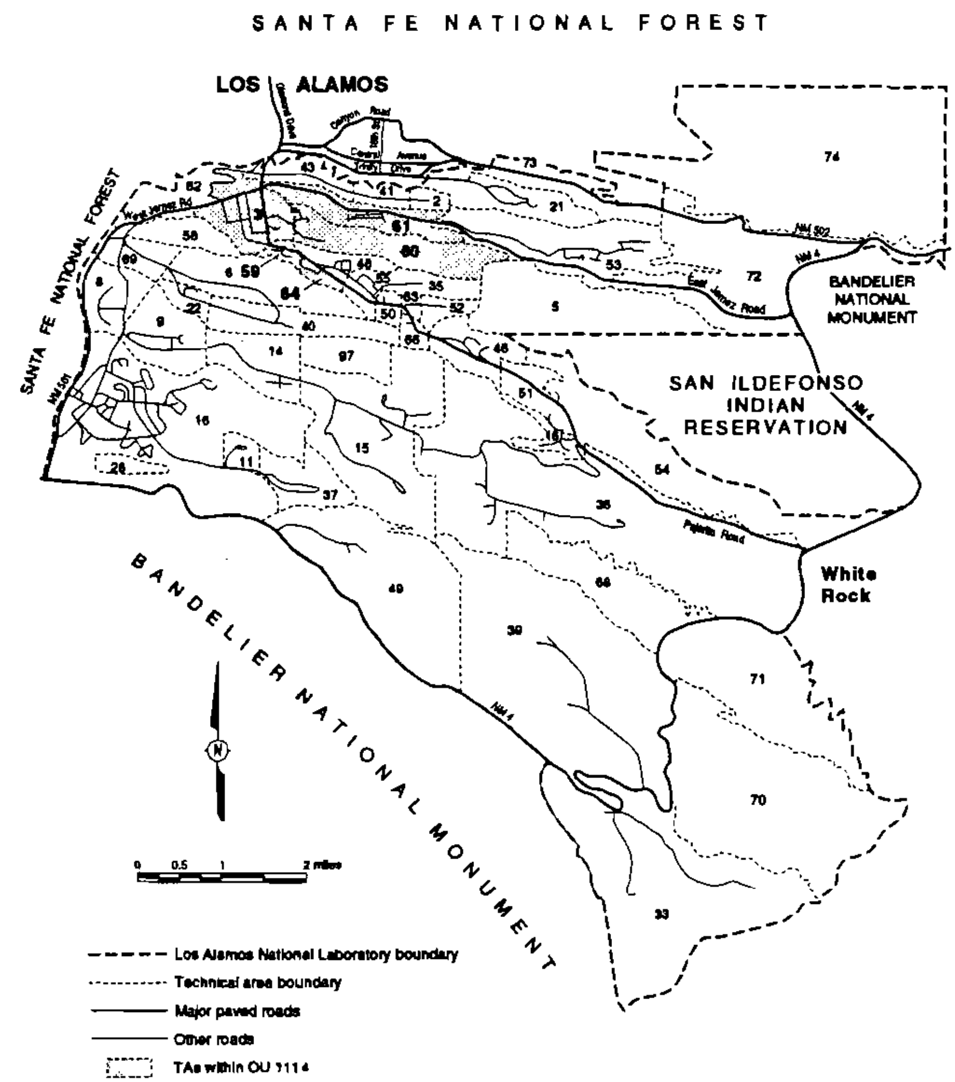
Reports generated during the implementation of this work plan will be available for public review at the ER Community Reading Room in Los Alamos (1450 Central, Suite 101).

The HSWA Module VIII of the Laboratory's RCRA Permit specifies that certain periodic reports be prepared and submitted during the course of the RFI process. Results of the RFI field investigation will be reported in three principal documents: quarterly technical progress reports; phase reports; and, the RFI report. RFI phase reports, which summarize results of initial site characterization activities and describe any planned follow-up activities, will be generated as site characterizations are completed as individual SWMUs or groups of SWMUs. The RFI phase reports will be approved by the EPA prior to proceeding with the subsequent field investigations. At the conclusion of the RFI, the phase reports will be compiled into an overall RFI report that is scheduled to be submitted to the EPA in November 2001.

Conclusion

Ensuring safe management of past, present, and future waste requires the cooperation of government, industry, and the public. The Laboratory is committed to providing the public with information concerning actions taken during investigation and throughout the entire restoration process. If you have additional questions about OU 1114 or the Laboratory's ER Program, please do not hesitate to call or write:

Community Relations Project Leader
Environmental Restoration Program
Los Alamos National Laboratory
Box 1663, MS M314
Los Alamos, NM 87545
505-665-5000 or 505-665-2127



Location of Operable Unit 1114 with respect to Laboratory technical areas and surrounding landholdings.

Appendix A

Cultural Resource Summary

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OU 1114 CULTURAL RESOURCE SUMMARY

As required by the National Historic Preservation Act of 1966 (as amended), a cultural resource survey was conducted during the summer of 1992 at Operable Unit (OU) 1114 (*Schillaci et al. in preparation, 17-790*). The methods and techniques used for this survey conform to those specified in the Secretary of the Interior's Standards and Guidelines for Archeology and Historic Preservation (Federal Register Vol. 48, No. 190, September 29, 1983).

Seventeen archaeological sites eligible for inclusion on the National Register of Historic Places under Criterion D are located within the survey area.

The attributes that make these sites eligible for inclusion on the National Register will not be affected by any Environmental Restoration (ER) Program sampling activities proposed at OU 1114. A report documenting the survey area, methods, results, and monitoring recommendations, if any, will be transmitted to the New Mexico State Historic Preservation Officer for his concurrence in a "Determination of No Effect" for this project. As specified in 36 CFR 800.5(b) and following the intent of the American Indian Religious Freedom Act, a copy of this report will also be sent to the governor of San Ildefonso Pueblo and to any other interested tribal group for comment on any possible impacts to sacred and traditional places.

All monitoring and avoidance recommendations contained in the report referenced below must be followed by all personnel involved in ER sampling activities. Environmental Protection Group (EM-8) archaeologists must be contacted 30 days prior to initiation of any ground-breaking activities so that monitoring and avoidance recommendations can be verified.

REFERENCE

Schillaci, Michael, et al., in preparation. "Environmental Restoration Program, Operable Unit 1114, Cultural Resource Survey Report," Los Alamos National Laboratory, Los Alamos, New Mexico. **(Schillaci et al. in preparation, 17-790)**

Appendix B

Biological Resource Summary

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BIOLOGICAL RESOURCE SUMMARY FOR TECHNICAL AREAS 3, 30, 59, 60, 61, AND 64

1.0 INTRODUCTION

During 1992, field surveys were conducted by the Biological Resource Evaluations Team (BRET) of the Environmental Protection Group (EM-8) for Operable Unit (OU) 1114, Technical Areas (TAs) 3, 30, 59, 60, 61, and 64. The surveys were conducted to provide information on the biological components prior to site characterization. Site characterization requires surface and subsurface soil sampling within the technical areas and associated drainages and canyons. Further information concerning the biological field surveys for OU 1114 is contained in the full report "Biological Assessment for the Environmental Restoration Program, Operable Unit 1114" (Bennett in preparation, 17-799). The biological assessment contains specific information on survey methodology, results, and mitigation measures. This assessment will also contain information that may aid in defining ecological pathways and site restoration.

2.0 PERTINENT REGULATIONS

Field surveys were conducted to comply with the amended Federal Endangered Species Act of 1973 (USFWS 1988, 17-795); New Mexico Wildlife Conservation Act (1974, 17-797); Endangered Plant Species in New Mexico (New Mexico Natural Resources Department 1985, 0546); Executive Order 11990, "Protection of Wetlands" (1977, 0635) Executive Order 11988, "Floodplain Management" (1977, 0634); 10 CFR 1022 "Compliance with Floodplain/Wetland Environmental Review Requirements" (DOE 1979, 17-804); and Department of Energy (DOE) Order 5400.1 (DOE 1988, 0075).

3.0 METHODOLOGY

The purpose of the surveys was three-fold. The first was to determine the presence or absence of critical habitat for any State or Federal sensitive, threatened, or endangered plant or animal species potentially occurring within OU 1114 boundaries. Second, surveys were conducted to determine presence of sensitive areas such as flood plains and wetlands within the areas to be sampled, the extent of such areas, and their general characteristics. The third purpose was to provide additional plant and wildlife data concerning the habitat types and species within OU 1114. These data provide further baseline information about the biological components of the site characterization and a determination of pre-sampling conditions. This information is also necessary to support the National Environmental Policy Act (NEPA) documentation and determination of a categorical exclusion for the sampling plan for site characterization (SEN 15-90).

OU 1114 personnel propose to collect surface and subsurface sediment samples. Subsurface characterization will involve drilling holes up to or exceeding 200 ft in depth. In some locations, trenching may be necessary.

After searching the data base maintained in EM-8 containing the habitat requirements for all State- and Federally-listed threatened, endangered, and sensitive plant and animal species known to occur within the boundaries of Los Alamos National Laboratory and surrounding areas, a habitat evaluation survey (Level 2) was conducted. A Level 2 survey is performed when there are areas that are not highly disturbed which could potentially support threatened and/or endangered species. Techniques used in a Level 2 survey are designed to gather data on the per cent cover, density, and frequency of both the understory and overstory components of the plant community.

The habitat information gathered through the field surveys was then compared to the habitat requirements for species of concern as identified in the data base search. If habitat requirements were not met, then no further surveys were conducted and the site was considered cleared for impact on State- and Federally-listed species. If habitat requirements were met, then specific surveys for the species of concern were conducted. These surveys were done in accordance with pre-established survey protocols. These protocols often require certain meteorological and/or seasonal conditions to perform.

In each location, all wetlands and flood plains within the survey area were noted using a National Wetlands Inventory map and field checks. Characteristics of wetlands, flood plains, and riparian areas are noted using criteria outlined in the Corps of Engineers Wetlands Delineation Manual (1987, 0871).

4.0 THREATENED, ENDANGERED, AND SENSITIVE SPECIES

Species of concern for OU 1114 are listed in Table B-1.

TABLE B-1

SPECIES OF CONCERN FOR OU 1114

COMMON NAME	SCIENTIFIC NAME	STATUS
Northern goshawk	*Accipiter gentilis*	Federal candidate
Mexican spotted owl	*Strix occidentalis lucida*	Federally proposed
Peregrine falcon	*Falco peregrinus*	Federally endangered
Common black hawk	*Buteogallus anthracinus*	State endangered
Bald eagle	*Haliaeetus leucocephalus*	Federally endangered
Mississippi kite	*Ictinia mississippiensis*	State endangered
Broad-billed hummingbird	*Cynanthus latirostris*	State endangered
Willow flycatcher	*Empidonax traillii*	State endangered and Federal candidate
Spotted bat	*Euderma maculatum*	State endangered and Federal candidate
Meadow jumping mouse	*Zapus hudsonius*	State endangered and Federal candidate
Pine marten	*Martes americana*	State endangered
Jemez Mountain salamander	*Plethodon neomexicanus*	State endangered and Federal candidate
Say's pond snail	*Lymnaea caperata*	State endangered
Wood lily	*Lilium philadelphicum*	State endangered

The State of New Mexico has two groups for listed species: State endangered (Group 1) and State endangered (Group 2). Both are protected in the same manner (State of New Mexico 1974, 17-797).

5.0 RESULTS AND MITIGATION

5.1 Threatened, Endangered, and Sensitive Species

As a result of a habitat evaluation and previous data for OU 1114, at least ten of the previously listed species have potential for occurrence within or near OU 1114. These are the Jemez Mountain salamander, northern goshawk, peregrine falcon, Mexican spotted owl, broad-billed hummingbird, pine marten, meadow jumping mouse, spotted bat, checker lily, and wood lily. These species are discussed below in more detail. The remaining species listed above are dismissed from further consideration because of the lack of more specific suitable habitat components or because they have not been located on more suitable habitat in other areas of the Laboratory. A comprehensive report entitled "Biological Assessment for the Environmental Restoration Program, Operable Unit 1114" is being prepared. This report will be submitted to the US Fish and Wildlife Service for concurrence. The report gives detailed reasons for dismissing a species.

The spotted bat is found in piñon-juniper, ponderosa, mixed conifer, and riparian habitats. The two critical requirements for the spotted bat are a source of open surface water and roost sites (caves in cliffs or rock crevices). Suitable roost sites were present in portions of Twomile Canyon and Sandia Canyon. Open water sources are somewhat limited and include a narrow flowing stream, a large cattail area, and several small outfalls. There were no surveys conducted for this species in OU 1114. However, during 1992 surveys for spotted bats in lower Pajarito Canyon, none were captured. In July of 1992, surveys of Los Alamos Canyon also resulted in no spotted bat captures. In addition, no spotted bats were captured in similar survey attempts at TA-8, TA-36, and Bandelier National Monument. This does not necessarily suggest spotted bats do not occur in OU 1114. However, no adverse impact is expected to occur to the spotted bat (if present) if potential habitat (rock faces, cliffs) and water sources within OU 1114 are not disturbed or altered.

Currently in draft form, a habitat management plan developed by Johnson (1992, 17-808) discusses the past and present status of the peregrine falcon in habitat north of this OU. The peregrine falcon has a low potential of occurrence in OU 1114 (according to modeling efforts by Johnson). It is not expected to nest in OU 1114 but may traverse the area (Johnson 1992, 17-808). Sampling is not expected to impact this species.

The northern goshawk occurs in mature ponderosa pine forest. Goshawks have been found hunting within the northwest portion of Laboratory property.

Nest sites are known to exist outside OU 1114 borders and could occur within the boundaries as well (Kennedy 1986, 17-796). The following measures must be taken to avoid adverse impact to goshawks:

1. Any machine sampling occurring between March and October must be cleared through BRET. BRET must be contacted 60 days prior to sampling to evaluate possible nest sites in and around the specific sampling area.

2. If any area over one-tenth acre will be disturbed, contact BRET for a pre-sampling site-specific survey.

3. Any tree removal (live or snag) must be approved by BRET.

Habitat requirements for the Mexican spotted owl include uneven-aged, multistory mixed conifer forests with closed canopies. Spotted owls are known to occur in Los Alamos County and may be present in mixed conifer areas in Twomile Canyon. Contact BRET 60 days prior to sampling within Twomile Canyon for evaluation of specific sampling locations. (Note: a habitat evaluation model is being prepared by Johnson to determine potential nesting areas for spotted owls in Los Alamos County and specifically Laboratory lands).

Broad-billed hummingbirds have been reported in Bandelier National Monument, but only as migrants. These hummingbirds require riparian woodlands at low to moderate elevations and are characterized by cottonwoods, hackberry, and oak. Riparian habitat exists within Sandia Canyon and a lesser extent in Twomile Canyon. The riparian areas of Sandia are not characterized by cottonwoods or hackberry, but do have some oaks. Breeding broad-billed hummingbirds are not thought to be supported in Sandia Canyon or Twomile Canyon. There have not been any sightings of these hummingbirds on Laboratory lands (Travis 1992, 0869). However, it is possible a few migrants could occur. Large disturbance of riparian areas should be avoided. If machine sampling will occur within any riparian area, contact BRET 60 days prior to sampling to evaluate the sampling sites.

Pine marten occur in mature old-growth spruce-fir communities with greater than 30% canopy cover and a large per cent of fallen logs. OU 1114 does not characteristically fit this description. However, there have been unsubstantiated reports of pine marten within the general upper areas of OU 1114. These sightings are thought to be mis-identifications (probably long-tailed weasels). However, there has not been a systematic survey for pine marten within Los Alamos County. An effective survey technique involves snow tracking. A survey for the pine marten was conducted in the upper portions of OU 1114 during the winter of 1992-93. Contact BRET prior to sampling for results of survey.

The meadow jumping mouse has a moderate potential for occurring in the upper reaches of OU 1114. It lives in riparian or wetlands zones along permanent water sources. If any sampling will occur along stream-side areas, contact BRET 60 days prior to sampling to evaluate the need for a site-specific survey. A meadow jumping mouse survey must be performed during the rainy season, the optimal month being July. This is the only time the survey can be performed. If a survey is required, sampling can not proceed until the survey is complete. (Note: some surveys for small mammals occurred within OU 1114 during the summer of 1992; no meadow jumping mice were found) (Bennett in preparation, 17-799).

Jemez Mountain salamander inhabits mixed-conifer to spruce-fir plant communities. The distribution of salamanders is dependent on soil moisture content and, therefore, is most often found in areas of closed canopies, north-facing slopes, or near streams and seeps. Salamanders are found within decaying logs and litter. Certain reaches within Twomile Canyon may support Jemez Mountain salamanders. Impacts on the salamander would include habitat destruction because of any tree removal, soil disturbance, and removal of down logs. The following mitigation measures are required if sampling within Twomile Canyon:

1. Notify BRET 60 days *prior to sampling* to evaluate the sampling site for salamanders. If a survey is required, it can only be conducted in the summer months after several days of heavy rains.

2. If sampling occurs on north-facing slopes or near stream-side, a biologist from EM-8 will be present during sampling. If any

salamanders are discovered, all ground-disturbing activities at that site will cease.

3. Any trees that are cut will be left to enhance habitat.
4. Sampling activity will not be permitted when the soil surface has a high moisture content.
5. All disturbed areas will be revegetated with native plants.

The wood lily and checker lily may occur in OU 1114, but only in moist, shaded areas. If extensive sampling will occur within riparian areas, contact EM-8 to conduct a site-specific survey prior to sampling. These lilies have been found in Los Alamos County but are very rare.

5.2 Wetlands/Flood Plains

Sampling for site characterization could range from surface sampling to core drilling. Sampling should remain outside designated wetlands until field surveys have been completed by EM-8 and entered into the Federal Register. Delineation of the wetlands boundaries will be completed before sampling to ensure sampling occurs outside of those designated areas. Delineations should be done within two years of the sampling; after two years, the delineation is no longer valid and must be repeated. OU 1114 has several palustrine wetlands and numerous NPDES outfalls with hydrophytic vegetation.

6.0 BEST MANAGEMENT PRACTICES

Impacts to non-sensitive species should be avoided when possible. Off-road driving is especially harmful to plants and soil crust. Vehicular travel should be restricted to existing roads whenever possible. Revegetation may be required at some sites. A list of native plants suitable for revegetation for OU 1114 will be included in the final report "Biological Assessment for the Environmental Restoration Program, Operable Unit 1114" (Bennett in preparation, 17-799). In addition, BRET may be consulted to determine suitable species for seeding.

Additional mitigation measures include the following:

- Avoid unnecessary disturbance (i.e., parking areas, equipment storage areas, off-road travel) to surrounding vegetation during the actual sampling and when traveling into the sampling sites.
- Avoid removal of vegetation along water sources, drainage systems, and stream channels.
- Avoid disturbance to vegetation along canyon slopes and especially to drainages.
- Avoid tree removal. If tree removal is required, contact BRET for evaluation.

In addition to the previously-mentioned mitigation measures, BRET requests notification of additional disturbances prior to their being conducted.

The "Biological Assessment for the Environmental Restoration Program, Operable Unit 1114" (Bennett in preparation, 17-799) will be evaluated by the US Fish and Wildlife Service for compliance with the Endangered Species Act. This federal agency may have additional mitigation measures that are required and are not represented in this summary. However, OU 1114 project leader will be notified of any additional required measures.

REFERENCES

Army Corps of Engineers, January 1987. "Corps of Engineers Wetlands Delineation Manual," final report, Technical Report Y-87-1, Wetlands Research Program, Waterways Experiment Station, P. O. Box 631, Vicksburg, Mississippi. **(Army Corps of Engineers 1987, 0871)**

Bennett, K., in preparation. "Biological Assessment for the Environmental Restoration Program, Operable Unit 1114," Los Alamos National Laboratory Report, Los Alamos, New Mexico. **(Bennett in preparation, 17-799)**

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US Fish and Wildlife Service, 1988. "Endangered Species Act of 1973 as Amended Through the 100th Congress (Public Law 100-478)," US Department of the Interior, Washington, DC. **(USFWS 1988, 17-795)**

Appendix C

List of Contributors

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LIST OF CONTRIBUTORS

NAME AND AFFILIATION	EDUCATION/EXPERTISE	ER PROGRAM ASSIGNMENT
Ed Griggs (CLS-DO)	B.S. Mechanical Engineering. 29 years at Los Alamos in nuclear and laser research, ES&H Tiger Team Sector Leader	Operable Unit 1114 Project Leader
Calvin Martell (CLS-1)	M.S. Analytical Chemistry 25 years experience in analysis of plutonium, design of plutonium chemistry laboratory, analytical chemistry liaison to Rocky Flats	Deputy Operable Unit 1114 Project Leader
Katherine Campbell (A-1)	Ph.D. Mathematics 13 years experience with statistical sampling/presentation/evaluation of geochemical and hazardous waste/chemistry data	Technical team leader, statistics and data quality objectives
E. Corine Ortiz (A-1)	15 years experience in technical document preparation, 2 years environmental restoration organizational activities	Computer technician
Lawrence Ticknor (A-1)	M.S. Statistics/ M.F. Forestry 12 years experience with sampling/analyzing/presenting environmental biological parameters	Technical team member, statistics and data quality objectives
Bonnie Slaten (Butler Service Group, Inc.)	B.A. Zoology/Psychology 4 years experience as a Geotech in petroleum exploration and production consulting; 1 year experience in EPA (Region VI) management, and 1.5 years experience in LANL ER Program	Sampling plan development, technical review
Dorothy Hoard (CLS-1)	B.A. Biochemistry 18 years experience in analytical chemistry, published author	Archival research, technical review
Carol LaDelfe (EES-1)	M.S. Geology 14 years experience in geology, geochemistry, geophysical well log analysis, and QA	Geology, technical review
Wayne Morris (EES-1)	M.S. Engineering Mechanics 12 years experience in geology/ geochemistry project management	Geology, technical review
Dow Davidson (EES-4)	B.A. Anthropology 14 years quality assurance/sample management	Development and incorporation of sampling plans
Kathryn Bennett (EM-8)	M.S. Environmental Science 3 years experience in field ecology	Biological assessment
Beverly Larson (EM-8)	B.A., M.A. Anthropology 19 years experience in cultural resource management	Archeology team leader

NAME AND AFFILIATION	EDUCATION/EXPERTISE	ER PROGRAM ASSIGNMENT
Paula Bertino (Environmental Resource Management)	M.A. International Energy Management; B.S. Chemistry, Environmental Science, Political Science 10 years experience in waste management, regulatory compliance, program management, permitting at DOE facilities, site investigation, and agency negotiations	Work plan support
James Noel (FIN-18)	M.B.A., B.A. Political Science and Anthropology 5 years experience in chemical waste disposal, radioactive waste management, regulatory compliance assessment	Work plan support
Susan Alexander (HS-5)	B.A. Environmental Health 6 years experience in industrial hygiene; 3 years experience in hazardous waste, occupational health and safety	Health and Safety Project Plan
Alison Dorries (HS-5)	Ph.D. Chemistry, M.P.H. Public Health 5 years experience in toxicology, pulmonary health research, regulation development, environmental health risk assessment	Technical team leader, human health risk assessment
Peter Gram (ICF Kaiser Engineers, Inc.)	M.S. Hydrogeology 2 years experience investigation of surface and subsurface heavy metal contamination and hazardous waste site remediation	Work plan support
Chris Timm (ICF Kaiser Engineers, Inc.)	M.S. Sanitary Engineering 25 years experience in characterization and design of point - source controls and remedial actions for hazardous and radioactive waste management and disposal	Work plan support
Margaret Burgess (IS-1)	B.A. English 9 years experience as a technical writer/editor, 2 years experience environmental restoration documents	Technical writer/editor
Jan Beck (Radian Corp.)	B.A. Biology 4 years experience in environmental risk assessment	Work plan support
Margo Buksa (Ray Rashkin Associates)	A.S. Environmental Science Undergraduate student	Archival research, technical review
Deborah Magid (Ray Rashkin Associates)	7 years editing experience, 12 years experience in desktop publishing	Editor/compositor
Lynda Sobojinski (Ray Rashkin Associates)	A.S. Environmental Pollution and Control 6 years experience in fire restoration management, including 3 years of asbestos abatement and 1 year of PCB cleanup	Archival research, technical review

Appendix D

Field Investigation Approach and Methods

- General
- Field Operations
- Standard Screening Methods
- Field Surveys and Screening
- Field Analysis
- Laboratory Analyses
- Sampling Methods

1.0 GENERAL

This appendix has been prepared to describe the common elements that apply to the conduct of field investigations at all Operable Unit (OU) 1114 potential release sites (PRSs). The purpose of providing this information in a single discussion is to reduce the repetition of common details. Several general concepts apply to all field investigations presented in Chapter 5 of this work plan. They include the following:

- releases of radioactive materials may have occurred without simultaneous release of hazardous constituents;
- the release of hazardous constituents at some PRSs may not have been associated with the release of radioactive materials, but human activities and action by physical forces would have diluted this isolation effect;
- field surveys and field screening samples can be used to identify gross contamination and assist in sample selection for laboratory analyses;
- field laboratory analyses will be used to more quickly provide Level II/III data to guide field operations (refer to Table D-1 for analytical levels appropriate to data uses); and,
- analytical laboratory analyses will complete the sampling planned at each phase of site investigation.

1.1 Field Operations

This discussion identifies several aspects of the Laboratory's implementation of the field sampling process that are not mentioned in the PRS-specific field sampling plans. Standard activities that will be used to support the following field operations (see Section 2.0, Field Operations) include:

- Laboratory-required preliminary activities and support procedures;

TABLE D-1

SUMMARY OF ANALYTICAL LEVELS APPROPRIATE TO DATA USES (EPA 1987, 0086)

DATA USES	ANALYTICAL LEVEL	TYPE OF ANALYSIS	LIMITATIONS	DATA QUALITY
• Site characterization • Monitoring during implementation	Level I	• Field screening for organic vapor and radiological detection using portable instruments • Field test kits	• Instruments respond to naturally occurring compounds	• If instruments calibrated and data interpreted correctly, can provide indication of contamination
• Site characterization • Evaluation of alternatives • Engineering design • Monitoring during implementation	Level II	• Variety of organics by GC; Inorganics by AA, XRF	• Tentative identification analyte-specific • Techniques/instruments limited mostly to volatiles, metals, some radionuclides	• Dependent of QA/QC steps employed • Data typically reported in concentration ranges • Detection limits vary from low ppm to low ppb
• Risk assessment • Site characterization • Evaluation of alternatives • Engineering design • Monitoring during implementation	Level III	• Organics/inorganics using EPA procedures other than CLP can be analyte-specific • RCRA characteristic tests • Radiological constituents	• Specific identification; tentative identification in some cases • Can provide data of same quality as Level IV	• Similar detection limits to CLP • Less rigourous QA/QC
• Risk assessment • Evaluation of alternatives • Engineering design	Level IV	• TCL/TAL organics/inorganics by GC/MS, AA, ICP	• Tentative identification of non-TCL parameters • Some time may be required for validation of packages	• Goal is data of known quality • Rigourous QA/QC • Low ppb detection limit
• Risk assessment	Level V	• Non-conventional parameters • Appendix 8 parameters	• May require method development/modification • Mechanism to obtain services requires special lead time	• Quality is method specific • Method-specific detection limits

AA: Atomic absorption
CLP: Contract laboratory program
EPA: Environmental Protection Agency
GC: Gas chromatography
ICP: Inductively coupled plasma
MS: Mass spectrometry
RCRA: Resource Conservation and Recovery Act
TAL: Target analyte list
TCL: Target compound list
XRF: X-ray fluoresence

- identifying and documenting locations that have been sampled;
- sample handling and laboratory coordination procedures;
- equipment decontamination procedures; and,
- management of wastes generated by sampling activities.

1.2 Investigation Methods

The primary focus of this appendix is on field investigation methods, and it is based on the field sampling methods section of the Laboratory's Installation Work Plan (IWP), Subsection 4.4 (LANL 1992, 0768). The methods presented here are specific examples of the options identified in the IWP. In addition, this appendix references the Laboratory's published ER Program standard operating procedures (SOPs) (LANL 1993, 0875). Each of the brief method descriptions given herein refers to the applicable SOPs for detailed methodology.

The methods described in this appendix (see Sections 4.0 to 7.0) include:

- field survey methods to identify contaminants *in situ* and field sample screening methods to be used at the point of sample collection (Level I);
- field analytical methods (Level II);
- analytical laboratory methods (Level III); and,
- sampling methods.

The method descriptions are simple and brief, and provide some information on application of the method. Specific information such as sampling location or target depth of a borehole is provided by the individual field sampling plan. The method descriptions presented here are not intended to supplant or reduce the importance of the Quality Assurance Project Plan (Annex II) of this work plan or of the governing SOPs (LANL 1993, 0875).

2.0 FIELD OPERATIONS

In this section, several aspects of field operations are described.

2.1 Health and Safety

Annex III of this work plan presents the Health and Safety Project Plan for all field activities within OU 1114. The plan gives PRS-specific information regarding known or suspected contaminants and the personal protection required for different activities. Samples acquired as part of this work plan will be screened at the point of collection to identify the presence of gross contamination or conditions that may pose a threat to the health and safety of field personnel. The techniques listed in Subsection 4.2 of this appendix will be used.

2.2 Site Control

Access, staging, and sample storage areas will be designated by the field team leader (FTL). In order to maintain sample integrity and sample documentation, all sampling sites will be included in one or several exclusion zones. Exclusion zones will be delineated by the FTL with the concurrence of the site safety officer (SSO). The boundary of an exclusion zone will be defined based on the nature, magnitude, and extent of confirmed or possible contamination; the potential for contaminant migration; hazards at the site, such as use of mechanical equipment; the presence of electrical lines or other utilities, structures, tanks, pits, or trenches; and the presence of steep banks or cliffs.

Boundaries of exclusion zones may be changed as operations progress. All changes will be designated by the FTL with the concurrence of the SSO.

In order to ensure sample integrity, to maintain control over sampling waste, and to avoid contamination of the site office, decontamination may be required for personnel, equipment, and vehicles moving from one zone to another. Therefore, a contamination reduction zone (CRZ) surrounding the exclusion zone(s) will be established. A contamination reduction corridor, the size of which will depend on the number of stations required for decontamination activities, will be established through the CRZs. The corridor should be located in a direction that is generally upwind from the exclusion zone.

If required, decontamination stations will be set up to reduce contamination as personnel move toward the end of the contamination reduction corridor. The system will wash and rinse all sample containers, waste containers, protective equipment, tools, and other equipment at least once. A sequential doffing of protective equipment will be conducted, starting with the most heavily-contaminated items at the first station and progressing to the least-contaminated items at the final station. The stations will be far enough apart to minimize cross-contamination.

All decontamination materials must be stored in drums with proper labels and identifying information. Efforts will be made to keep the volume of decontamination materials to a minimum. Persons involved in performing the actual decontamination will generally be dressed in protective clothing one level below what the exclusion zone workers are required to wear. All personnel and equipment will be monitored for radioactive contamination prior to leaving an exclusion zone or central decontamination area.

Personnel entering an exclusion zone in which personnel decontamination is required must follow the specified decontamination procedures. Personnel who are not required to wear the maximum level of protective clothing may by-pass the decontamination stations for protective clothing that they are not wearing.

2.3 Site Monitoring

Entry to and egress from sites will be controlled for monitoring purposes. All personnel entering the sites must use appropriate radiation monitoring badges. Locations for drinking water, rest room facilities, etc., will be identified prior to beginning site activities. Protective clothing requirements will be determined by the SSO assigned to the project.

Field measurements for wind-borne contaminants shall be made and documented prior to, during, and after surface sampling activities. Qualified health and safety personnel (or designees) are responsible for this monitoring. Results of monitoring will be used to evaluate possible existing hazards at the site in order to ascertain current conditions and specify personal protective equipment. All personnel will visually monitor for extreme weather conditions, lightning, or other physical or environmental hazards that may develop. Personnel will notify the SSO when unanticipated physical or environmental hazards develop. Potential site hazards are discussed in detail in Annex III of this work plan.

2.4 Archaeological, Cultural, and Ecological Evaluations

Prior to initiation of fieldwork and as part of the Laboratory's environment, safety, and health (ES&H) questionnaire process, archaeological and ecological evaluations will be performed in all areas where the surface is to be disturbed, vegetation removed, or invasive sampling performed. Depending on the results of the archaeological and ecological evaluations, a DOE environmental check list for either categorical exclusion or environmental assessment will be completed.

2.5 Support Services

Physical support services during the field investigation will be provided by the Laboratory Design Group (ENG-3), Field Operations Group (ENG-5), Johnson Controls, or contractors. Existing job ticket procedures will be used. The services these groups will provide include, but are not limited to, excavating using backhoes and front-end loaders, moving pallets of drummed auger cuttings and decontamination solutions, and setting up signs and other warning notices around the perimeter of work areas.

2.6 Excavation Permits

As part of the ES&H questionnaire process, excavation permits are required by the Laboratory prior to any excavation, drilling, or other invasive activity. Acquisition of the permits will be coordinated with the Laboratory's Safety and Risk Assessment Group (HS-3) and Johnson Controls. Acquisition of excavation permits will be scheduled as appropriate for each phase of fieldwork. All areas intended for excavation, drilling, or sampling deeper than 18 in. will be marked in the field for formal clearance prior to the work.

2.7 Sample Control and Documentation

Guidance for sample handling is provided in Annex II, Subsection 3.3, of the IWP (LANL 1992, 0768). Sample packaging, handling, chain-of-custody, and documentation procedures are provided in the following ER Program SOPs (LANL 1993, 0875):

- LANL-ER-SOP-01.01, R0, General Instructions for Field Investigations;
- LANL-ER-SOP-01.02, R0, Sample Containers and Preservation;
- LANL-ER-SOP-01.03, R0, Handling, Packaging, and Shipping of Samples; and,
- LANL-ER-SOP-01.04, R1, Sample Control and Field Documentation.

2.8 Sample Coordination

A sample coordination facility has been established by the ER Program in the Laboratory's Health and Environmental Chemistry Group (EM-9) to provide consistency for all investigations. The system is described in Subsection 3.3.11 of the IWP (LANL 1992, 0768). The applicable SOP is LANL-ER-SOP-01.04, R1, *Sample Control and Field Documentation* (LANL 1993, 0875).

2.9 Quality Control Samples

Field quality control (QC) samples of several types are collected during the course of a field investigation. The definition for each kind of sample and the purpose it is intended to fulfill are given in Annex II of this work plan, the Quality Assurance Project Plan (QAPjP), and LANL-ER-SOP-01.05, R0, *Field Quality Control Samples* (LANL 1993, 0875). The frequency with which each type of field quality assurance (QA) sample is to be collected is detailed in the sampling plans in Chapter 5 of this work plan.

2.10 Equipment Decontamination

Decontamination is performed as a quality assurance measure and a safety precaution. It prevents cross contamination among samples and helps maintain a clean working environment for the safety of personnel. Sampling tools are decontaminated by washing, rinsing, and drying. Disposable sample collection devices will be used as deemed necessary to eliminate costly decontamination procedures in the field. The effectiveness of the decontamination process is documented through rinsate blanks submitted for laboratory analysis. *Steam cleaning* is used for large machinery, vehicles, auger flights, and coring tools used in borehole sampling. Decontamination fluids, including steam-cleaning fluids, are considered wastes and must be collected and contained for proper disposal.

2.11 Waste Management

This discussion is based on the guidance provided in Subsection 3.5.4 and Appendix B of the IWP (LANL 1991, 0553). Wastes produced during sampling activities may include borehole auger cuttings, excess sample, excavated soil from trenching, decontamination and steam-cleaning fluids, and disposable materials such as wipes, protective clothing, and sample bottles. In different areas of OU 1114, several of the following waste categories may be encountered: hazardous waste, low-level radioactive waste, transuranic waste, and mixed waste (either low-level or transuranic). Requirements for segregating, containing, characterizing, treating, and disposing of each type and category of waste are provided in the LANL-ER-SOP-01.06, R0, Management of RFI-Generated Waste (LANL 1993, 0875).

3.0 STANDARD SCREENING METHODS

In all sampling plans of this RFI work plan, a table has been used to identify certain field operations as well as sample analytical requirements. Table D-2 is an example of screening and analytical requirements for a sampling plan at OU 1114.

3.1 Samples and Sampling Methods

The two columns on the left side of Table D-2 identify, by PRS, the sampling location or type and description. The next six columns identify the following: depth interval (as appropriate), space for recording the sample identification number, QA/QC samples, and total samples. The sampling methods or activities identified in the first column are specifically defined below. Sampling methods are described in detail in Section 7.0 of this appendix.

TABLE D-2

EXAMPLE OF SCREENING AND ANALYTICAL REQUIREMENTS FOR A SAMPLING PLAN

SCREENING AND ANALYSIS FOR OU 1114 PHASE I SAMPLING PLAN SUMMARY OF SIGMA MESA SOLAR POND

SAMPLING LOCATION/TYPE	SAMPLE LOCATION DESCRIPTION	SAMPLE DESCRIPTION						FIELD SCREENING				FIELD LAB		LABORATORY ANALYSIS															
														Radionuclides					Organics							Metals			Misc
		Sample depth (inches)	Sample I.D. number	Field duplicate	Field split	Collocated sample	Total samples	Gross alpha	Gross beta	Gross gamma	Organic vapor	GC/FID for TPH (SW 8015)	Immunoassay kit for PCBs (SW 4020)	Gross alpha	Gross beta	Gross gamma	Strontium-90	Tritium	Herbicides (SW 8150)	Organochlorine pesticides (SW 8080)	Organophosphorous pesticides (SW 8140)	PCBs (SW 8080)	SVOCs (SW 8270)	TPH (SW 8015)	VOCs (SW 8240)	Mercury (SW 7470, 7471)	OU 1114 metals suite (SW 6010)[1]	OU 1114 Subpart S metals (SW 7000)[2]	Cyanide (SW 9010, 9012)
SWMU 60-004(c)	Temporary drum storage																												
Manual shallow core	Stained soil	0–12					1															1	1						
		12–18					1																		1				
Manual shallow core	Stained soil	0–12				1	2															2	2						
		12–18		1			2																		2				
Manual shallow core	25 ft south of gate	0–12					1															1	1						
		12–18					1																		1				
Manual shallow core	50 ft south of gate	0–12					1															1	1						
		12–18																							1				
SWMU 60-005(a)	Solar Pond																												
Liner removal	Hypolon liner	N/A					1	1	1	1																			
Manual shallow core	Pond bottom (above gravel)	0–12			1		2	2	2	2	1			2	2	2		2					2				2	2	
		12–18			1		2	2	2	2	1			2	2	2		2							2		2	2	2
Manual shallow core	Pond bottom (above gravel)	0–12					1	1	1	1	1			1	1	1		1					1				1	1	
		12–18					1	1	1	1	1			1	1	1		1							1		1	1	1
Manual shallow core	Pond bottom (above gravel)	0–12					1	1	1	1	1			1	1	1		1					1				1	1	
		12–18					1	1	1	1	1			1	1	1		1							1		1	1	1
Manual shallow core	Pond bottom (below gravel)	0–12					1	1	1	1	1			1	1	1		1					1				1	1	
Manual shallow core	Pond bottom (below gravel)	0–12					1	1	1	1	1			1	1	1		1					1				1	1	
Manual shallow core	Pond bottom (below gravel)	0–12					1	1	1	1	1			1	1	1		1					1				1	1	
TOTAL NUMBER OF SAMPLES							21	12	12	12	9			11	11	11		11				5	12		9		11	11	4

[1]OU 1114 metals suite: beryllium, cadmium, chromium, lead, mercury, nickel, silver

[2]Subpart S metals (TAL list): antimony, arsenic, barium, selenium, thallium, vanadium

s/t = soil/tuff interface

SCB = sediment catchment basin

3.2 Screening, Surveying, and Analysis Methods

Very precise language has been adopted in this work plan to refer to categories of measurements. Refer to Table D-3 for instrumentation and methods for proposed analytical levels.

TABLE D-3

INSTRUMENTATION AND METHODS FOR PROPOSED ANALYTICAL LEVELS

LEVEL I: FIELD SURVEY AND SCREENING
Portable instruments:
Phoswich meter
FIDLER meter
Geiger-MOeller counter ESP-1 beta/gamma meter ESP-1 alpha meter
MicroR meter
Organic vapor analyzer (OVA)
Photoionization detector
Explosimeter
Oxygen level indicator
Field test/methods/kits:
OVA head space test
HNU head space test
Ensys™ PCB immunoassay kits
LEVEL II: FIELD ANALYSIS / INSTRUMENTATION
Radiological screening laboratory
Field gas chromatography (GC)/flame ionization detector (FID)
X-ray fluorescence
LEVEL III / IV: LABORATORY ANALYSIS / INSTRUMENTATION
EPA protocol for soil, air, and water analysis for semivolatile organic compounds and metals using Los Alamos, off-site, or mobile laboratories typically includes the following instrumentation (EPA 1986, 0291):
Gas chromatography (GC)
Gas chromatography/mass spectrometry (GC/MS)
Inductively-coupled plasma atomic emission spectroscopy (ICAP)
Atomic absorption (AA)

Surveys, screening, and analysis are defined as follows:

1. **Field Surveys** (or "surveys"). Direct reading or recording instruments are used to scan the land surface to make measurements of *in situ* conditions. Typically, surveys provide Level I data. Gamma radioactivity is a common target of field surveys. Land surveys and borehole logging are included in this category.

2. **Field Screening** ("field sample screening" or "screening"). This is the process by which instruments or observations are applied to samples at the point of collection to measure the presence of contaminants or to determine other properties of the sample. Screening usually provides Level I data. Gross radioactivity (beta/gamma) and organic vapors are common targets of field screening. Lithologic logging of core samples is included in this category.

3. **Field Analysis** (or "field laboratory analysis"). This category represents the initial analyses conducted on samples in the field prior to selecting samples for submission to the analytical laboratory. These analyses are conducted to provide information to direct voluntary corrective actions (VCAs) or to direct which samples are submitted for further analysis at the analytical laboratory. Field analysis usually provides Level II data. Analyses conducted in field radiological trailers and with the field gas chromatography (GC)/flame ionization detector (FID) are included in this category.

4. **Laboratory Analysis** (or "analytical laboratory analyses"). This category represents the primary analysis for which samples are collected, preserved, and sealed. Level III or IV data are usually expected. Analyses are commonly provided by off-site analytical laboratories.

For each of the categories in Table D-2, several measurement techniques are identified by vertical columns. The individual measurement techniques represented by each vertical column are identified in the following sections of this appendix: Section 4.0, Field Surveys and Screening; Section 5.0, Field Analyses; and Section 6.0, Laboratory Analyses.

3.2.1 Use of the Standard Screening and Analysis Tables

The screening and analysis tables serve two major purposes. First, they clearly and concisely summarize the details of a sampling plan. They give locations, indicate sampling methods and intervals, identify the screening and analysis measurements for each sample detailed in Chapter 5 of this work plan, explicitly identify the collection and analysis of field quality assurance samples, and give a representation of certain options and uncertainties in the plan. Second, the tables provide the detail needed to estimate the costs of the investigation.

4.0 FIELD SURVEYS AND SCREENING

Field surveys and field screening are defined in Section 3.0 of this appendix. The field survey and screening methods are combined in this section because similar techniques and instrumentation are applied to each method.

Field surveys were defined in Section 3.0 of this appendix. These are primarily walking scans of the land surface using direct reading or recording instruments. Field survey data such as radioactivity or organic vapor measurements are used to identify the presence of contaminants or structures in the field. While negative results from field surveys are not conclusive evidence of the absence of contaminants, positive results obtained at an early stage can allow timely redirection of a sampling plan. For convenience, land surveys to identify and mark locations from old drawings are included here.

4.1 Radiological Surveys

4.1.1 Radiological Surveys

Radiological surveys are conducted to identify the presence of radioactive contamination at a site. Several instruments are suitable for these surveys: microR meters, sodium iodide (NaI) detectors of various sizes with ratemeters and scalers, Geiger-Müeller detectors (such as the ESP-1 beta/gamma meters), FIDLER, and Phoswich. The specific uses of each meter are discussed in the following subsections.

4.1.1.1 Gross Gamma Survey

Several instruments are suitable for these surveys: microR meters, NaI detectors of various sizes with ratemeters or scalers, and Geiger-Müeller detectors. The preferred instruments are microR meters with the ability to measure to 5 μR/hr, 2-in.-by-2-in. NaI detectors with a ratemeter capable of displaying 100 counts per minute (cpm), and the ESP-1 beta/gamma meter. Some discrete- or continuous-measurement recording instruments are also available using the same detectors. Surveys are conducted by carrying the instrument at waist height, walking at a slow pace, and observing and recording the ratemeter response. Measurements may also be made at the ground surface to aid in identifying the presence of localized contamination.

4.1.1.2 Low-Energy Gamma Survey

Two instruments are commonly used for these surveys, the FIDLER and the Phoswich. Both are optimized for the detection of low-energy gamma photons, such as the 60 keV gamma emission from americium-241 or the x-rays that accompany the decay of heavy radionuclides such as uranium, thorium, plutonium, and other transuranic radionuclides. Either instrument may be used for this work plan. Discrete- or continuous-measurement recording options are available. Surveys are conducted by carrying the instrument close to the ground surface and observing the ratemeter or scaler. Measurements may also be made at the ground surface to aid in identifying the presence of localized contamination.

4.1.2 Organic Vapor Surveys

Organic vapor detectors will be used to monitor breathing zones for personnel safety in sample collection and handling areas at OU 1114 sites. Two types of detectors, photoionization detector (PID) and FID, will be used to survey a wide range of organic vapors as described below.

4.1.2.1 PID

A Model PI 101 PID or its equivalent will be used. This is a general survey instrument capable of detecting real-time concentrations of many complex organic compounds and some inorganic compounds in air. The instrument can be calibrated to a particular compound; however, it cannot distinguish between detectable compounds in a mixture of gases.

4.1.2.2 FID

A Foxboro Model OVA-128 FID or its equivalent will be used. An FID can be used as a general screening instrument to detect the presence of many organic vapors. Its response to an unknown sample is relative to the response to a gas of known composition to which the instrument has been calibrated.

4.1.2.3 Combustible Gas/Oxygen Detector

A Gastech Model 1314 or its equivalent will be used to determine the potential for combustion or explosion of unknown atmospheres during drilling and intrusive activities. A typical combustible gas indicator (CGI) determines the level of organic vapors and gases present in an atmosphere as a percentage of the lower explosive limit or lower flammability limit. The Gastech Model 1314 also contains an oxygen detector to determine atmospheres that are deficient or enriched in oxygen. For health and safety purposes, the CGI will be used (if appropriate) to monitor atmospheres during some intrusive activities.

4.1.3 Land Surveys

Land surveys will be used for two purposes: first, to document all sampling locations; and second, to locate either former or buried structures where needed. In all cases, the documentation requirements for the surveys are the same: plus or minus 1 ft horizontal and plus or minus 0.1 ft vertical. The conventional survey procedures used are documented by Laboratory Facilities Engineering Division personnel.

4.1.4 Geomorphic Mapping

Field or geomorphic mapping will be required for OU 1114 to assist in the location of certain sampling points. In order to sample drainages judged most likely to contain potential contamination, several of the individual sampling plans in Chapter 5 require the identification of watercourses or drainages. Preliminary fieldwork at OU 1114 indicates that an expert field geologist will be required to map present-day precipitation runoff channels. The geologist will also correlate present-day drainage channels to the historic channels that would have carried effluent from OU 1114 outfall locations into the lower gradient area at the floor of the canyon. To assist in correlating current drainage channels to historic drainage channels, the geologist will use field mapping, aerial photographs, topographic maps, and other archival information.

Several PRS aggregate drainages and channels are well defined from the rim to the floor of the canyon. Other aggregates will require mapping as described above. Professional judgment allows placing representative sampling locations or establishing placement of a systematic sampling grid on field maps. Representative sampling locations must provide adequate coverage to assess dissemination of potential contaminants in the drainages. Correct use of well-documented judgmental sampling points will allow less reliance on nonjudgmental or random sampling regimens.

4.2 Field Screening

Field screening is defined in Subsection 3.2 of this appendix. Screening measurements are applied at the point of sample collection, in borehole head space, and in excavations to identify gross contamination and to assess conditions affecting the health or safety of field personnel. Application of screening for personnel health and safety is detailed in Annex III of this work plan and the Health and Safety Program Plan, Annex III in the IWP (LANL 1992, 0768). Individual sampling plans may not explicitly identify the use or role of sample screening measurements; however, the standard analytical table for each investigation will show the methods to be used.

4.2.1 Radiological Screening

Radiological screening is conducted to identify the presence of gross radioactive contamination of samples and personnel. Several instruments are suitable for these surveys: microR meters, NaI detectors of various sizes with ratemeters and scalers, Geiger-Müeller detectors (such as the ESP-1 beta/gamma meter), and alpha scintillation detectors (such as the ESP-1 alpha meter). The specific uses of each meter are discussed in the following subsections.

4.2.1.1 Gross-Gamma Radiological Screening

Field screening of samples for gross-gamma radioactivity will be done using a hand-held NaI detector probe and ratemeter or the ESP-1 beta/gamma meter. The NaI detector is held close to the sample or core and is capable of identifying elevated concentrations of certain radionuclides as an increased reading above instrument background levels. Quantification of the response is difficult and is best interpreted as a gross indicator of potential contamination.

4.2.1.2 Gross-Alpha Radiological Screening

Field screening of samples for gross-alpha radioactivity is conducted using a hand-held alpha scintillation detector and a ratemeter. The detector is held close to contact with the sample or core and is capable of detecting on the order of 100-200 pCi/g for a damp soil sample. However, detection of alpha activity can be difficult in moist samples because of shielding by the water. The instrument cannot identify specific radionuclides.

4.2.1.3 Gross-Beta Radiological Screening

Field screening of samples for gross-beta radioactivity is conducted using a hand-held detector. A typical beta detector consists of a Geiger-Müeller tube with a thin mica window protected by a sturdy wire screen. The mica window thickness may vary from 1.4 to 2 mg/cm^2. The detector is held close to contact with the sample or core and is capable of detecting gross-beta activity down to 40 keV. The gamma sensitivity of such a detector is approximately 3 600 cpm/mR/h. The beta efficiency with screen in place is 45% for strontium-90 and 10% for carbon-14. Screen removal will increase efficiency by 45%. The efficiencies are determined as percentage of 2π emission rate, from a 1-in.-diameter source. This beta detector is alpha sensitive above 3 MeV.

4.2.2 Organic Vapor Detectors

Organic vapor detectors will be used to screen borehole cores and soil samples at the point of collection to identify grossly contaminated samples. Two types of detectors, photoionization and flame ionization, will be used to improve the probability of detecting a wide range of vapors, and are described in Subsection 4.1.2 of this appendix.

4.2.3 Polychlorinated Biphenyls

Portable enzyme-linked immunosorbent assay kits will be used to identify areas of polychlorinated biphenyl (PCB) contamination in the field. The technique will use PCB-RISc kits following the manufacturer's instructions and the draft SW 846 Method 4020. The method is designed to provide indication of PCB contamination above 5 ppm. Selected confirmation samples for laboratory analysis will be collected from areas to confirm the results of the PCB screening kits.

4.2.4 Lithologic Logging

Lithologic logging of drill core to describe the physical nature of borehole cores will be performed by a geologist capable of describing subsurface lithologies and differentiating the various strata of Bandelier Tuff.

5.0 FIELD ANALYSES

Section 3.0 of this appendix provides the definition of field analysis as used in this work plan. Level II analyses are intended to be used to identify areas of contamination, to select samples for confirmation by laboratory analysis, and to provide a preliminary radiological analysis of samples. The radiological analyses will be conducted using the Health and Environmental Chemistry (EM-9) Group's radiological analysis van, either on site or at an easily accessible location, following the analyses described in Subsection 5.1. The field analyses will be conducted using field GC/FID as described in Subsection 5.2, and x-ray fluorescence as described in Subsection 5.3.

5.1 Field Radiological Analyses

The EM-9 field radiological analysis van will be used to conduct preliminary radiological analyses of samples. The results of these analyses will be used to identify areas of radiological contamination and to provide an accurate indication of radioactive contamination. For areas with suspected radiological contamination, an accurate estimate of sample radioactivity is required before the samples can be submitted to the Sample Coordination Facility. These analyses are discussed in the following subsections.

5.1.1 Gross Alpha and Gross Beta Radioactivity

Measurements of gross alpha and beta radioactivity can be used to assess the presence of plutonium, uranium, and americium in samples, although identification of individual radionuclides is not possible by this method. For example, the alpha emissions from plutonium-238 are indistinguishable from those of americium-241 by gross alpha counting. These Level II measurements can be used to guide field operations, bias sample selection, or provide an initial assessment of the sample radioactivity for health and safety purposes.

The method uses dried soil samples in a fixed geometry with measurement times of 15 to 20 minutes. Detection limits are approximately 4 to 10 pCi/g for alpha emitters and 5 to 12 pCi/g for beta emitters.

5.1.2 Gamma Spectrometry

Gamma spectrometry can be used to quantify gamma-emitting radionuclides in soil samples. Rapid turnaround analysis can be Level II or Level III quality using computer-based, multi-channel analyzers and NaI or germanium photon detectors. Dried soil samples in a fixed geometry can be analyzed for cesium-137 in approximately 20 to 30 minutes with a detection limit of approximately 5 pCi/g. Detection limits for this technique are isotope specific.

5.2 Field GC/FID

Field GC/FID analysis will be used to identify areas with hydrocarbon contamination. The field GC will be used to analyze samples following an adaptation of SW 846 Method 8015 for total petroleum hydrocarbons (TPH). In the field, this method will provide Level II data for use in identifying the extent of areas to be excavated during VCAs. Samples will be sent for Level III laboratory analysis to confirm that the petroleum contamination has been remediated.

The TPH method uses a GC/FID to analyze extracts of soil samples for hydrocarbons. The method can be standardized against different petroleum products (such as Stoddard solvent or diesel fuel) or site-specific materials (such as spilled petroleum products that have weathered). The method is sensitive below the proposed 100 ppm cleanup levels.

5.3 X-Ray Fluorescence Probe for Metals

X-ray fluorescence (XRF) is a technique for analyzing metals in solids. The instrument consists of a source for sample excitation (x-ray tube), a detector or proportional counter, a sample chamber, and an energy analyzer. The XRF instrument will be kept in the radiological analysis van and used for detection of metals on solid surfaces. Dried soil or crushed debris samples are placed in a sample chamber, excited, and counted for finite time periods (e.g., 400 seconds). Detection limits for metals in soil must be low enough to ascertain whether action levels for metals on soil or debris will be exceeded. Even if metal action-level detection limits cannot be achieved in field instruments, gross concentrations of metals may be detected. This will be valuable information for soil or debris assessment. There is no ER SOP for XRF; calibration and field procedures recommended by the instrument manufacturer will be followed.

6.0 LABORATORY ANALYSES

Subsection 3.2 of this appendix provides the definition of laboratory analyses as used in this work plan. Level III is intended to be the highest quality level of data acquired. As described in Subsections 2.7 and 2.8 of this appendix, samples to be submitted to an analytical laboratory will be coordinated, handled, and tracked by the ER Program Sample Coordination Facility.

Table D-4 is a summation of analytical methods for sample analyses. The following list clarifies a few of the analytical methods that appear in Table D-4.

- **Gamma spectroscopy.** This refers to quantification of radionuclides by measurement of photon emissions.
- **Isotopic plutonium.** Radiochemical separation of plutonium from soil is followed by alpha spectrometry to quantify each isotope of plutonium.
- **Isotopic uranium.** Radiochemical separation of uranium from soil is followed by alpha spectrometry to quantify each isotope of uranium.

TABLE D-4

SUMMARY OF ANALYTICAL METHODS FOR THE ANALYSES OF SAMPLES COLLECTED AT OU 1114

SAMPLE TYPE	METHOD USED	METHOD DETECTION/ QUANTITATION LIMIT IN SOILS
Radionuclides		
Gross alpha	Gas flow proportional counter	4.0-10.0 pCi/g [a]
Gross beta	Gas flow proportional counter	5.0-12.0 pCi/g [a]
Gamma spectrometry	High-purity germanium gamma-ray spectrometry	0.1-2.0 pCi/g [a]
Isotopic plutonium (^{238}Pu, ^{239}Pu, ^{240}Pu)	Ion exchange and alpha spectrometry	0.02 pCi/sample [b]
Isotopic uranium (^{234}U, ^{235}U, ^{238}U)	Ion exchange and alpha spectrometry	3.00 pCi/g [b]
Strontium-90	Solvent extraction and beta counting	0.50 pCi/g [b]
Tritium	Distillation and liquid scintillation	2.50 pCi/total activity, or 500 pCi/L per 5 ml sample[b]
Organics		
Herbicides	EPA SW 846 Method 8150	0.05-167.0 ppm [c]
Organochlorine pesticides	EPA SW 846 Method 8080	0.0014-0.16 ppm [c]
Organophosphorus pesticides	EPA SW 846 Method 8140	0.02-3.35 ppm [c]
Polychlorinated biphenyls	EPA SW 846 Method 8080	0.045 ppm [c]
PCB/immunoassay	EPA SW 846 Method 4020 [d]	5.0 ppm [d]
Semivolatile organic compounds	EPA SW 846 Method 8270	0.10-3.30 ppm [c]
Total petroleum hydrocarbons	EPA SW 846 Method 8015 [e]	10 ppm [e]
Volatile organic compounds	EPA SW 846 Method 8240	0.005-0.10 ppm [c]
Metals		
Mercury	EPA SW 846 Method 7471	0.2 ppm [f]
OU 1114 and Subpart S metals suite (arsenic, barium, beryllium, cadmium, chromium, lead, nickel, selenium, silver)	EPA SW 846 Method 6010 [c]	See Table D-5
Subpart S metals suite (antimony, arsenic, thallium)	EPA SW 846 Method 7000 [c]	See Table D-5
Miscellaneous		
Cyanide	EPA SW 846 Methods 9010 and 9012[a]	1.0 ppm [g]

a DOE 1983, 0516
b LANL 1992, 0520
c EPA 1987, 0518
d EPA 1987, 0518 Draft SW 846 Method, Update 3, 1992
e EPA 1987, 0518 modified
f A dilution factor of 100 was applied to the detection limit reported
g EPA 1990, 17-821

- **Strontium-90.** This refers to radiochemical separation using multiple selective precipitation and counting of beta activity by gas proportional detectors.

- **Tritium.** This refers to measurement of tritium in soil moisture. Soil moisture is distilled from soil, and the low energy beta emission from tritium is measured by liquid scintillation techniques.

- **OU 1114 Metals Suite.** A selected list of hazardous metals has been defined as the "OU 1114 suite." It consists of beryllium, cadmium, chromium, lead, mercury, nickel, and silver. This suite will be used as the default list of metals where no subset has been specified for analysis. There is no documented use at OU 1114 of several metals on the target analyte (TAL) list, including antimony, arsenic, barium, selenium, thallium, and vanadium. Because of their hazardous natures, uses of these metals would have been documented in Health and Safety Division records for any areas contributing to PRSs. For several metals on the TAL list (including aluminum, calcium, cobalt, iron, magnesium, manganese, potassium, sodium, and zinc), the screening action levels (SALs) are far higher than any waste concentrations expected at the site, or are such common constituents in the environment that no SALs have been defined for soil. Table D-5 compares the TAL list to the OU 1114 default suite and the SAL in soil.

- **Cyanide** (SW 846 Methods 9010, 9012). Methods 9010 and 9012 are the standard EPA methods for quantification of cyanide in an aqueous waste or leachate.

- **Mercury** (SW 846 Methods 7470, 7471). Method 7470 is the standard EPA method for quantification of mercury in aqueous wastes and groundwaters. Method 7471 is

TABLE D-5

ANALYTE LISTS COMPARED

TARGET ANALYTE LIST	OU 1114 ANALYTE LIST	SAL IN SOIL (ppm) [a] (LANL 1992, 0768)	ESTIMATED DETECTION LIMIT (ppm) IN SOIL [b]
Aluminum		None	
Antimony	Antimony	32.00	0.30
Arsenic	Arsenic	0.40	01.0
Barium	Barium	5 600.00	0.20
Beryllium	Beryllium [c]	0.16	0.03
Cadmium	Cadmium [c]	80.00	0.40
Calcium	Calcium	None	
Chromium III	Chromium III	80 000.00	0.70
Chromium VI	Chromium VI [c]	400.00	0.70
Cobalt		None	
Copper		3 000.00	
Cyanide		1 600.00	1.0 [d]
Iron		None	
Lead	Lead [c]	To be determined	4.20
Magnesium		None	
Manganese		8 000.00	
Mercury	Mercury [c]	24.00	0.2
Nickel	Nickel [c]	1 600.00	1.50
Potassium		None	
Selenium	Selenium	400.00	7.50
Silver	Silver [c]	400.00	0.70
Sodium		None	
Thallium	Thallium	6.40	0.10
Uranium		240.00	
Vanadium	Vanadium	560.00	0.80
Zinc		24 000.00	

a LANL 1992, 0768
b A dilution factor of 100 was applied to the reported detection limit (EPA 1987, 0518).
c These metals constitute the OU 1114 metals suite. Analysis for the remaining metals will only occur at the waste water treatment system aggregate and the Sigma Mesa solar pond.
d EPA 1990, 17-821

the EPA method for quantification of mercury in solid and sludge-type wastes.

7.0 SAMPLING METHODS

7.1 Introduction

For the field sampling plans used in this work plan, a suite of specific sampling methods has been selected, and the details of their use and application in the field have been carefully defined. For example, a "surface soil sample" in this document is specifically defined as representing a 0 to 6 in. layer of soil collected with a hand-held scoop (see Subsection 7.2.1), and a "manual shallow core sample" is specifically defined as a less than 10 ft core interval taken with a hand auger or thin-wall tube sampler (see Subsection 7.2.5).

Setting these common definitions and using them uniformly in all of the field sampling plans provides several benefits: consistency of field operations, comparability of sample analysis results from location to location in OU 1114, and the ability to have each sampling plan refer to a method definition in this appendix without reproducing the information in each plan. For each method identified below, the specifically-defined portion is detailed; however, complete specification of the method requires additional information that is referenced to the applicable SOP or provided in the field sampling plan (e.g., nominal or target depth for a borehole).

7.2 Soil Sampling Methods

7.2.1 Surface Soil Samples

Surface soil samples are defined as samples taken from the upper 0 to 6 in. of soil. This type of soil sample will be gathered using a stainless steel or Teflon scoop. Care will be used to take the sample to a full 6 in. depth and to cut the sides of the hole vertically to ensure that equal volumes of soil are taken over the full 6 in. depth. The applicable SOP is LANL-ER-SOP-06.09, R0, Spade and Scoop Method for Collection of Soil Samples (LANL 1993, 0875).

7.2.2 Near-Surface Soil Samples

The spade and scoop method will be used to obtain near-surface soil samples from depths of 6 to 12 in. Sample collection from depths greater than 12 in. can become labor-intensive. Collection of samples is accomplished with spades, shovels, and scoops. Spades and shovels are used to remove surficial material to the required depth. A stainless steel or Teflon scoop is then used to collect the sample (devices plated with chrome or other materials are not acceptable for sample collection).

Care will be used to take the sample to a full 12 in. depth and to cut the sides of the hole vertically to ensure that equal volumes of soil are taken over the full 12 in. Unless otherwise specified, the sample interval will be 12 in. The applicable SOP is LANL-ER-SOP-06.11, R0, Stainless Steel Surface Soil Sampler (LANL 1993, 0875).

7.2.3 Undisturbed Surface Soil Samples

Undisturbed soil samples will be gathered from the first 6 in. of soil using the ring sampler method. This method involves driving a 4-in.-diameter stainless steel tube (ring sampler) vertically into the area to be sampled. The soil around the ring sampler is then excavated so that the tube can be removed. An undisturbed core sample is obtained by pushing the soil from the ring sampler. The applicable SOP is LANL-ER-SOP-06.11, R0, Stainless Steel Surface Soil Sampler (LANL 1993, 0875).

7.2.4 Deposition-Layer Soil Samples

Deposition-layer soil samples are those samples collected from the first 1 in. of soil. The method is used to collect samples that represent wind- or air-deposited contaminants on the soil surface (i.e., contaminants dispersed and deposited from stack emissions). They will be collected by using a stainless steel or Teflon trowel to scrape off the upper 1 in. of soil. The applicable SOP is LANL-ER-SOP-06.09, R0, Spade and Scoop Method for Collection of Soil Samples (LANL 1993, 0875).

7.2.5 Manual Shallow-Core Samples

Small volume soil samples can be recovered from depths approaching 10 ft with a hand auger or with a thin-wall tube sampler. The thin-wall tube sampler provides a less disturbed sample than that obtained with a hand auger. However, it may not be possible to force the thin-wall tube sampler through some soil or tuff, and sampling with the hand auger may be the more viable alternative. The applicable SOP is LANL-ER-SOP-06.10, R0, Hand Auger and Thin-Wall Tube Sampler (LANL 1993, 0875).

7.3 Chip Samples

Chip samples are destructive samples collected to be representative of porous surfaces such as asphalt, concrete, wood, brick, unglazed clay pipe, and tuff. Destructive porous surface techniques are used for any porous object considered too large for collection, such as a discrete sample. Examples include intact structures such as a roadbed or wall, chunks of debris too large for transport, boulders or bedrock surfaces, and surfaces of functioning structures. Chip sampling requires a chisel, drill, hole saw, or similar tool to collect a minimum of 100 grams of sample to a maximum depth of 1 in. The applicable SOP is in preparation, LANL-ER-SOP-06.28, R0, Chip Sampling of Porous Surfaces.

7.4 Liquid Samples

The Coliwasa is designed to collect liquid hazardous waste. It permits the representative sampling of multiphase wastes with a wide range of viscosity, corrosivity, volatility, and solids content. The main parts of the Coliwasa consist of a sampling tube, stop-cock, and closure system. The sampling tube is a 5-ft by 1 5/8 in. I.D. translucent plastic pipe; usually polyvinyl chloride (PVC), or a borosilicate glass plumbing tube. The plastic Coliwasa is used to sample most containerized liquid wastes except wastes that contain ketones, nitrobenzene, dimethylforamide, mesityl oxide, and tetrahydrofuran. The glass Coliwasa is used to sample all other containerized liquid wastes except for strong alkali and hydrofluoric acid solutions. The applicable SOP is LANL-ER-SOP-06.15, R0, Coliwasa Sampler for Liquids and Slurries (LANL 1993, 0875).

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Appendix E

Topographic Maps Showing PRS Locations

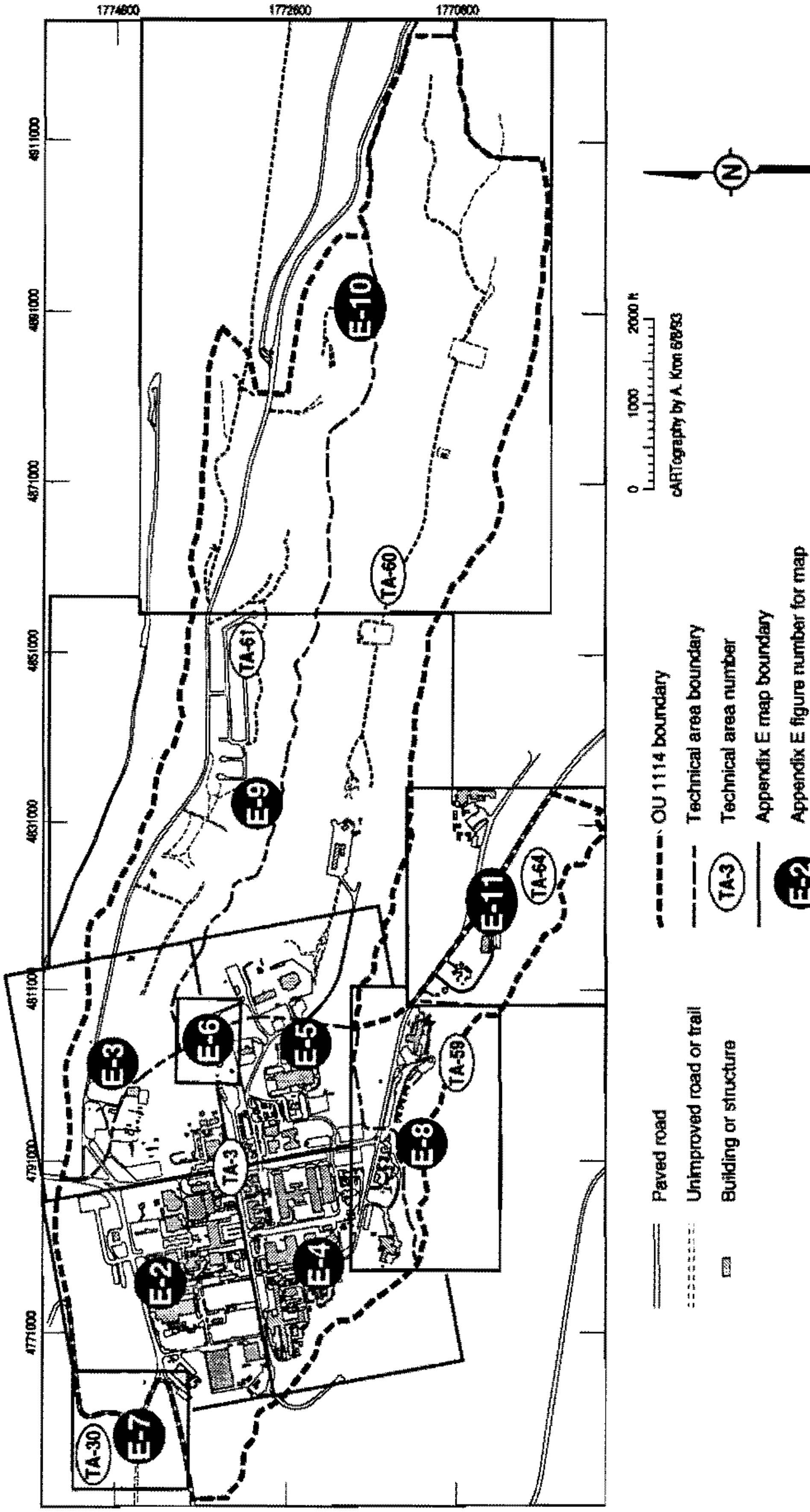

Fig. E-1. Index to topographic maps of OU 1114.

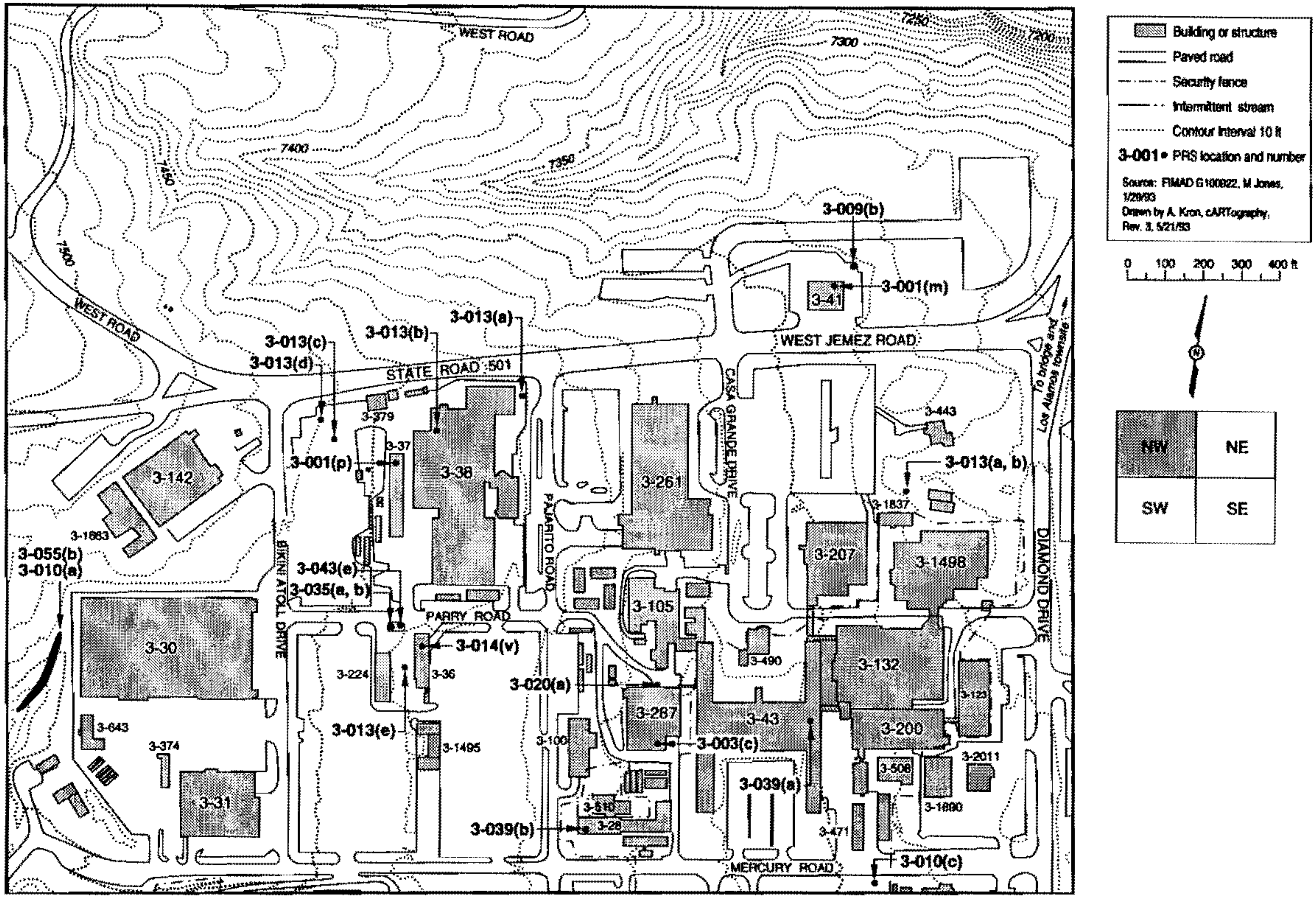

Fig. E-2. Topographic map of TA-3 (NW quadrant) showing locations of PRSs.

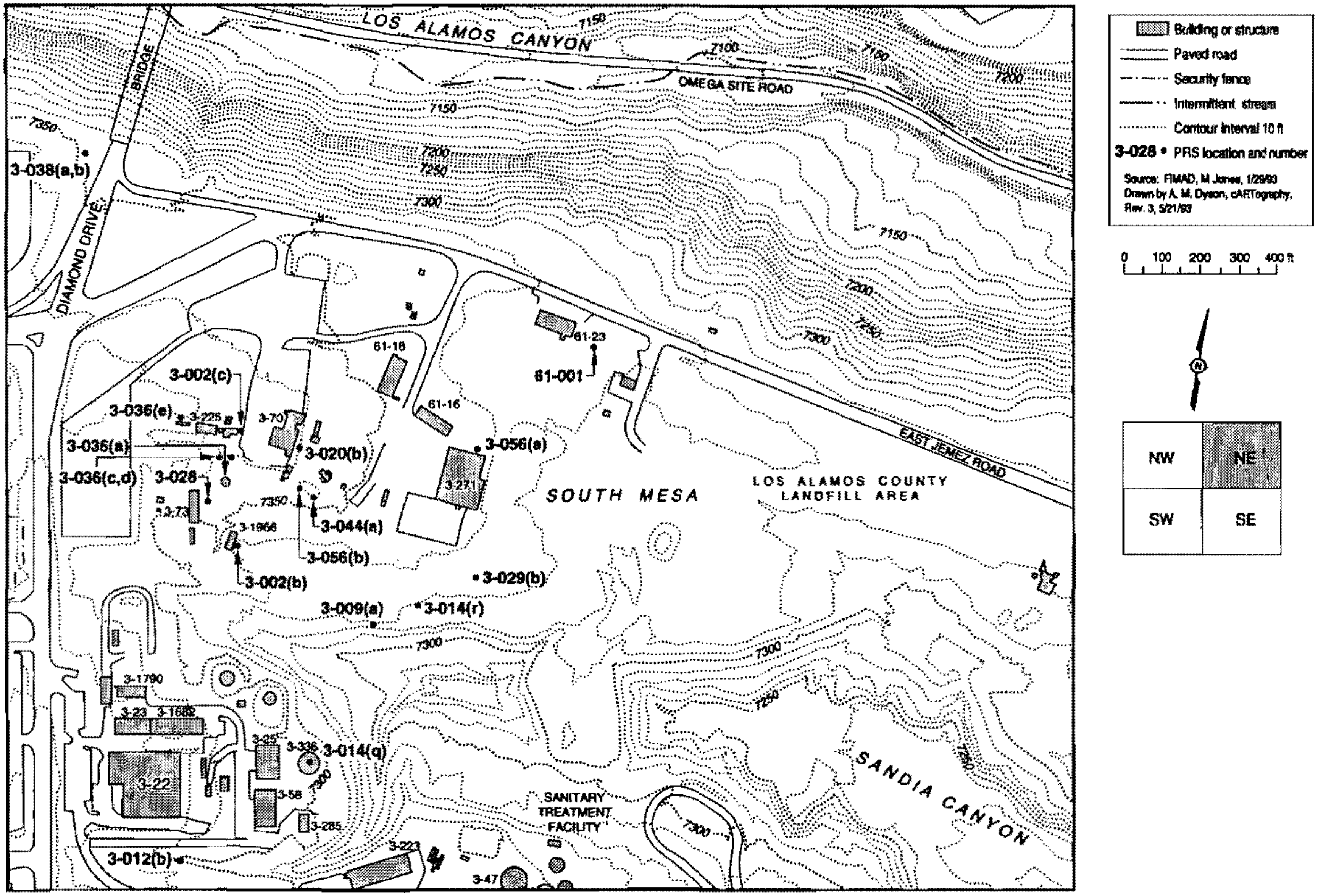

Fig. E-3. Topographic map of TA-3 (NE quadrant) showing locations of PRSs.

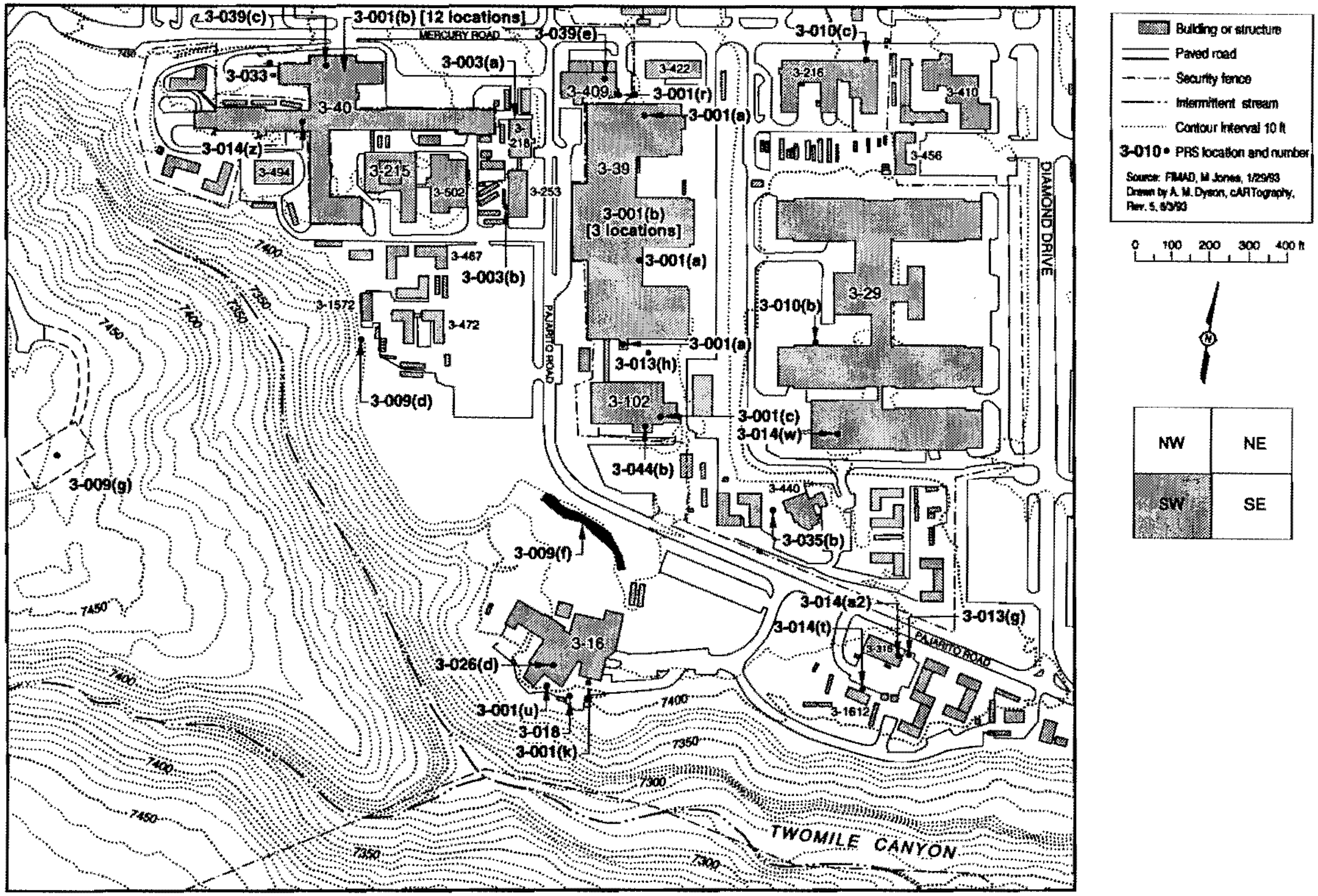

Fig. E-4. Topographic map of TA-3 (SW quadrant) showing locations of PRSs.

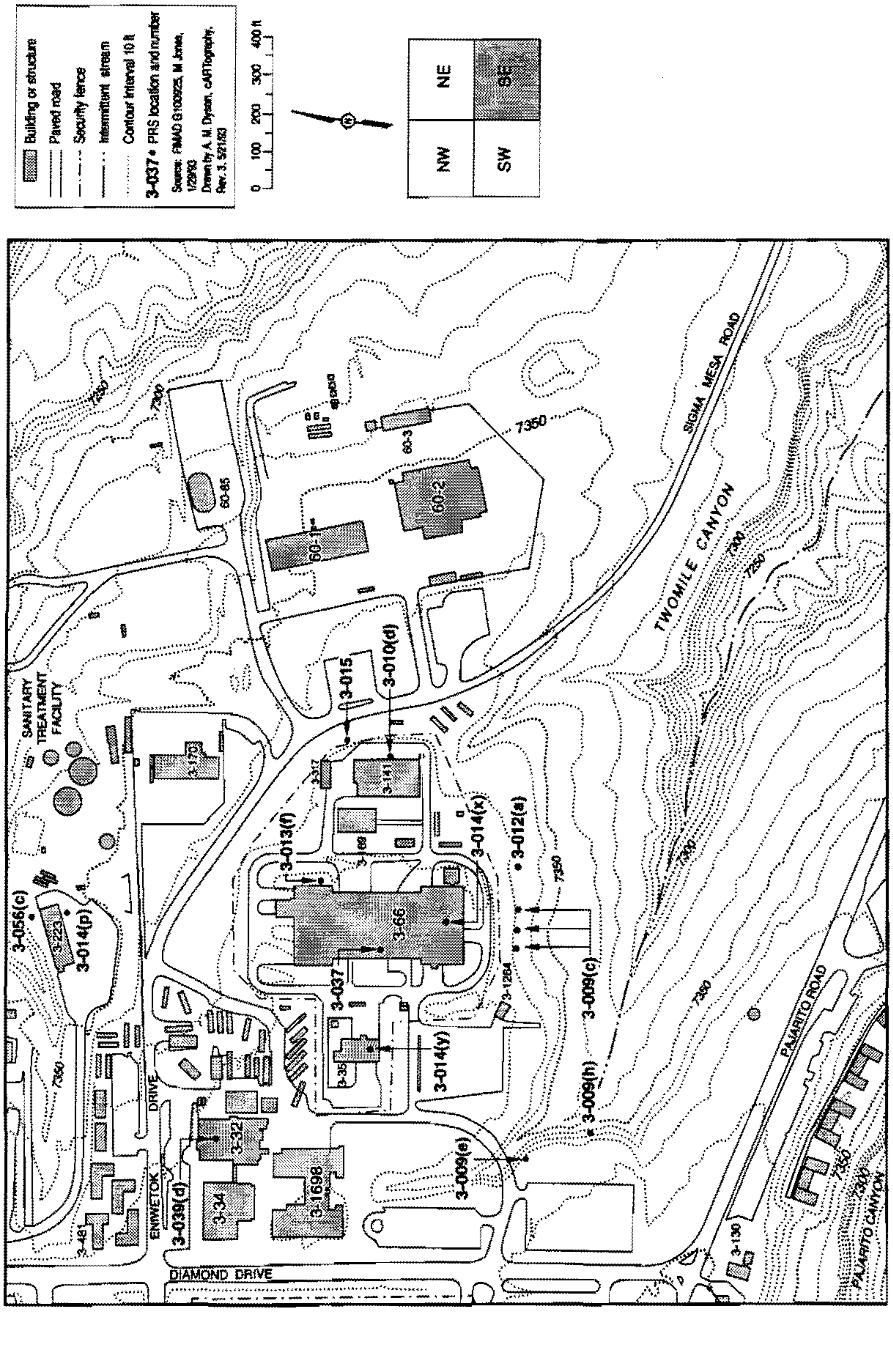

Fig. E-5. Topographic map of TA-3 (SE quadrant) showing locations of PRSs.

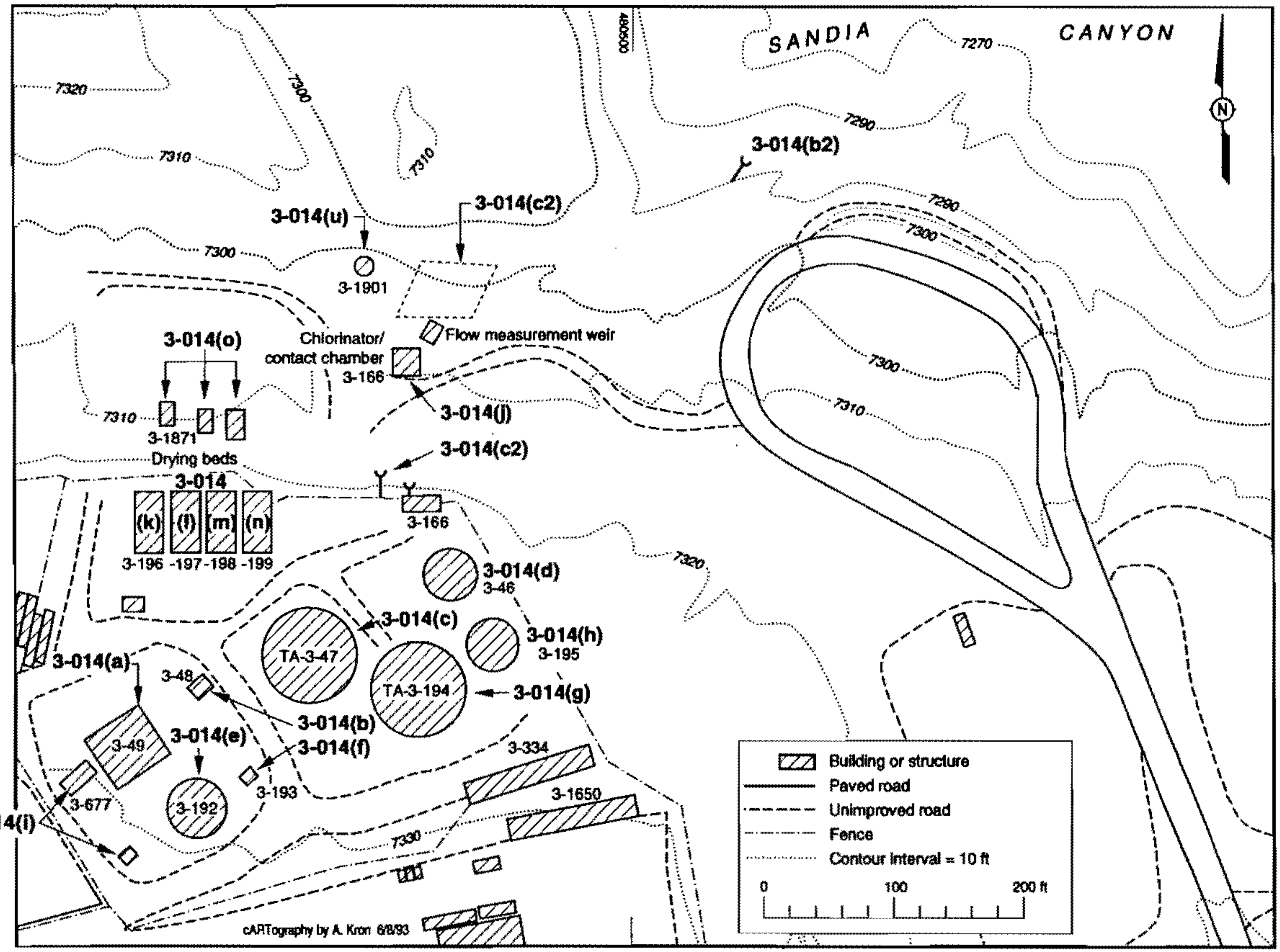

Fig. E-6. Locations of PRSs in the sanitary treatment system at TA-3.

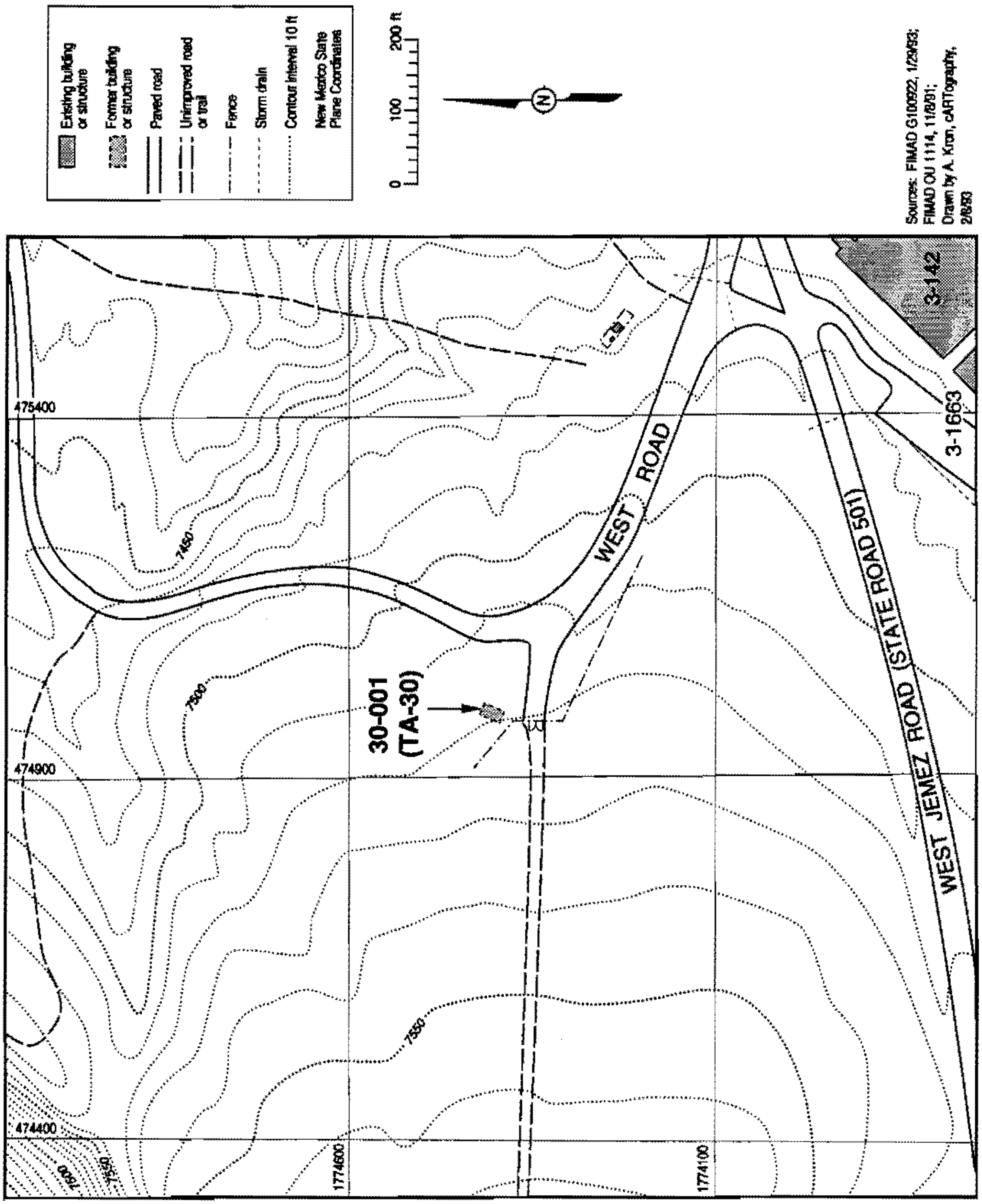

Fig. E-7. Topographic map of TA-30 showing PRS 30-001.

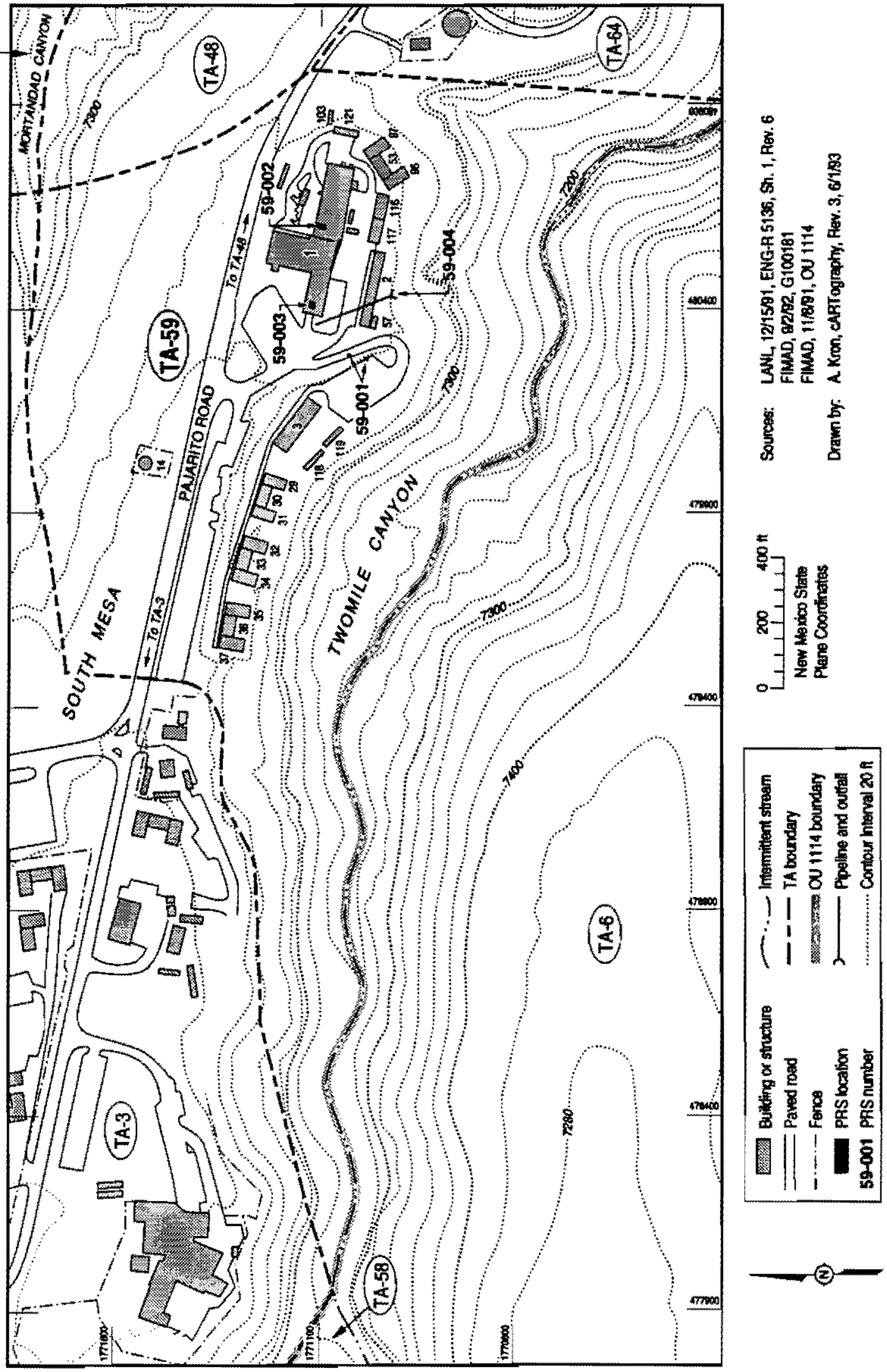

Fig. E-8. Topographic map of TA-59 showing locations of PRSs.

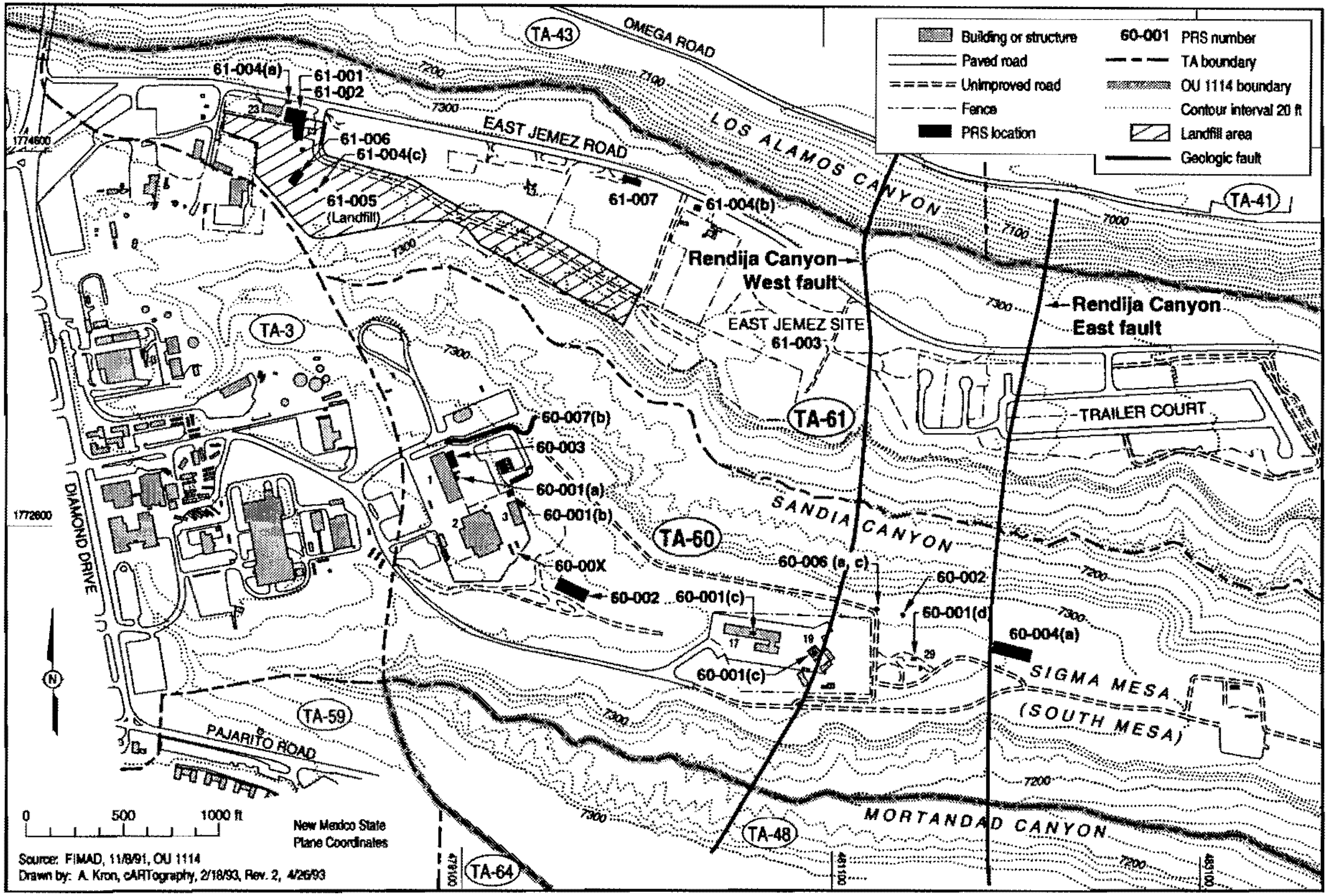

Fig. E-9. Topographic map of TA-60 and TA-61 (western half) showing locations of PRSs and faults.

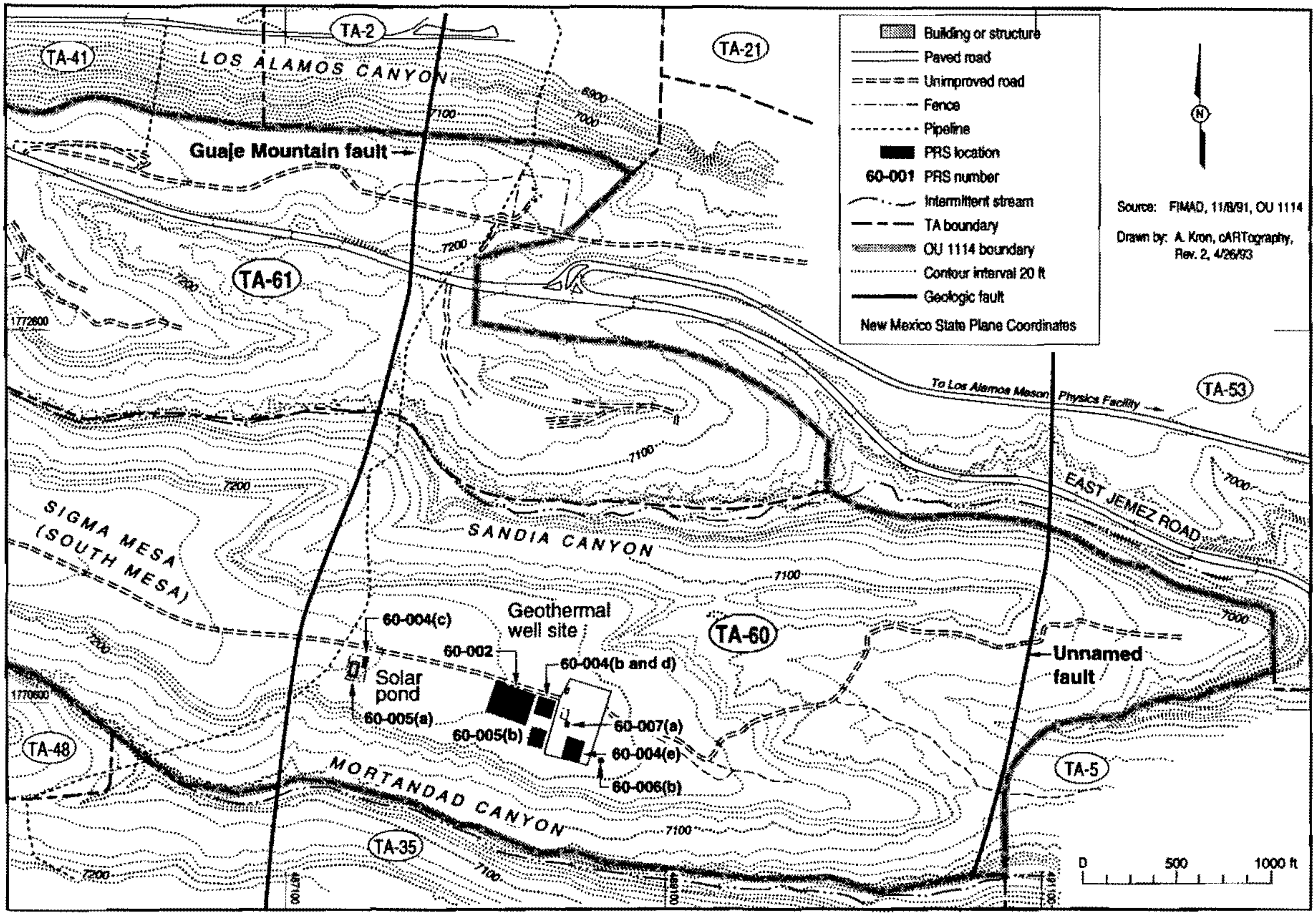

Fig. E-10. Topographic map of TA-60 and TA-61 (eastern half) showing locations of PRSs and faults.

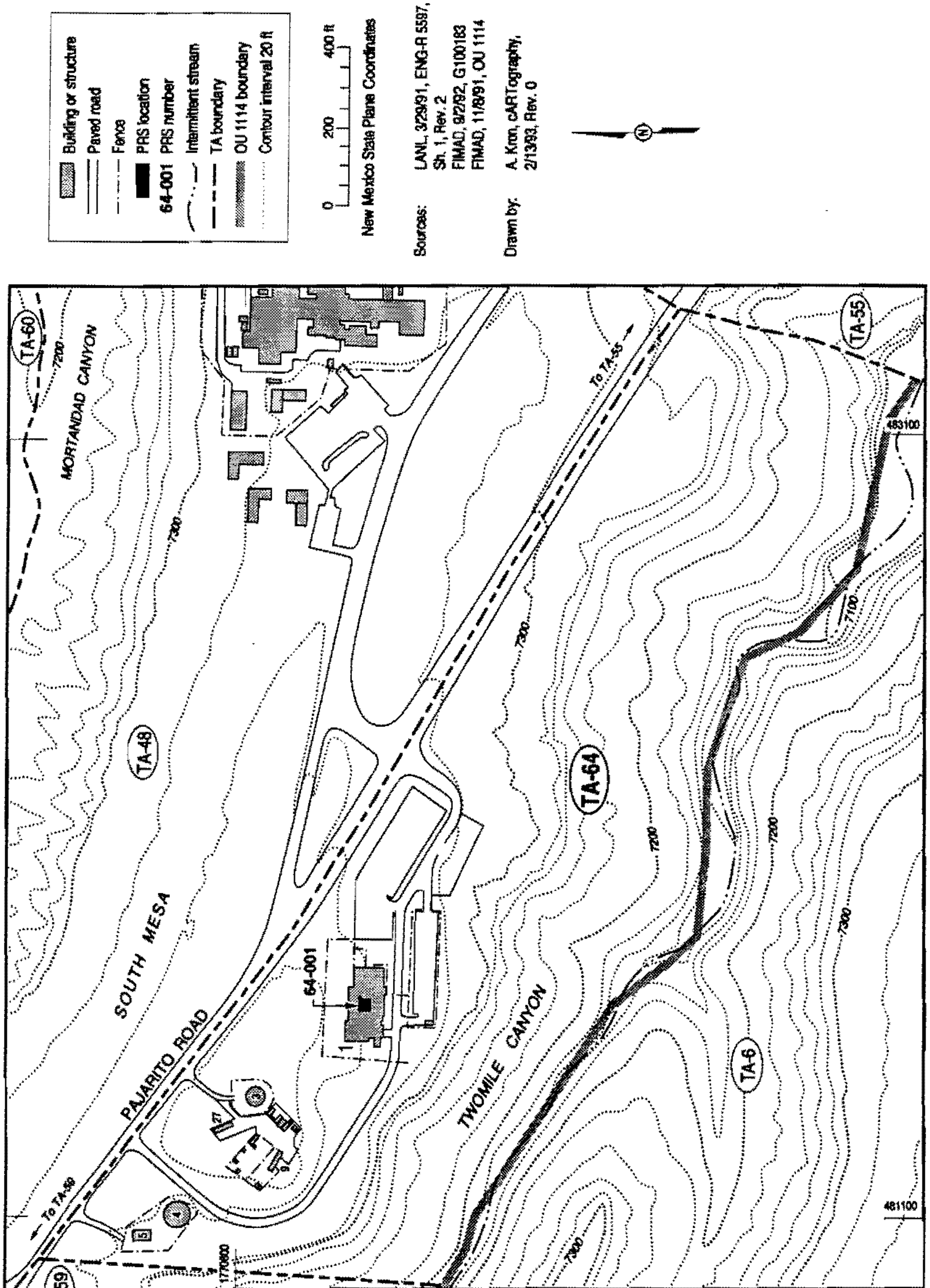

Fig. E-11. Topographic map of TA-64 showing locations of PRSs.