environmental restoration project

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Installation Work Plan for Environmental Restoration Project

Revision 8

Los Alamos
NATIONAL LABORATORY
Los Alamos, NM 87545

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EXECUTIVE SUMMARY

Background

This Installation Work Plan (IWP) describes how the US Department of Energy (DOE) and the University of California (UC), under contract to DOE, are conducting the DOE Environmental Restoration (ER) Project at Los Alamos National Laboratory (the Laboratory).

The Laboratory and the neighboring residential areas of Los Alamos and White Rock are located in Los Alamos County, north-central New Mexico, approximately 60 mi north-northeast of Albuquerque and 25 mi northwest of Santa Fe. The 43-mi^2 Laboratory site and the communities adjacent to it are situated on the Pajarito Plateau.

Since its inception in 1943, the primary mission of the Laboratory has been nuclear weapons research and development. In achieving this objective, the Laboratory used hazardous and radioactive materials. Some of these materials were disposed on the Laboratory site or were otherwise released into the environment. Beginning in the 1960s, Congress enacted basic legislation to protect the environment. As a result, DOE began to clean up areas of the Laboratory where spills and disposal occurred. Additionally, the Laboratory began to implement practices to minimize the generation of hazardous and radioactive materials. The Laboratory's current central mission is to reduce global nuclear danger.

In 1989, the DOE established its Office of Environmental Restoration and Waste Management (EM). The goal of this office is to implement the DOE's policy of ensuring that its past, present, and future operations do not threaten human health, safety, or the environment. Also in 1989, the Environmental Restoration Directorate (EM-40) established its ER Project, assigning the Laboratory to its DOE Albuquerque Field Office and thereby establishing the Laboratory's ER Project. The DOE's Los Alamos Area Office Environmental Restoration Team is assigned to oversee the ER Project at the Laboratory.

Statutory Basis of the ER Project

The ER Project at the Laboratory adheres to two primary laws: the Resource Conservation and Recovery Act (RCRA), which is the statutory basis for the ER Project at the Laboratory, and the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), which provides a reference for remediating sites at the Laboratory that contain certain hazardous substances not covered by RCRA. For cleanups conducted by the ER Project, the primary regulatory driver is RCRA.

Authorized by the US Environmental Protection Agency (EPA) under RCRA, the New Mexico Environmental Improvement Division (now the New Mexico Environment Department [NMED]) issued a Hazardous Waste Facility Permit to the Laboratory in 1989. This permit addresses the treatment and storage of hazardous wastes at the Laboratory. In 1990, EPA issued a Hazardous and Solid Waste Amendment (HSWA) Module (Module VIII) to the Laboratory's Hazardous Waste Facility Permit. Module VIII prescribes a specific corrective action program for the Laboratory, provides the primary requirements for the Laboratory's ER Project, and defines the principal requirements with which DOE and UC must comply in implementing corrective action at the Laboratory. Through 1995, EPA had sole authority over corrective actions at the Laboratory. On January 2, 1996, EPA delegated this authority to NMED.

Certain issues of concern at the Laboratory are exempt from RCRA's definition of solid waste and are therefore not subject to the provisions of Module VIII, for example, source, by-product, and special nuclear materials (regulated under the Atomic Energy Act). The ER Project adheres to the provisions of applicable DOE orders to implement a technically comprehensive program that covers all potentially contaminated sites not regulated under RCRA. Provisions in this IWP pertaining to subjects outside the scope of RCRA are not enforceable under the Laboratory's Hazardous Waste Facility Permit.

Scope and Purpose

This IWP has been prepared in accordance with Module VIII of the Laboratory's Hazardous Waste Facility Permit and with corrective action guidance provided by EPA. This IWP describes how each step in the corrective action process will be implemented at the Laboratory. This document also meets the requirements of the Outline for Facility-Wide Workplans as provided in NMED's RCRA Permits Management Program Document Requirement Guide.

The primary goal of the RCRA facility investigation (RFI) is to confirm or deny that a release has occurred and, once confirmed, identify the nature and extent of contamination that could lead to exposure of human and environmental receptors. The corrective measures study (CMS) evaluates alternatives that could reasonably be implemented if characterization indicates that corrective measures are needed. Finally, the corrective measures implementation (CMI) effects the chosen remedy, verifies its efficacy, and establishes ongoing control and monitoring requirements if needed. The Laboratory's ER Project, in cooperation with NMED, also initiated a process for implementing accelerated cleanups prior to the CMS if there is an obvious remedy and a cleanup approach agreed upon by all parties.

The focus of the Laboratory's ER Project is the investigation of all corrective action sites, including those identified in Module VIII of the Laboratory's Hazardous Waste Facility Permit. The ER Project has grouped all sites to be taken through the corrective action process into 3 operational focus areas (formerly 24 operable units). All new data are evaluated as they become available. The ER Project and NMED jointly decide the priorities of upcoming fieldwork. Corrective action sites are addressed in work plans or sampling and analysis plans that provide information on how each site will be investigated. Completed investigations are addressed in reports.

The current projection for the completion of the RFI/CMS/CMI phases of the corrective action process at the Laboratory is approximately the year 2013 (when the last potential release site is closed out), depending on funding levels. This process will address all corrective action sites at the Laboratory in order to meet all applicable environmental regulations.

Public involvement is an important component of the Laboratory's ER Project; accordingly, the ER Project implements a public involvement plan in which the public is provided with accurate, complete, and timely information and early, meaningful participation opportunities. In addition, formal public meetings are held, as needed.

In conjunction with corrective action activities, the ER Project also oversees decommissioning activities at the Laboratory for the purpose of coordinating field campaigns.

Contents of the IWP

This IWP is revised only as needed to reflect the current status of the ER Project. Revisions to the IWP capture any changes in Laboratory and ER Project structure, changes in DOE and regulator guidance and mandates, and changes in funding or ways of doing business.

Chapter 1 discusses the background, purpose and scope of both the IWP and the Laboratory's ER Project. Chapter 1 also includes the statutory and regulatory framework that forms the basis of the ER Project and describes the ER Project and its organization. Chapter 2 describes the Laboratory and its environmental setting.

Chapter 3 describes the requirements of the corrective action process, the ER Project assessment strategy for conducting corrective action, and the ER field sampling procedures for conducting corrective action characterization and confirmation. A detailed discussion of the decision process leading to no further action, the next phase of investigation, and remediation is also provided.

The Records Management Plan, which describes the mechanisms to be used to track information and data throughout the ER Project, is presented in Chapter 4.

Chapter 5 provides a detailed plan for ensuring the health and safety of workers during implementation of the ER Project. The plan establishes generic health and safety requirements, procedures, and emergency actions that apply to all field operations project-wide and is intended to be used in conjunction with a site-specific health and safety plan prepared for each field project.

Chapter 6 describes the waste management activities of the ER Project. This chapter includes a listing of the types of wastes anticipated to be generated, describes the types of waste storage areas used, and provides treatment options.

Chapter 7 contains the ER Project's public involvement plan, describing the ER Project approach to public outreach and public involvement in the decision-making process, both at the project and Laboratory levels.

This document also contains five appendixes:

- Appendix A — Acronyms, Glossary, and Conversion Table;
- Appendix B — Potential Release Sites at Los Alamos National Laboratory;
- Appendix C — Methodology for Calculating Human Health Screening Action Levels in Soils and Sediments;
- Appendix D Reporting Requirements; and
- Appendix E Annual Work Schedule for the Environmental Restoration Project at Los Alamos National Laboratory.

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INTRODUCTION TO THE INSTALLATION WORK PLAN

The management plan for the US Department of Energy's (DOE's) Environmental Restoration (ER) Project at the Los Alamos National Laboratory (the Laboratory) is documented in this Installation Work Plan (IWP). The IWP is developed by the Laboratory's ER Project on behalf of the DOE and the University of California (UC), which operates the Laboratory for the DOE. This document is required under Module VIII, Task II, of the Hazardous Waste Facility Permit issued to the Laboratory by the New Mexico Environment Department (NMED) and complies with the Outline for Facility-Wide Workplans provided in Section II.B.4.a.(1) of NMED's Hazardous and Radioactive Materials Bureau guidance document, "RPMP Document Requirement Guide" (NMED 1998, 57897).

The IWP consists of seven chapters. Chapters 1 and 2 describe the ER Project and its management plan and the Laboratory and its environment, respectively. Chapter 3 presents the ER Project quality assurance project plan, including the requirements of the corrective action process, the project's assessment strategy, and its approach to data collection and evaluation. Chapters 4–7 present the ER Project plans for records management, health and safety, waste management, and public involvement, respectively. In addition, this document contains five appendixes that supplement information provided in Chapters 1–7. Appendix A includes a list of acronyms and abbreviations, a glossary, and a table showing conversion of metric to English units of measure. A list of the ER Project corrective action sites is contained in Appendix B. Appendix C contains the methodology for calculating human health screening action levels. Appendix D describes reporting requirements, and Appendix E is the annual work schedule for the ER Project.

Background for the IWP

Since its inception in 1943, the Laboratory's primary mission has been nuclear weapons research and development. The Laboratory was established with the singular objective of rapidly developing nuclear weapons. In achieving this objective, the Laboratory used hazardous and radioactive materials. Some of these materials were disposed on the Laboratory site or were otherwise released into the environment. Beginning in the 1960s, Congress enacted basic legislation to protect the environment. As a result, DOE began to clean up areas of the Laboratory where spills and disposal occurred. Additionally, the Laboratory began to implement practices to minimize the generation of hazardous and radioactive materials.

The Laboratory is operated by UC under contract to DOE and under the regulatory oversight of both DOE and NMED (as authorized by the Environmental Protection Agency [EPA]). The Laboratory's current mission is to reduce global nuclear danger. This mission supports disciplines that enable the Laboratory to contribute to defense, civilian, and industrial needs.

In 1989, the DOE created its Office of Environmental Restoration and Waste Management (EM). The goal of the EM Office is to establish policies ensuring that DOE's past, present, and future operations pose no unacceptable risk to human or environmental health and safety (DOE 1993, 12602; 12603). The goal of the policies established by the EM Office is to ensure compliance with NMED and EPA regulations and DOE orders. EM Office policies are implemented through three associate directorates: Environmental Restoration (EM-40), Waste Operations (EM-30), and Technology Development (EM-50).

Also in 1989, EM-40 established its ER Project as a Major Systems Acquisition Project, assigning the Laboratory to its DOE Albuquerque Field Office and thereby establishing the Laboratory's ER Project. The DOE's Los Alamos Area Office (DOE-LAAO) is assigned to oversee the ER Project at the Laboratory under DOE-LAAO's Environmental Restoration Team. The DOE ER Project at Los Alamos includes ER activities and decommissioning activities at the Laboratory.

Under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), EPA ranked facilities throughout the nation according to the potential hazard to human health and safety. The Laboratory was not ranked as a high-priority facility, and, therefore, is not on the National Priorities List.

In November 1989, the New Mexico Environmental Improvement Division (NMEID) (now the NMED), authorized by the EPA under the Resource Conservation and Recovery Act (RCRA), issued to the Laboratory its Hazardous Waste Facility Permit (NMEID 1989, 11737), which addresses treatment and storage of hazardous wastes at the Laboratory. In March 1990, the EPA issued a Hazardous and Solid Waste Amendments (HSWA) Module VIII to the permit (EPA 1990, 1585). Module VIII sets forth the procedural requirements for RCRA corrective action at sites identified as solid waste management units (SWMUs) and specifies the development of an installation-wide work plan to be updated annually. Through 1995, EPA had sole authority over corrective actions at the Laboratory. In January 1996, EPA delegated this authority to NMED.

Purpose and Scope of the IWP

The purpose of the IWP is to provide an overview of the Laboratory's ER Project, to describe the general environment of the Laboratory, and to describe the RCRA corrective action process as implemented by the Laboratory's ER Project at the several hundred sites under its purview. This process follows the requirements of DOE Order 414.1, "Quality Assurance," and Title 10 Code of Federal Regulations (CFR) Part 830.120 (10 CFR 830.120), "Quality Assurance Requirements," as implemented in the ER Project's Quality Management Plan (Environmental Restoration Project 1998, 59575). In addition, the IWP includes the ER Project's plans for records management, health and safety, waste management, and public involvement.

This IWP has been prepared in accordance with Module VIII of the Laboratory's Hazardous Waste Facility Permit and describes how each step in the corrective action process will be implemented at the Laboratory.

This IWP has also been prepared in accordance with the corrective action requirements proposed under Subpart S of 40 CFR 264, "Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities." In July of 1990, EPA proposed Subpart S to implement the corrective action program mandated in Section 3004(u) of RCRA. However, in 1999, the EPA stated that the majority of Subpart S (which has not previously been adopted) will never be promulgated, but implemented as guidance only.

1.0 PROJECT MANAGEMENT PLAN

This project management plan provides an overview of how the Laboratory's ER Project operates to achieve its corrective action goals. Included in this plan are the statutory and regulatory framework, which is the basis for the Laboratory's ER Project and an overview of the goals, organization and functioning of the project.

The Laboratory's ER Project adheres to contractual performance measures as required by Objective Standards of Performance, Appendix F of the contract between the UC and the DOE for management and operation of the Laboratory (available at `http://iosun.lanl.gov:2000/qp/measurements.html`). The ER Project adheres to specific measures tailored to ER as well as more general measures that apply to the Laboratory as a whole. The general measures provide details on how Laboratory operations (including the ER Project) will ensure a safe workplace and meet regulatory requirements.

1.1 Background

EPA regulations [40 CFR 270.14(d), "Information Requirements for Solid Waste Management Units"] require that applicants for operating permits (such as the Laboratory) submit "reasonably available" information that identifies SWMUs at the facility requesting the permit and that the facility identify the potential for release at each SWMU. To meet these requirements, the ER Project identified potentially contaminated sites at the Laboratory and listed those sites within SWMU reports (International Technology Corporation 1988, 11646; 11647; 11648; 11649; LANL 1990, 7511; 7512; 7513; 7514).

Based on the findings of the SWMU reports, EPA Region 6 identified a subset of sites to be included in Module VIII of the Laboratory's Hazardous Waste Facility Permit, issued to the Laboratory in 1989 (EPA 1990, 1585). To make the corrective action process for these sites more manageable, the ER Project originally grouped them into 24 operable units.

From October to December of 1997, the ER Project reorganized to improve the efficiency and effectiveness of corrective actions at the Laboratory. Corrective action sites were assigned to 3 major areas of investigation: the canyons and corrective action sites situated in canyons; the major material disposal areas (MDAs) and the corrective action sites located near them; and all other RCRA corrective action sites not assigned to canyons or MDAs.

To further facilitate corrective actions, in December of 1998, the ER Project and the NMED developed criteria for, and started the process of, consolidating corrective action sites that are related by contaminant source, geographic location, and potential cumulative risk. All sites in the original Module VIII of the Laboratory's Hazardous Waste Facility Permit were evaluated (EPA 1990, 1585).

Also in 1999, the ER Project reengineered its approach to become more systems-oriented, using the natural watersheds across the Laboratory installation to delineate discrete systems within which multiple, consolidated sites will be investigated, assessed, and (if necessary) remediated together.

1.2 Purpose and Scope

The purpose of the Laboratory's ER Project is to conduct investigations and corrective actions, if necessary, in accordance with RCRA at the several hundred sites under its purview. All work conducted by the ER Project adheres to internal administrative controls such as quality procedures (QPs) and standard operating procedures (SOPs), which are modified on an ER Project-driven schedule.

Traditionally, the scope of the RCRA corrective action process included performing a RCRA facility investigation (RFI), followed by a corrective measures study (CMS), if applicable, and a corrective measure implementation (CMI). An RFI entails a detailed investigation to determine the nature, extent, and migration rate of releases, if any, and provides information necessary for addressing contamination. A CMS serves to identify and evaluate alternatives to remediate identified releases. The CMI implements the selected remedy, defines its effectiveness, and establishes ongoing control and monitoring requirements, if needed.

In conjunction with the administrative authority, the ER Project constantly strives to streamline the corrective action process at the Laboratory by improving the efficiency and effectiveness of corrective actions at the Laboratory. As a part of this streamlining effort, the ER Project implements its corrective action process to ensure that the following criteria are met and documented.

- Nature and extent of contamination are characterized to assess any risk posed by the contamination.
- All sites are addressed to the extent necessary to ensure no unacceptable risk to human health and the environment.

The scope of the corrective action process at a specific site depends upon the conditions at that site. In some cases, the contamination at a site can be shown to be of no risk or of acceptable risk, and no action is taken. In other cases, the contamination at a site poses an unacceptable risk, and the contamination is treated, removed, stabilized, or contained in place to the extent necessary to eliminate or minimize risk. Sites are removed from the Laboratory's Hazardous Waste Facility Permit only after they are demonstrated to meet the aforementioned criteria to the satisfaction of the administrative authority.

1.2.1 Statutory and Regulatory Framework

The Laboratory's ER Project is conducted to comply with

- RCRA regulations and Module VIII of the Laboratory's Hazardous Waste Facility Permit;
- the National Environmental Policy Act (NEPA);
- applicable DOE Directives, Laboratory policies, and Executive Orders; and
- other applicable federal and state laws and regulations (as stated in Section 1.2.1.5 of this document).

1.2.1.1 Resource Conservation and Recovery Act

RCRA was enacted in 1976 to amend the Solid Waste Disposal Act of 1965. The Solid Waste Disposal Act provided the first federal statutory provisions to improve national solid waste disposal practices. RCRA added provisions for proper hazardous waste management. The hazardous waste provisions of RCRA govern the day-to-day operations of hazardous waste management at treatment, storage, and disposal (TSD) facilities. The law establishes a permitting system and sets standards for all hazardous waste-producing operations at a facility. Under RCRA, the Laboratory qualifies as a TSD facility and must have a permit to operate such a facility.

The Hazardous and Solid Waste Amendments to RCRA expand the scope and requirements of the law even further. HSWA requires that facilities assess, investigate, and potentially remediate releases of hazardous wastes and hazardous constituents from SWMUs. HSWA defines a SWMU as

> "...any discernible unit at which solid wastes have been placed at any time, irrespective of whether it was intended for the management of solid or hazardous waste. Such units include any area at or around a facility at which solid wastes have been routinely and systematically released."

HSWA requires corrective action for releases both inside and outside the boundary of any facility (such as the Laboratory) seeking a hazardous waste facility permit. HSWA Section 3004(u) requires corrective action for all releases of hazardous wastes or hazardous constituents from SWMUs within the boundary of the facility, whereas Section 3004(v) requires corrective action for releases that have migrated beyond the facility boundary. Implementation of HSWA Sections 3004(u) and (v) is required by the New Mexico Hazardous Waste Act of 1977 (NMHWA) and all subsequent amendments of this act. The Laboratory implements HSWA Sections 3004(u) and (v) and NMHWA through its Hazardous Waste Facility Permit (NM0890010515).

Common usage of the term “RCRA” does not exclusively refer to the 1976 RCRA Amendment to the Solid Waste Disposal Act of 1965, but includes the Solid Waste Disposal Act itself and all subsequent amendments to that act (including HSWA).

1.2.1.2 Comprehensive Environmental Response, Compensation, and Liability Act

CERCLA, enacted in 1980, addresses liability, compensation, cleanup, and emergency response relating to the release of hazardous substances into the environment and cleanup of inactive sites where hazardous substances have been released. The CERCLA definition of hazardous substance includes a broader spectrum of chemicals than RCRA, for example radionuclides and ammonia.

For cleanups conducted by the ER Project, RCRA is the primary regulatory driver.

1.2.1.3 Integration of the Provisions of RCRA and CERCLA

Even though the Laboratory is designated as a RCRA facility and is not on the National Priorities List, DOE orders specify that the ER activities be consistent with CERCLA. Lands conveyed or transferred from federal facilities to other parties are subject to CERCLA under Section 120 (42 USC 9682). The Laboratory implements Section 120 requirements at the time of property transfer.

1.2.1.4 Integration of the Provisions of RCRA and NEPA

NEPA provides a national policy to encourage protective environmental practices to promote efforts that will prevent or eliminate damage to the environment, to enrich the understanding of ecological systems and natural resources, and to establish a Council on Environmental Quality. NEPA ensures that major federal actions that may significantly impact the environment are reviewed prior to the initiation of the action.

In accordance with the provisions of DOE guidance, to the extent practicable, the ER Project has integrated NEPA procedural requirements with the RCRA process for assessing and cleaning up contaminated sites. In most cases, the technical basis for this integration is the RFI/CMS process prescribed by RCRA. The RFI/CMS process will be supplemented to the extent necessary to meet procedural and documentation requirements of NEPA. Such supplements might include the development of environmental assessments or information for use in environmental impact statements.

1.2.1.5 Other Statutes and Regulations

The following federal and New Mexico statutes, DOE requirements, and Executive Orders also affect the conduct of the Laboratory’s ER Project.

(a) Federal Statutes

- The American Indian Religious Freedom Act of 1978 establishes a policy to protect and preserve for Native Americans their inherent right to exercise their traditional religions.
- The Atomic Energy Act of 1948, as amended in 1954 and later years, authorizes energy research and development.

- The Clean Air Act of 1970, as amended, regulates emissions from a facility that could affect air quality. Such emissions must meet the performance standards established in this act.
- The Clean Water Act of 1972, as amended, seeks to restore and maintain the chemical, physical, and biological integrity of the nation's waters. The Clean Water Act regulates waste discharges to navigable waters and sets pretreatment standards for contaminant discharges to sewer lines that lead to publicly owned treatment works.
- The Department of Energy Organization Act of 1977 vests in DOE the responsibilities of ensuring that national environmental protection goals are incorporated in energy programs; of advancing the goals of restoration, protection, and enhancement of environmental quality; and of ensuring public health and safety.
- The Department of Transportation Act of 1966 defines the US Department of Transportation's regulatory responsibility for safety in the transportation of all hazardous materials, including radioactive materials.
- The Emergency Planning and Community Right-to-Know Act of 1986 creates an emergency management task force to develop and distribute to emergency response personnel a comprehensive plan for assessing and managing hazardous materials spills. This plan stipulates the requirements for reporting spills and performing cleanup activities.
- The Endangered Species Act of 1973, as amended, requires federal agencies, in consultation with and with the assistance of the Secretaries of Interior and Commerce, to ensure that their actions are "not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of the critical habitat of such species...".
- The Federal Facility Compliance Act of 1992, which amended RCRA, waives sovereign immunity under RCRA for federal facilities so that federal facilities are subject to enforcement actions, including fines and penalties, to the same extent as any private entity.
- The Fish and Wildlife Coordination Act of 1934 ensures that fish and wildlife resources receive consideration equal to that given other values during the planning of development projects that affect water resources.
- The National Historic Preservation Act of 1966 requires federal agencies to take into account the effects of their proposed actions on properties listed on, or eligible for, the National Register of Historic Places.
- The Occupational Safety and Health Act of 1970 provides for the general welfare of workers, to the extent possible, by ensuring that every working man and woman in the nation has safe and healthful working conditions.
- The Safe Drinking Water Act of 1974, as amended, defines safety standards for public water systems. The maximum contaminant levels developed under the Safe Drinking Water Act are the levels with which drinking water must comply.
- The Toxic Substances Control Act of 1976, as amended, ensures that technological innovation and commerce in chemical substances and mixtures do not present an unreasonable risk of injury to health or the environment. The Toxic Substances Control Act provides for the identification of toxic hazards posed by chemical substances. This statute regulates the use, storage, disposal, and cleanup of polychlorinated biphenyls.

(b) State Statutes

- The Air Quality Control Act of 1967 provides the basic framework for air pollution control in New Mexico.
- The Ground Water Protection Act of 1990 provides for the regulation of hazards associated with leaks and spills from underground storage tanks, containment and remediation of pollution incidents, and funding of groundwater protection activities.
- The Hazardous Chemicals Information Act of 1990 establishes state-level systems of emergency planning and notification to deal with releases of extremely hazardous substances and to provide a means whereby members of the public can be informed about hazardous chemicals used in their communities and about any releases of those chemicals.
- The Hazardous Waste Act of 1977, as amended, establishes the State of New Mexico's program for hazardous waste management and control.
- The Radiation Protection Act of 1978 establishes the general rule of radiation protection. The Radiation Protection Act specifies that levels of radiation be kept as low as reasonably achievable, taking into account the state of technology and the costs of improvements in relation to public health and safety benefits and to the use of ionizing radiation in the public interest.
- The Radioactive and Hazardous Materials Act of 1990 regulates the transportation of radioactive material on highways. It requires use of means of transportation that protect the health, safety, and welfare of the citizens and includes criteria for establishing the safest route.
- The Solid Waste Act of 1990 establishes a comprehensive statewide solid waste management program to regulate the reduction, storage, collection, transportation, separation, processing, recycling, and disposal of solid waste and to promote source reduction, recycling, reuse, treatment, and transformation of solid waste.
- The Water Quality Act of 1990 gives the New Mexico Oil Conservation Division exclusive authority over the prevention of water pollution resulting from oil or gas operations.

(c) DOE Orders and Directives and Secretary of Energy Notices

The DOE Orders and Directives and Secretary of Energy Notices that apply to the ER Project are detailed in Appendix G of the contract between DOE and UC (`http://iosun.lanl.gov:2001/qp/appg.html`).

(d) Executive Orders

The following Executive Orders (EOs) are applicable to the ER Project:

EO 11988, May 24, 1977	Floodplain Management
EO 11990, May 24, 1977	Protection of Wetlands
EO 11991, May 24, 1977	Relating to Protection or Enhancement of Environmental Quality
EO 12580, January 23, 1987	Superfund Implementation

1.2.2 Objectives of the ER Project

The objectives of the Laboratory's ER Project are to effectively formulate, evaluate, implement, and manage steps in the corrective action process in a manner that fully complies with all applicable environmental regulations and protects human health and the environment.

1.2.2.1 Project Management Objectives

The objectives of the Laboratory's ER Project Management Plan are to

- establish and maintain a management control system and project control procedures for efficient baseline management through a procedural framework and schedules for developing, implementing, coordinating, and monitoring corrective actions that comply with RCRA and all applicable environmental statutes;
- prioritize projects, taking into account resource availability; minimize duplication of analysis and documentation; and expedite corrective actions;
- provide both formal and informal mechanisms through which NMED and the public can review, comment on, and participate in the corrective action review process at the Laboratory;
- record plans, procedures, costs, and other data and prepare progress and technical reports so the knowledge and experience can be used to manage later elements in a cost-effective manner;
- ensure integration of the Decommissioning Project into the overall ER Project and provide a forum for the exchange of information among affected Laboratory organizations;
- complete decommissioning activities at all Laboratory facilities currently designated, and at those process-contaminated facilities that may be designated, as surplus facilities in the future;
- support DOE initiatives to transfer federal lands to other governmental agencies or to private owners by remediating such lands, as required; and
- establish procedures for ensuring that, when the ER Project ends, ER Project sites requiring long-term monitoring are turned over to the appropriate Laboratory facilities or organizations.

1.3 Structure of the DOE ER Project at the Laboratory

The DOE Los Alamos Area Office ER Team oversees the ER Project at the Laboratory. Sections 1.3.1 and 1.3.2 describe the organization of DOE-LAAO and the Laboratory's ER Project, respectively.

1.3.1 Organization of DOE-LAAO

The DOE-LAAO ER Management Team consists of the assistant area manager for environment, the ER team leader, and four ER project managers. The assistant area manager is responsible for the effective implementation of the DOE ER Project at the Laboratory. The ER team leader oversees regulatory correspondence and signs regulatory certification. ER Project managers consist of regulatory experts, environmental scientists, and technical engineers. Figure 1.3-1 shows the organization of DOE-LAAO.

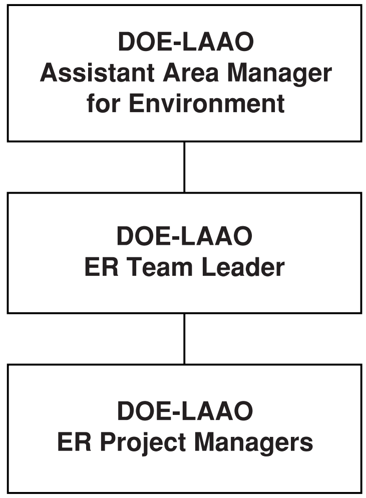

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Figure 1.3-1. Organization of DOE-LAAO

Representatives of both DOE-LAAO and the Laboratory's ER Project interact with the NMED. The representatives strive to work as partners to achieve objectives mutually acceptable to DOE and UC and to the regulatory agencies. DOE and UC seek to cooperatively define strategies and work with regulatory agencies to arrive at the best mutually acceptable agreements. Processing time is reduced and product quality is increased through a teaming approach by the ER project managers of DOE-LAAO and the Laboratory focus area project leaders. The teaming occurs during all phases of the ER Project.

1.3.2 Organization of the Laboratory's ER Project

Figure 1.3-2 shows the organization of the Laboratory's ER Project.

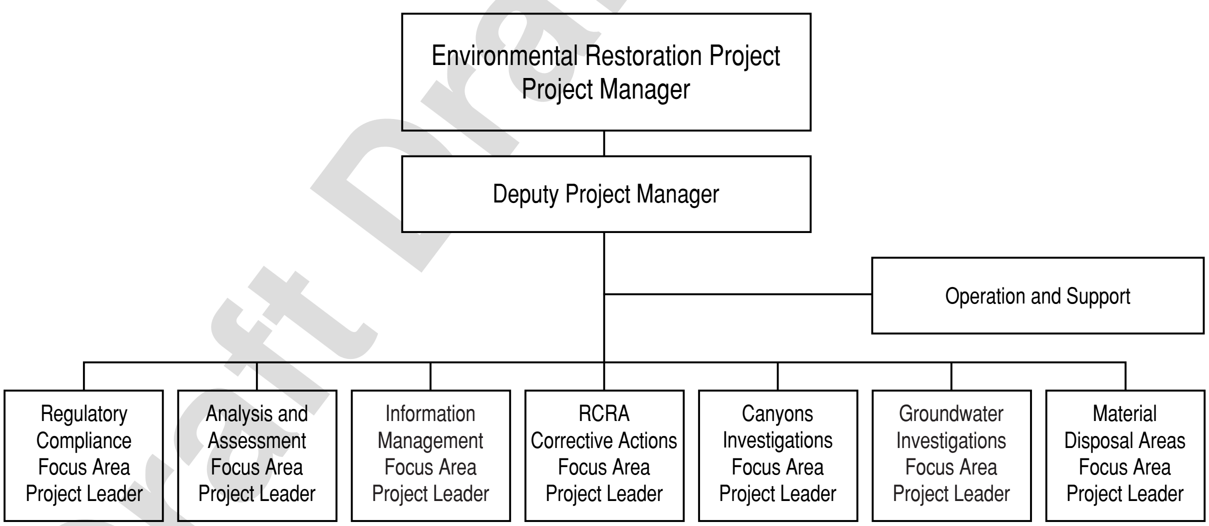

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Figure 1.3-2. Organization of the ER Project

1.3.2.1 Project Management Team

The ER Project Management Team consists of the ER Project project manager, deputy project manager, and seven focus area project leaders. The ER Project project manager is responsible for the effective implementation of the ER Project throughout the Laboratory. In executing these responsibilities, the project manager is supported by a deputy project manager and seven project leaders responsible for the management of the following key facets of the ER Project known as focus areas.

- Regulatory Compliance,
- Analysis and Assessment,
- Information Management,
- RCRA Corrective Actions,
- Canyons Investigations,
- Groundwater Investigations, and
- Material Disposal Areas.

1.3.2.2 Regulatory Compliance Focus Area

The project leader for the Regulatory Compliance Focus Area is responsible for directing four team leaders. The team leaders direct staff in the following areas:

- Facility Integration and Guidance;
- Special Projects and Deployed Regulatory Generalists;
- Communications and Outreach; and
- Closeout, Tracking, and Contracts.

The project leader and team leaders are responsible for day-to-day interactions with the administrative authority, the public, the pueblo tribes, other stakeholders, and various operational managers of the Laboratory. The Regulatory Compliance Focus Area is responsible for providing consistent interpretation of regulatory requirements and ensuring that the ER Project remains in compliance with all applicable regulations.

1.3.2.3 Analysis and Assessment Focus Area

The project leader for the Analysis and Assessment Focus Area is responsible for directing three team leaders who manage the following teams:

- Strategic Decision Analysis,
- Risk Assessment and Review, and
- Data Analysis and Assessment.

The project leader and team leaders are responsible for the development of technical strategy and implementation of consistent technical methodology across the ER Project. Analysis and Assessment

Focus Area activities include strategic decision analysis, surface and subsurface modeling, human health and ecological risk assessment, and technical peer review. The focus area is also responsible for data quality and management requirements.

1.3.2.4 Information Management Focus Area

The project leader for the Information Management Focus Area is responsible for coordinating the following activities

- sample management;
- geographic information system (Facility for Information Management, Analysis and Display [FIMAD]);
- database administration and management;
- computer systems support; and
- information management.

The project leader is responsible for integrating these activities so that ER Project information processes are adequately supported.

1.3.2.5 RCRA Corrective Actions Focus Area

The project leader for the RCRA Corrective Actions Focus Area is responsible for directing five team leaders who manage the following teams:

- HE Production Sites,
- Firing Sites,
- Industrial Sites,
- Town Sites, and
- MDA P Closure.

Team leaders supervise staff and field teams responsible for the characterization, stabilization, and remediation (when necessary) of all corrective action sites not under the purview of the MDAs and Canyons Investigations Focus Areas. Each team addresses sites of similar type or sites located in similar geographic locations with corresponding technical issues.

Corrective action activities implemented by RCRA Corrective Actions Focus Area teams are determined through interaction with other focus areas, the DOE, the public, and the administrative authority.

1.3.2.6 Canyons Investigations Focus Area

The project leader for the Canyons Investigations Focus Area is responsible for directing two team leaders that manage the following teams:

- Sediment Investigation and
- Alluvial Groundwater and Surface Water Investigation

Team leaders supervise staff and field teams responsible for the RCRA characterization of 19 major canyon systems, including investigations of sediment, alluvium, and surface water.

1.3.2.7 Groundwater Investigations Focus Area

The project leader of the Groundwater Investigations Focus Area is responsible for implementing the Laboratory's hydrogeologic work plan (LANL 1998, 59599). The hydrogeologic work plan is intended to characterize the Laboratory's hydrogeologic system as specified in Module VIII of the Laboratory's Hazardous Waste Facility Permit. Team leaders are responsible for directing the following activities:

- installation of ER and DOE Defense Program (DP) regional and intermediate depth characterization wells;
- quarterly sampling of these wells to evaluate possible Laboratory impacts;
- collection of geologic, geochemical, geophysical, and hydrologic data from these wells;
- analysis and assessment of the data collected from ER and DP characterization wells, in conjunction with Analysis and Assessment Focus Area; and
- management of the Field Support Facility.

The project leader and team leaders are responsible for interactions with the administrative authority, the public, other stakeholders, and various Laboratory groups.

1.3.2.8 Material Disposal Areas Focus Area

The project leader for the MDAs Focus Area is responsible for directing three team leaders that manage the following teams:

- Technical Area (TA)-21 MDAs,
- TA-49 MDAs, and
- TA-50 and TA-54 MDAs.

Team leaders supervise staff and field teams responsible for the characterization, stabilization, and remediation (when necessary) of corrective action sites designated as MDAs in TAs-21, -49, -50, and -54. Teams follow a consistent framework for focusing characterization activities around presumptive remedies.

Corrective action activities implemented by the MDAs Focus Area are determined through interactions with the DOE, the public, and the administrative authority.

1.3.2.9 Operation and Support

The project manager and deputy project manager are responsible for managing all of the remaining (i.e., non-focus-area) facets of the project, including

- Health and Safety,
- Quality Assurance/Quality Management,

- Finance and Procurement,
- Project Planning and Control,
- Project Infrastructure,
- Records Management,
- Long-Term Surveillance and Monitoring, and
- Decontamination and Decommissioning.

1.3.2.10 Interaction of the Project Management Team

Figure 1.3-3 illustrates management team interaction. This interaction provides the ER Project with an integrated, consistent, and manageable approach for implementing corrective actions.

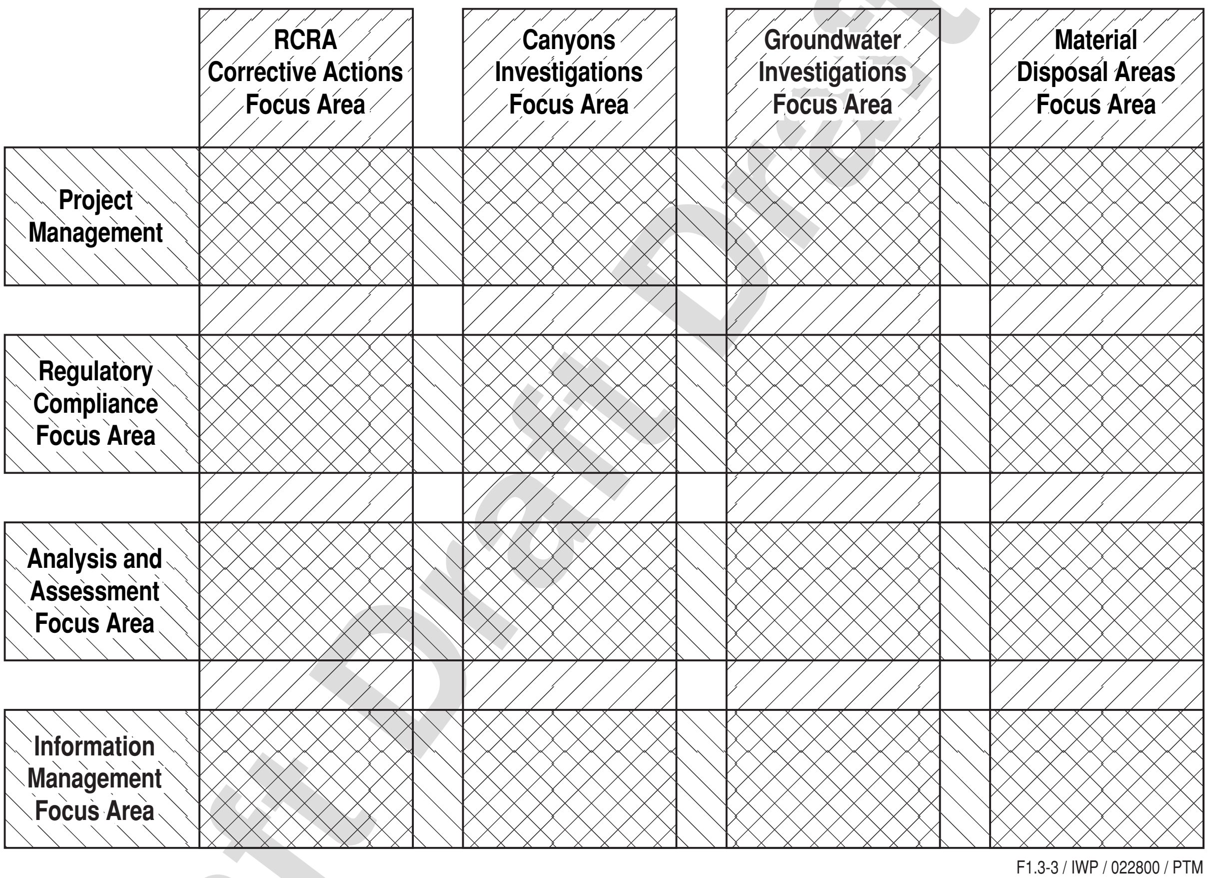


Figure 1.3-3. Interaction of the Project Management Team

ER Project RCRA corrective action sites are grouped into canyon, MDA, and other RCRA corrective action sites. Groundwater is addressed (to the extent possible) as a whole, rather than as a component of individual sites. Corrective action activities at each grouping of sites and for groundwater are managed independently by their respective focus area and are relatively autonomous. The Canyon, MDA, RCRA Corrective Action and Groundwater Focus Areas concentrate on the operational aspects of implementing corrective action activities.

ER Project management and the Regulatory Compliance, Analysis and Assessment, and Information Management Focus Areas address issues and activities that affect all sites and groundwater, providing consistency and integration across the large number and variety of corrective action sites under the purview of the ER Project.

1.4 Reporting Requirements

ER Reporting Requirements

To comply with applicable regulations and to keep all interested parties informed of progress made during the corrective action process, the ER Project prepares several types of plans and reports. Plans and reports contain information adequate to support the corrective action decision being addressed. Specific reporting requirements are detailed in Section 3.2.1 and Appendix D of this document. All plans and reports produced by the ER Project are made available to the public through the information repositories described in Chapter 7 of this document.

All ER Project reports comply with the reporting requirements specified in Module VIII of the Laboratory's Hazardous Waste Facility Permit, conform to RCRA, conform to DOE Order 430.1A, "Life-Cycle Asset Management," and follow the outlines specified in NMED's "RPMP Document Requirement Guide" (NMED 1998, 57897) or others as negotiated. In addition, ER Project reports comply with applicable guidance from DOE, EPA, and internal Laboratory administrative controls and are consistent with the substantive requirements of CERCLA as applicable.

In accordance with 40 CFR 270.11, "Signatories to Permit Applications and Reports," the appropriate DOE-LAAO and ER Project officials sign the following certification for each document delivered to NMED.

> I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Decommissioning Reporting Requirements

The Decommissioning Project prepares formal Laboratory reports upon completion of a decommissioning project. Decommissioning reports conform to DOE Order 430.1A, "Life-Cycle Asset Management," and contain background information, characterization data, decommissioning methods and techniques, final survey and release data, and any lessons learned.

REFERENCES FOR CHAPTER 1

The following list includes all references cited in this chapter. The parenthetical information following the reference provides the author, publication date, and ER Project identification (ER ID) number. This information is also included in the citation in the text and can be used to locate the document.

ER ID numbers are assigned by the Laboratory's ER Project to track all material associated with Los Alamos National Laboratory corrective action sites. These numbers can be used to locate copies of the documents at the ER Project's Records Processing Facility and, where applicable, within the ER Project reference library. The references cited in this report can be found in the volumes of the reference library titled "Reference Set for Regulatory Compliance Focus Area."

Copies of the reference library are maintained at the New Mexico Environment Department Hazardous and Radioactive Materials Bureau, the Los Alamos Area Office of the US Department of Energy, the US Environmental Protection Agency, and the ER Project Office. This library is a living document that was developed to ensure that the administrative authority has all the necessary material to review the decisions and actions proposed in this report. However, documents previously submitted to the administrative authority are not included in the reference library.

DOE (US Department of Energy), January 1993. "Environmental Restoration and Waste Management Five-Year Plan, Fiscal Years 1994-1998," Volumes I and II, DOE/S-00097P, Washington, DC. (DOE 1993, 12602; 12603)

Environmental Restoration Project, June 1998. "Quality Management Plan for the Los Alamos National Laboratory Environmental Restoration Project," Los Alamos, New Mexico. (Environmental Restoration Project 1998, 59575)

EPA (US Environmental Protection Agency), April 10, 1990. Hazardous and Solid Waste Amendments, Module VIII, of RCRA Permit No. NM0890010515, EPA Region VI, issued to Los Alamos National Laboratory, Los Alamos, New Mexico, effective May 23, 1990, EPA Region VI, Hazardous Waste Management Division, Dallas, Texas. (EPA 1990, 1585)

International Technology Corporation, December 1988. "Solid Waste Management Units Report," Volumes I–IV, prepared for Los Alamos National Laboratory by International Technology Corporation, Project No. 301215.02.01, Los Alamos, New Mexico. (International Technology Corporation 1988, 11646, 11647, 11648, 11649)

LANL (Los Alamos National Laboratory), November 1990. "Solid Waste Management Units Report," Vol. I—IV, Los Alamos National Laboratory Report LA-UR-90-3400, prepared by International Technology Corporation, Contract No. 9-XS8-0062R-1, Los Alamos, New Mexico. (LANL 1990, 7511, 7512, 7513, 7514)

LANL (Los Alamos National Laboratory) 1998. "Hydrogeologic Workplan," Los Alamos National Laboratory report, Los Alamos, New Mexico. (LANL 1998 59599)

NMED (New Mexico Environment Department), March 3, 1998. "RPMP Document Requirement Guide," Hazardous and Radioactive Materials Bureau, RCRA Permits Management Program, Santa Fe, New Mexico. (NMED 1998, 57897)

NMEID (New Mexico Environmental Improvement Division), November 8, 1989. “Hazardous Waste Facility Permit,” Permit No. NM0890010515-1 issued to Los Alamos National Laboratory, Los Alamos, New Mexico, effective February 19, 1990, Santa Fe, New Mexico. (NMEID 1989, 11737)

2.0 FACILITY DESCRIPTION

2.1 Description

2.1.1 Operational History

In 1942, the US Army Manhattan Engineer District was established to develop the atomic bomb. The research quickly progressed to a point that necessitated a remote site for experimental work, and the Army selected the Los Alamos Ranch School for Boys as an appropriate location. The Undersecretary of War directed acquisition of the school site, which consisted of a group of some 50 log buildings on a 790-ac site northwest of Santa Fe. The project ultimately acquired an additional 3120 privately owned acres and 45,666 ac of public land managed by the US Forest Service. In 1943, this land became known as the Los Alamos Site, later as the Los Alamos Scientific Laboratory. It is now named the Los Alamos National Laboratory (the Laboratory).

Since its inception, the Laboratory has been operated by the University of California (UC) for the federal government. Research activities were established in wooden buildings south of the original Ranch School buildings in what is now downtown Los Alamos. Additional Laboratory buildings were constructed; army-style barracks (temporary and prefabricated) provided housing.

With the end of World War II and the growth of international competition, a national policy of maintaining superiority in the field of atomic energy was established. Congress chose to sustain the Los Alamos site; the Atomic Energy Commission (AEC) received control of the Laboratory from the Army and renewed the operating contract with UC. Thereafter, a major construction program was started south of Los Alamos Canyon. During subsequent years, the Laboratory continued to expand at a steady rate, first under the AEC and later under the Energy Research and Development Administration. Since 1978, the Laboratory has operated under the control of the US Department of Energy (DOE). Figure 2.1-1 shows the location of the Laboratory. A map showing active technical areas (TAs) at the Laboratory is shown in Figure 2.1-2.

2.1.2 Geography

The Laboratory and the neighboring residential areas of Los Alamos and White Rock are located predominantly in Los Alamos County, north-central New Mexico, approximately 60 mi north-northeast of Albuquerque and 25 mi northwest of Santa Fe (Figure 2.1-1). The 43-mi^2 Laboratory site and the communities adjacent to it are situated on the Pajarito Plateau, which consists of a series of finger-like mesas separated by deep canyons containing ephemeral and intermittent streams that run from west to east. Mesa tops range in elevation from approximately 7800 ft on the flank of the Jemez Mountains to about 6200 ft at their eastern termination above the Rio Grande valley. The eastern margin of the plateau stands 300 to 900 ft above the Rio Grande (DOE 1979, 8610). The DOE controls the area within the Laboratory's boundaries and determines restrictions on access.

2.1.3 Land Use

Most Laboratory and community developments are confined to mesa tops. Large tracts of land north, west, and south of the Laboratory site are managed by the Santa Fe National Forest, Bureau of Land Management, Bandelier National Monument, General Services Administration, and Los Alamos County (Figure 2.1-3). The San Ildefonso Pueblo borders Los Alamos County and the Laboratory to the east.

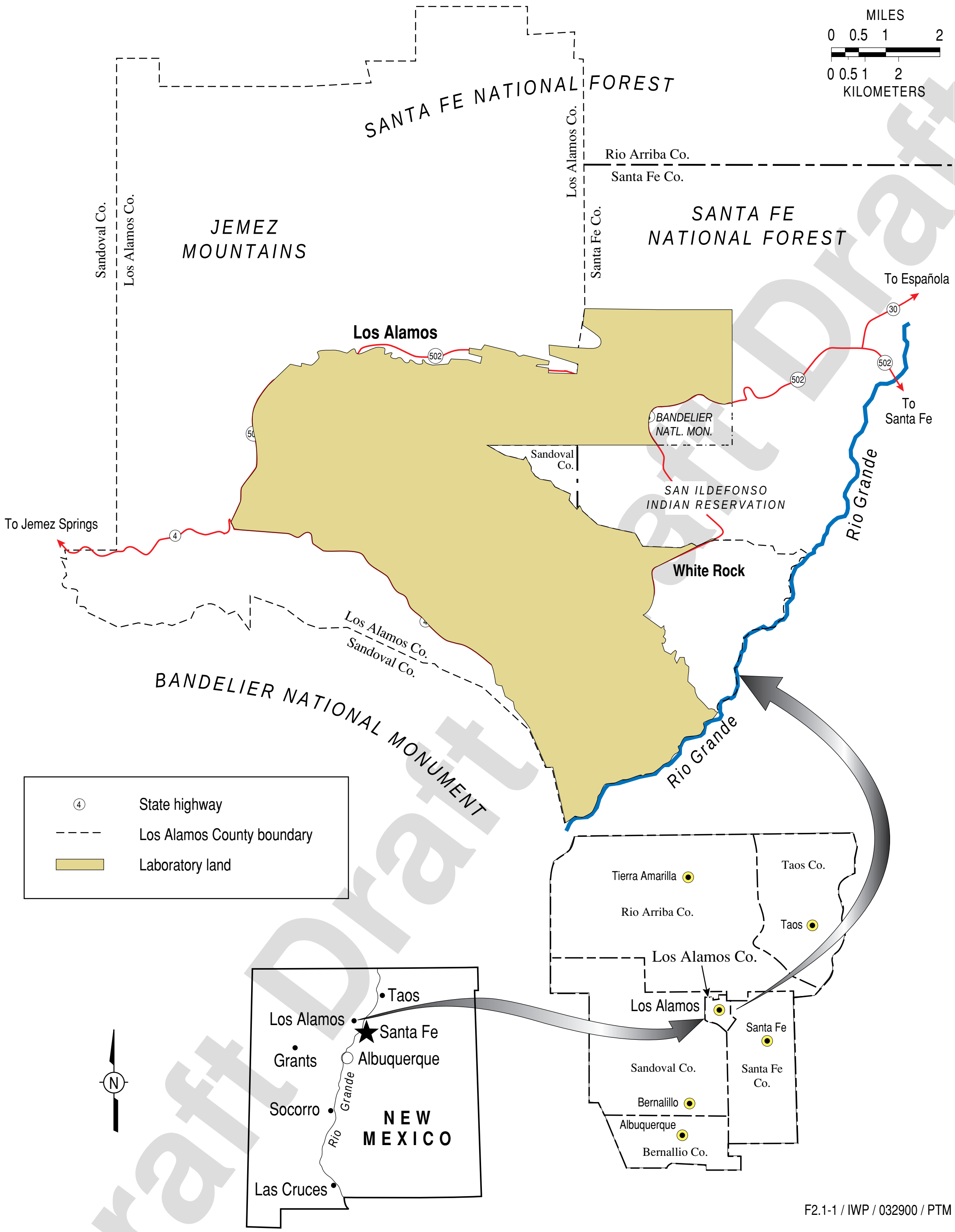


Figure 2.1-1. Location map of Los Alamos National Laboratory

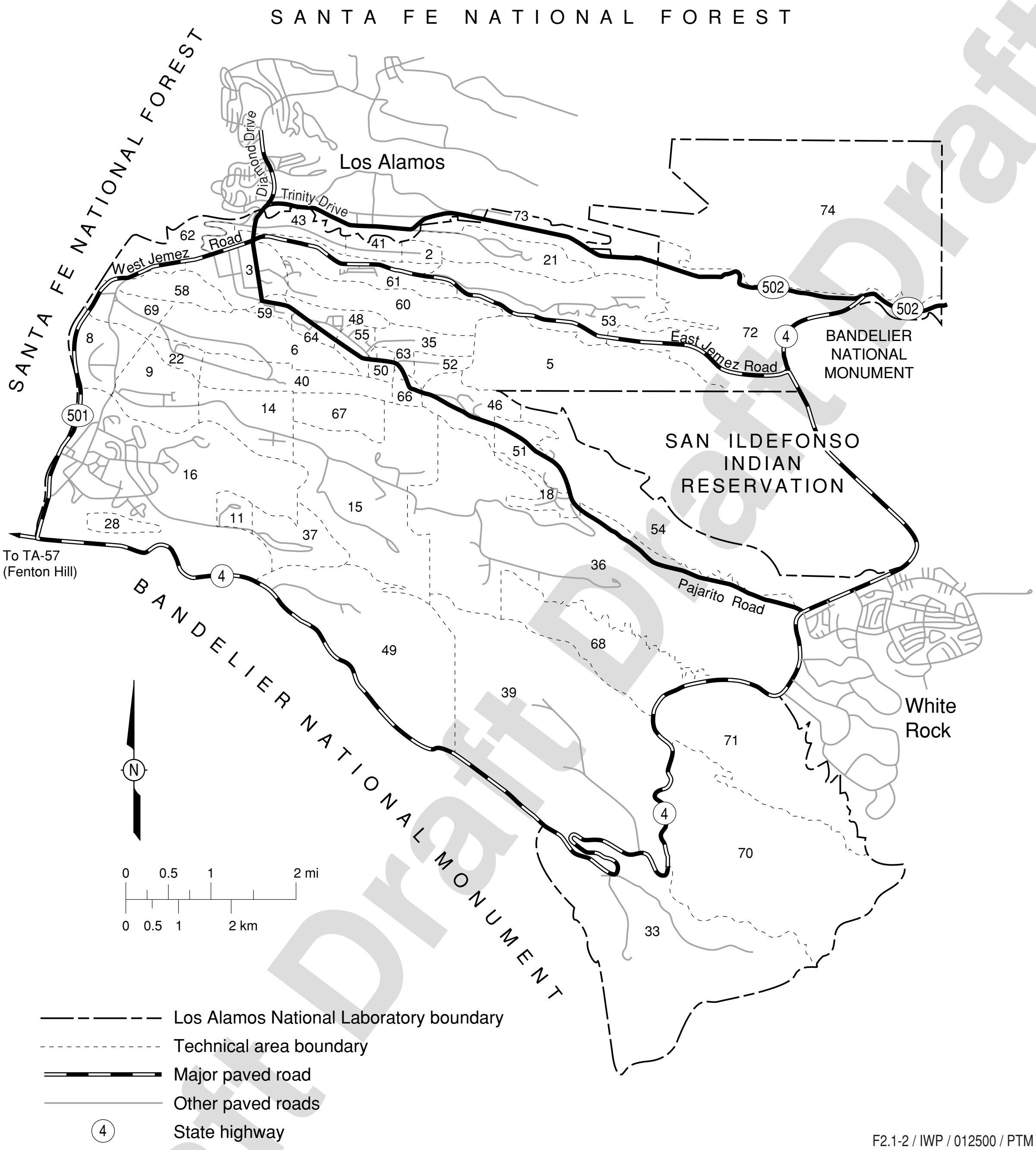


Figure 2.1-2. Technical areas at Los Alamos National Laboratory

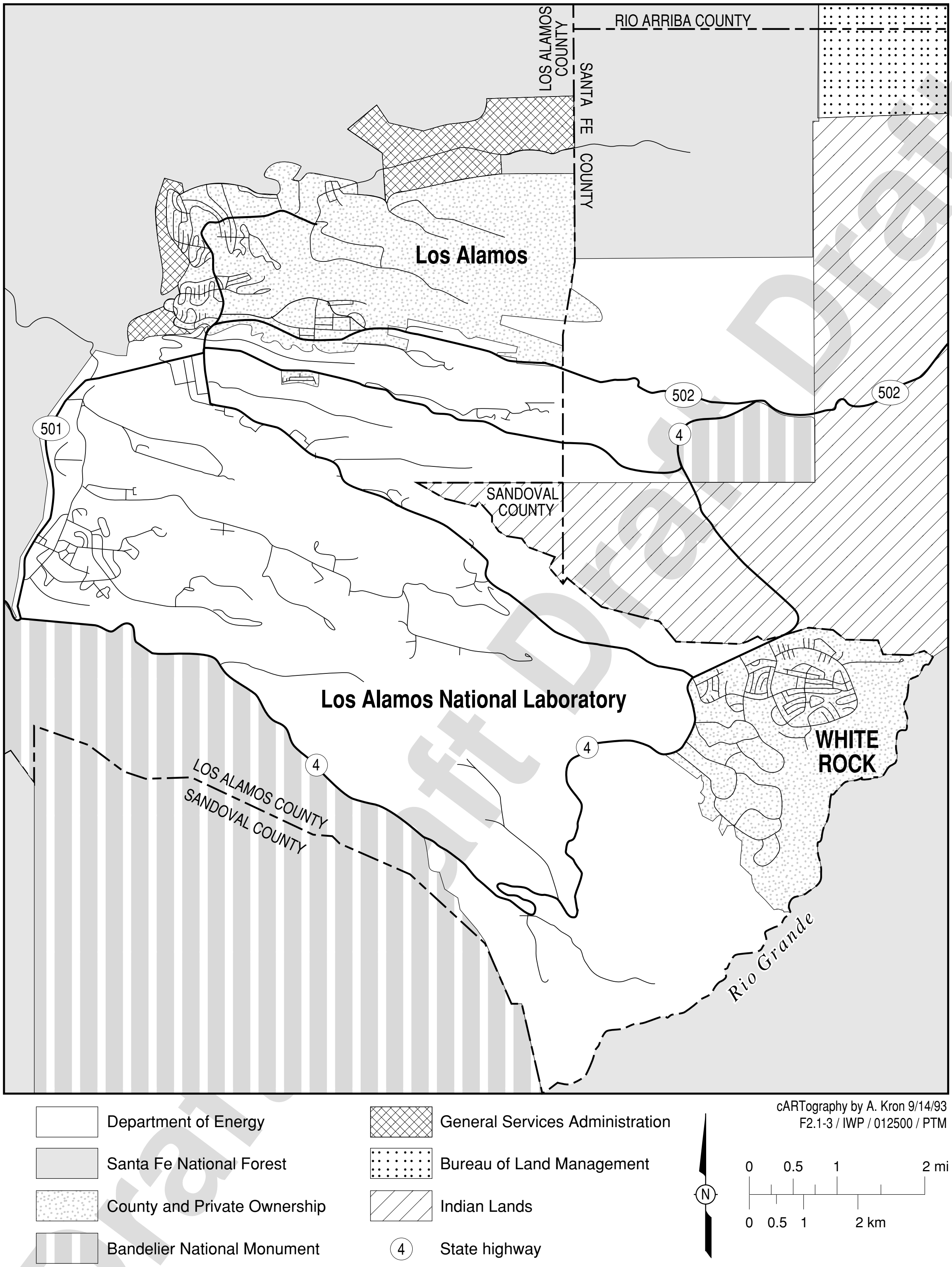


Figure 2.1-3. Land use map for the Laboratory and adjacent lands

Laboratory land is used for building sites, experimental areas, waste disposal locations, roads, and utility rights-of-way. However, these uses account for only a small part of the land. Most of the land controlled by the Laboratory serves as a buffer zone for Laboratory facilities, providing security and safety to the public, and as a reserve for future construction. The Laboratory's long-range site development plan (LANL 1995, 52976) addresses the best possible future uses of available Laboratory lands (Figure 2.1-4).

The public is allowed limited access to certain areas of the Laboratory site. An area north of Ancho Canyon between the Rio Grande and State Highway 4 is open to hikers but woodcutting and vehicles are prohibited. Portions of Mortandad and Pueblo Canyons are also open to the public. An archaeological site (the Otowi tract), northwest of State Highway 502 near the White Rock Y, is open to the public, subject to restrictions imposed by regulations to protect cultural resources.

2.1.4 Population Distribution

Los Alamos County had an estimated 1998 population of approximately 18,300 (BBER 1999, 65061). Two residential areas (Los Alamos and White Rock) and their related commercial areas exist in the county (Figure 2.1-1). The Los Alamos townsite (the original area of development that now includes the residential areas known as Eastern Area, Western Area, North Community, Barranca Mesa, and North Mesa) has an estimated population of 11,500. The White Rock area (including the residential areas of White Rock, La Senda, and Pajarito Acres) has about 6800 residents. Population projections place about 234,200 persons within a 50-mi (80-km) radius of the Laboratory (Table 2.1-1) (Environmental Surveillance Program 1999, 64034, p. 54).

Table 2.1-1
1998 Population Within 80 km of Los Alamos

Direction	Distance from TA-53 (km)									
	0–1	1–2	2–4	4–8	8–15	15–20	20–30	30–40	40–60	60–80
S	3	3	0	0	21	0	15	127	381	2962
SSW	3	3	0	0	31	1	711	1244	6463	49,597
SW	3	11	0	0	4	1	0	0	2037	164
WSW	1	16	29	0	7	0	26	355	2340	4
W	0	3	83	216	0	6	61	267	57	68
WNW	2	15	969	6155	0	0	24	28	58	2427
NW	5	31	887	1407	0	2	23	47	418	553
NNW	7	63	639	288	0	5	19	253	154	284
N	7	68	240	129	0	13	87	917	786	566
NNE	7	61	83	16	2	10	2311	386	646	296
NE	4	7	0	0	1	1185	14,165	2436	2363	3483
ENE	0	0	0	0	540	1456	4282	3426	1369	1493
E	0	0	0	1	313	1291	3852	362	21	401
ESE	0	0	0	0	7	11	652	7408	679	2108
SE	0	1	0	4552	496	0	947	69,214	7129	640
SSE	2	3	0	604	354	0	289	5397	2444	101
Totals	44	285	2930	13,368	1776	3981	27,464	91,867	27,345	65,147

Note: Total population within 80 km of Los Alamos National Laboratory is 234,207.

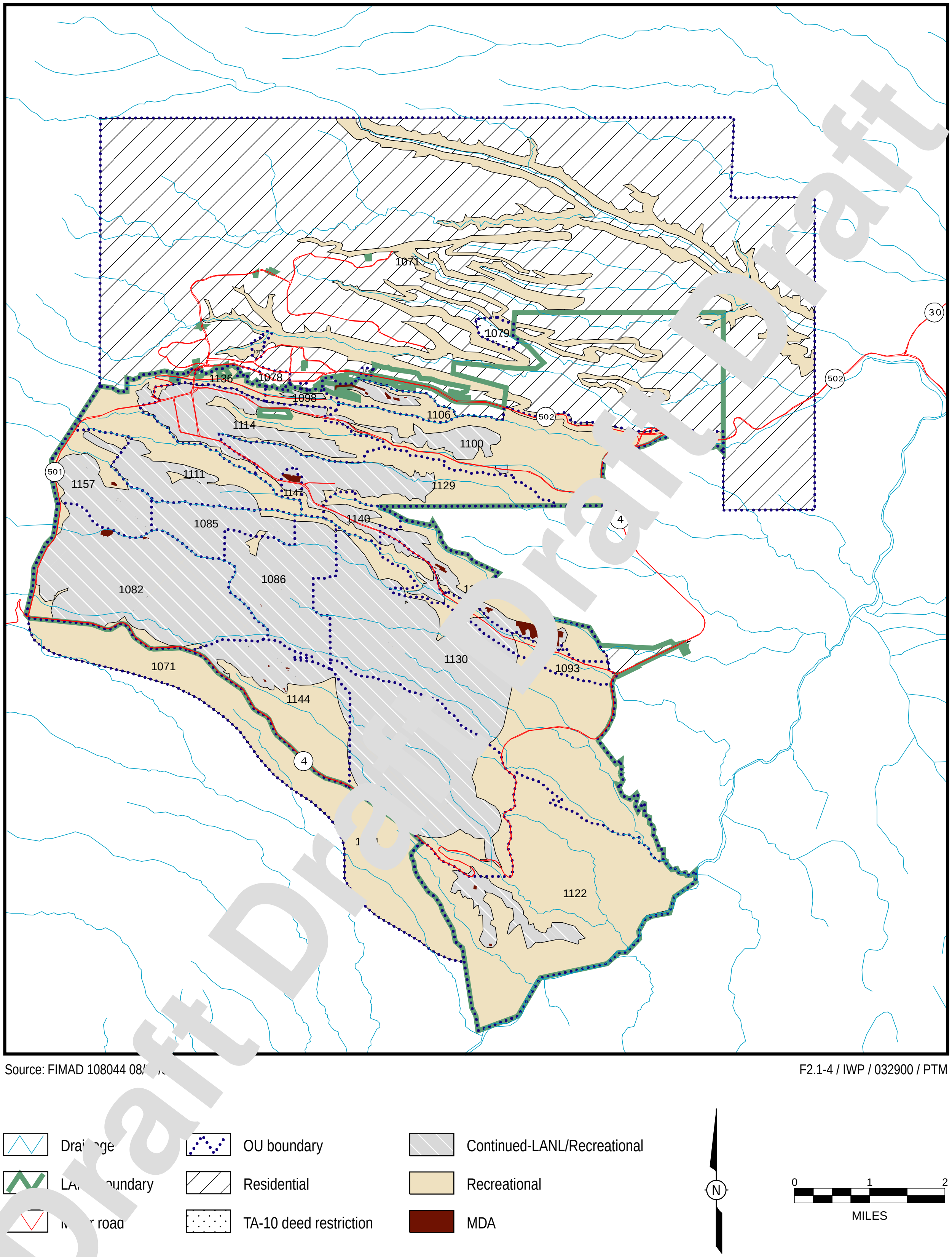


Figure 2.1-4. Proposed future land-use areas

2.2 Environmental Setting

2.2.1 Geology

This summary of the hydrogeologic environment at the Laboratory and in the northern New Mexico region is intended to describe the major geologic, hydrologic, and hydrogeologic features and their conceptual interrelationships. It addresses the regional and installation-wide geologic setting and the hydrologic characteristics that affect surface water and groundwater occurrence and movement and their interactions as they relate to the potential for contaminant transport. The sources cited here and additional literature on the hydrology and geology of the Los Alamos region may be found in an annotated bibliography of geologic, hydrogeologic, and environmental studies related to solid waste management units at the Laboratory (LANL 1990, 47588). This bibliography was submitted to the US Environmental Protection Agency (EPA) in September 1990. The bibliography and the literature it describes are available for review in the Laboratory's Public Reading Room located at 1619 Central Avenue in Los Alamos.

The ER Project maintains qualified geologic data for the Pajarito Plateau and Española basin in a sitewide 3-D geologic computer model. This model provides the framework for numerical flow and transport models to evaluate groundwater migration and contaminant transport beneath the Laboratory. An atlas showing key geologic and hydrologic features has been abstracted from the site-wide 3-D geologic model (Environmental Restoration Project 1999, 64039).

2.2.1.1 Regional Setting

The Laboratory is sited on the Pajarito Plateau, an east-sloping, dissected tableland bounded on the west by the eastern Jemez Mountains (Sierra de los Valles) and on the east by White Rock Canyon of the Rio Grande (Figure 2.2-1). The geology of the Pajarito Plateau reflects the interplay of volcanism in the Jemez Mountains and surrounding areas with the development of the Rio Grande rift, a series of north-south trending fault troughs extending from southern Colorado to southern New Mexico (Figure 2.2-1). Volcanism over the last 13 million yr has built up the highlands area of the Jemez Mountains, while the contemporaneous tectonic rifting has resulted in subsidence of the area extending from the eastern margin of the Jemez Mountains to the western margin of the Sangre de Cristo Mountains. This area of subsidence, locally termed the Española basin of the Rio Grande rift, is a graben between two larger basins—the Albuquerque basin to the south and San Luis basin to the north (Kelley 1978, 11659). During this interplay of volcanism and rifting, erosion has removed materials from the highlands areas to the west and deposited them downslope to the east into the rifted lowlands, which were contemporaneously receiving sediments from other sources. The Pajarito Plateau has developed in and now occupies the western part of the Española basin (Figure 2.2-1).

Figure 2.2-2 is a general geologic map highlighting the dominantly volcanic rock types of the area. The gently east-sloping Bandelier Tuff covers the Pajarito Plateau (Figure 2.2-3). Deep canyons are incised into the Bandelier Tuff and expose it to depths of up to several hundred feet below the general level of the plateau. From west to east, these canyons cut progressively deeper into the Bandelier Tuff and, near the Rio Grande, some of the deeper canyons expose older lavas and sedimentary rocks. Figure 2.2-4 and Figure 2.2-5 schematically portray the complex interfingering of volcanic rocks and sediments that occurs below the Bandelier Tuff. Volcanic rocks of the Tschicoma Formation and their derivative sediments (fanglomerate facies of the Puye Formation) extend eastward under the plateau where they interfinger with Santa Fe Group rocks and basaltic rocks of the Cerros del Rio volcanic field (also called "basaltic rocks of Chino Mesa").

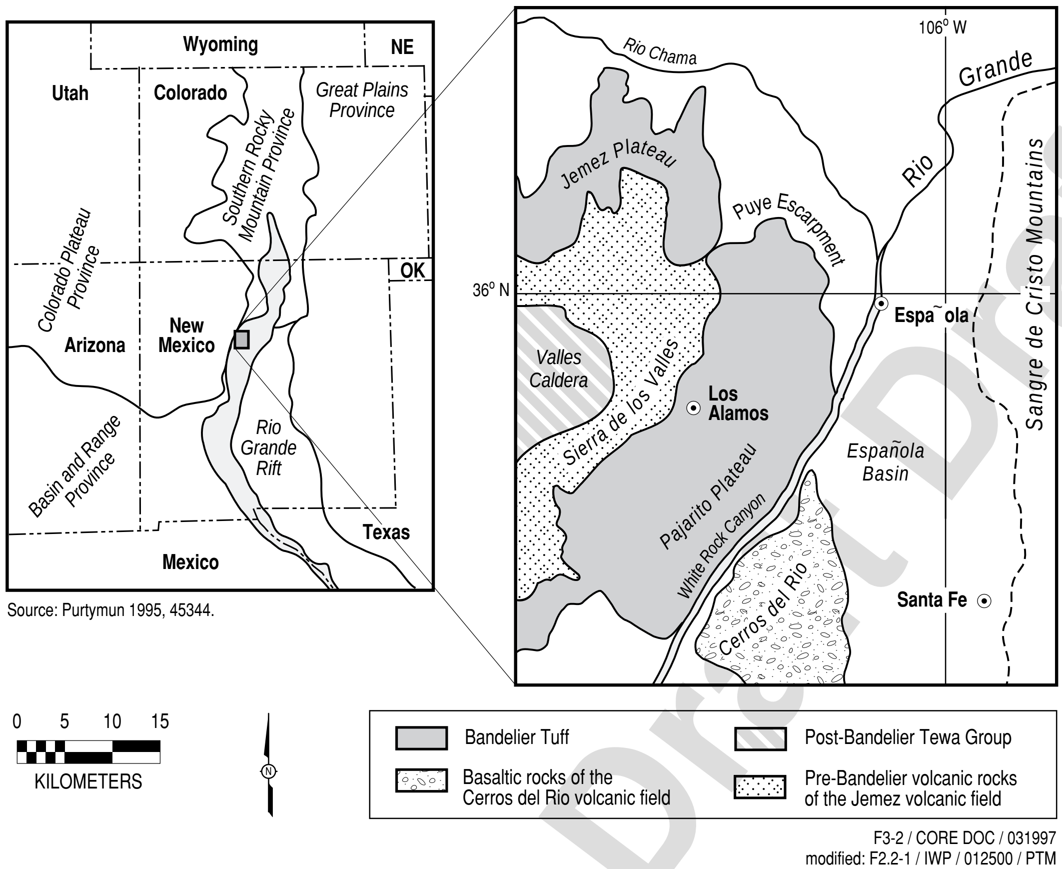
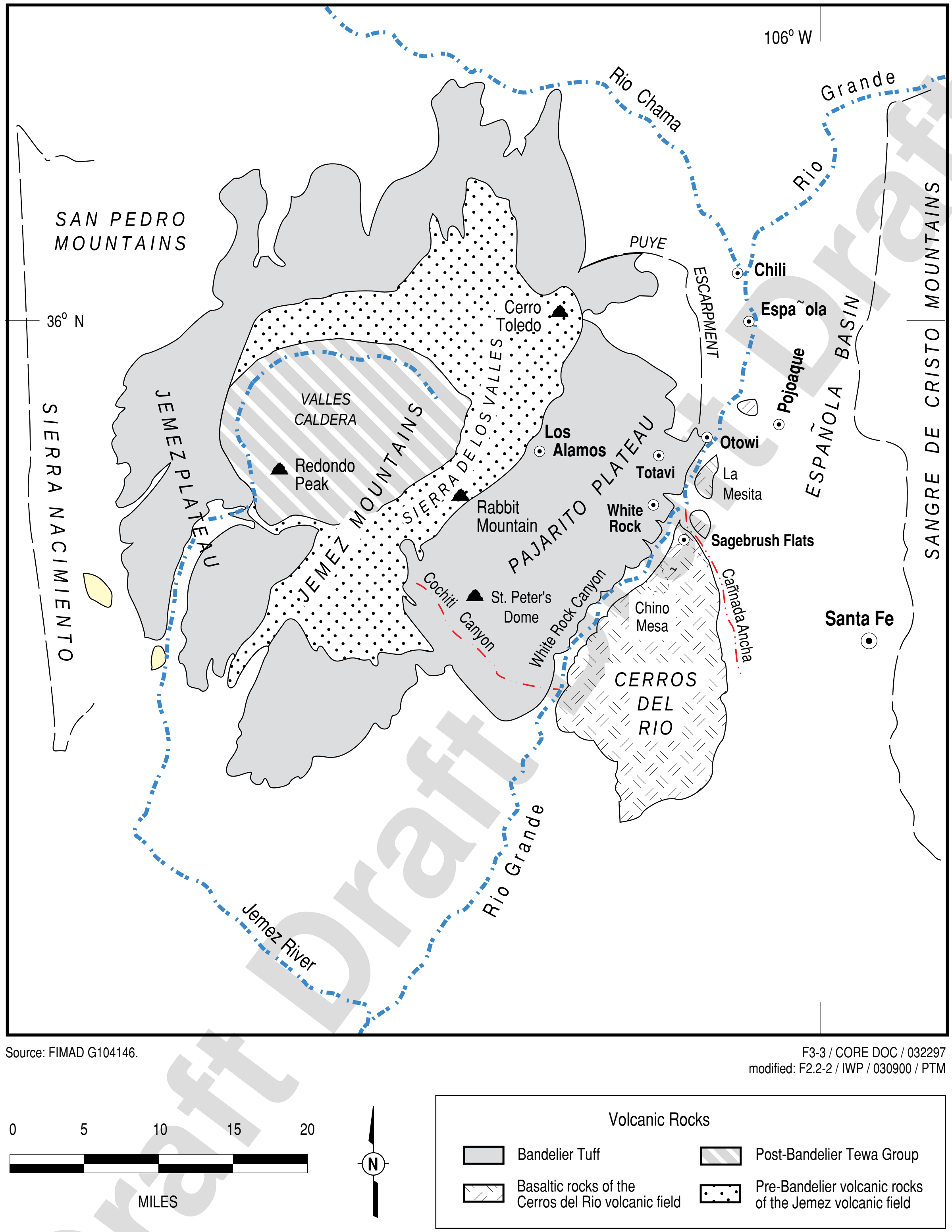


Figure 2.2-1. Physiographic features of the Pajarito Plateau

2.2.1.2 Stratigraphy

The following descriptions cover the rock units relevant to the environmental restoration (ER) investigations, starting with the oldest (deepest) and proceeding to the youngest (topmost). Fossil evidence, stratigraphic correlations, and radiometric measurements provide the approximate ages of most of the bedrock units. The bedrock units and their ranges of approximate radiometric ages are listed below in ascending order.

1. Santa Fe Group: 4 to 21 million yr (Manley 1979, 11714)
2. Tschicoma Formation: 2.53 to 6.7 million yr (Dalrymple et al. 1967, 49924)
3. Puye Formation: 1.7 to 4 million yr (Turbeville et al. 1989, 21587; Spell et al. 1990, 21586), which includes a fanglomerate facies, an axial facies (Manley 1979, 11714; Turbeville et al. 1989, 21587), and a lacustrine facies
4. Basaltic Rock of the Cerros del Rio volcanic field (also known as “Basaltic Rocks of Chino Mesa”): 2 to 3 million yr (Gardner and Goff 1984, 44021; WoldeGabriel et al. 1996, 54427)
5. Otowi Member of the Bandelier Tuff: 1.61 million yr (Izett and Obradovich 1994, 48817; Spell et al. 1996, 55542)



Source: FIMAD G104146.

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Figure 2.2-2. **General geologic and geographic features of the Pajarito Plateau and surrounding areas**

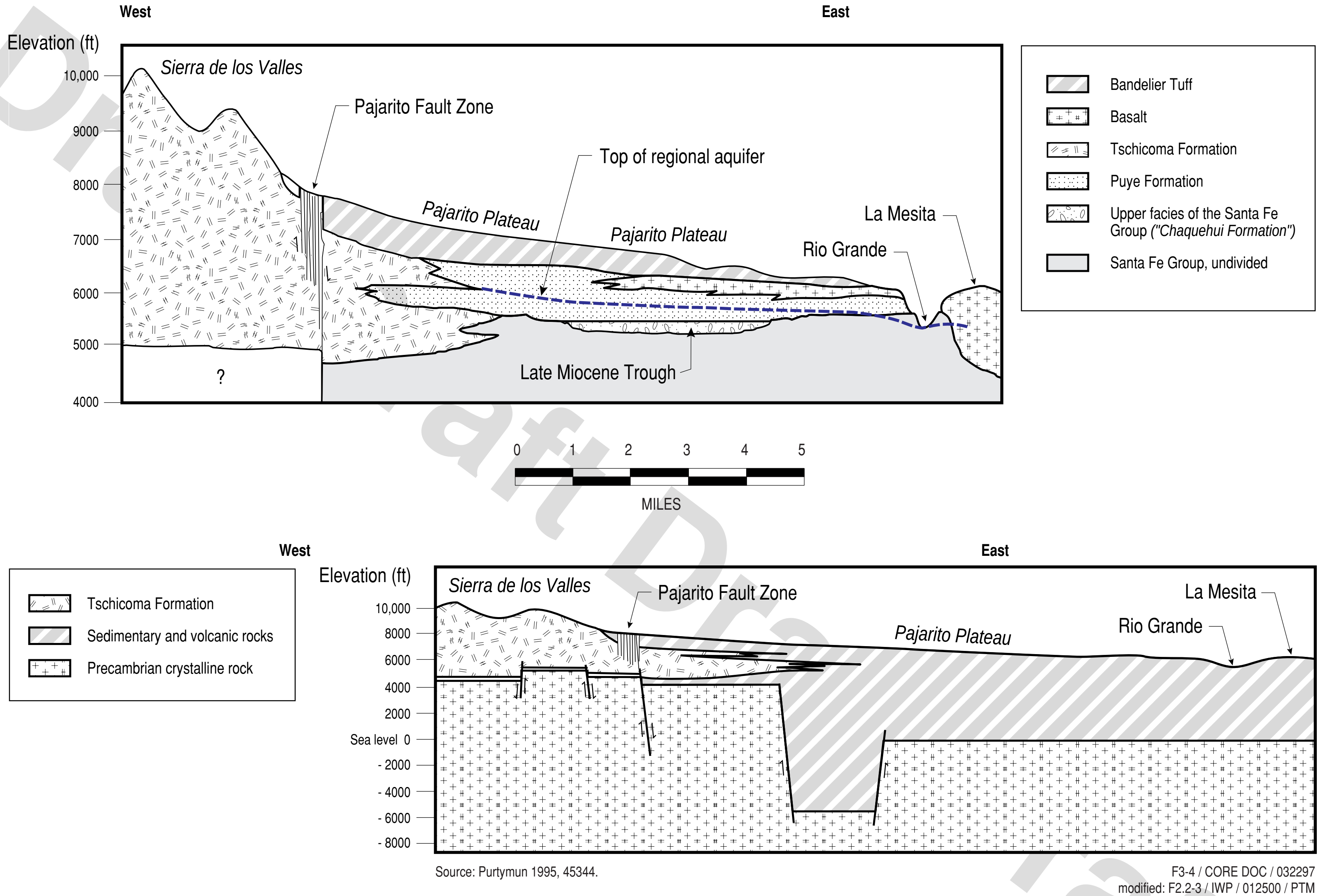
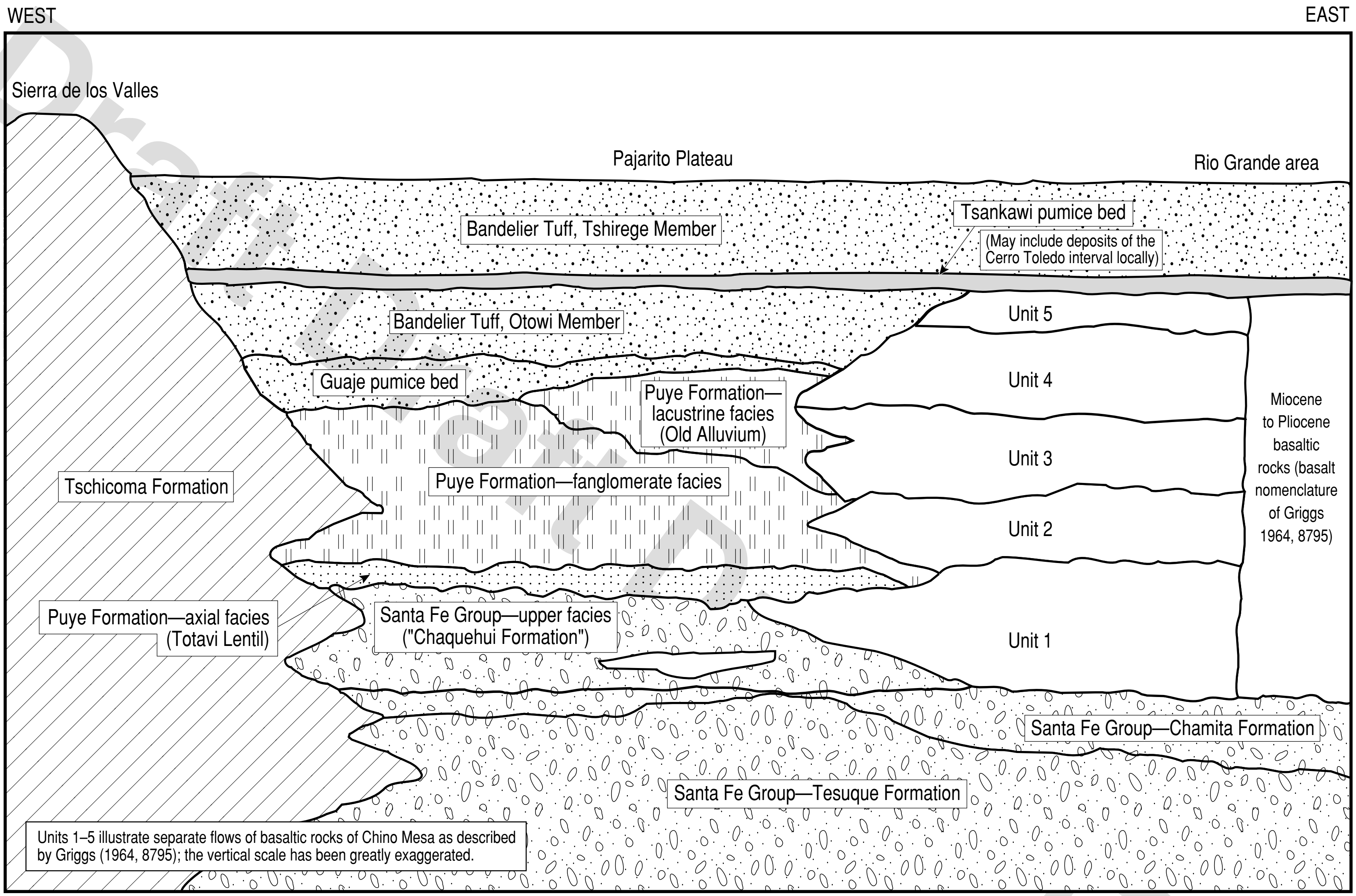


Figure 2.2-3. Generalized geologic cross sections of the Pajarito Plateau



Source: Modified from Griggs 1964, 8795 and Purtymun 1995, 45344.

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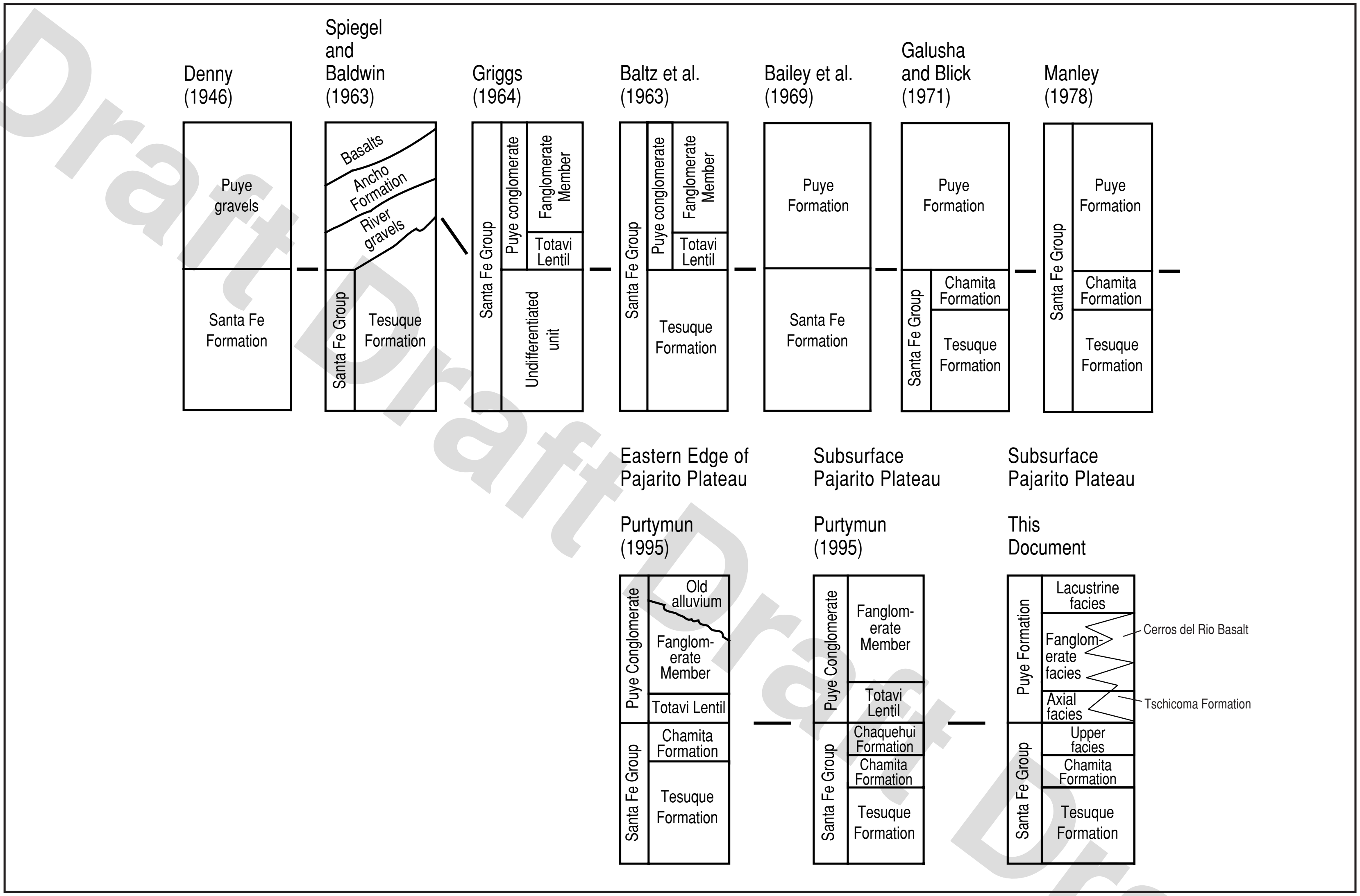
Figure 2.2-4. Schematic cross section of the Pajarito Plateau showing complex interfingering of volcanic and sedimentary rocks



Source: Modified from Purtymun 1995, 45344.

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modified: F2.2-5 / IWP / 031600 / PTM

Figure 2.2-5. Stratigraphic relationships and evolution of nomenclature for pre-Bandelier Tuff rocks of the Pajarito Plateau

6. Volcaniclastic sediments and tephras of the Cerro Toledo Interval: age of this unit is bracketed by the ages of the underlying Otowi Member (1.61 million yr) and the overlying Tshirege Member (1.22 million yr) of the Bandelier Tuff

7. Tshirege Member of the Bandelier Tuff: 1.22 million yr (Izett and Obradovich 1994, 48817; Spell et al. 1996, 55542)

A geologic map published by Smith et al. (1970, 9752) shows the distribution of these bedrock units across the Pajarito Plateau. Other general geological maps covering this area are those by Griggs (1964, 8795), Kelley (1978, 11659), and Goff et al. (1990, 21574). More detailed geological maps covering portions of the Laboratory include those by Baltz et al. (1963, 8402), Rogers (1995, 54419), Vaniman and Wohletz (1990, 21589), Reneau et al. (1995, 54405), and Goff (1995, 49682). Figure 2.2-2 shows area locations, and Figure 2.2-4 and Figure 2.2-5 illustrate the stratigraphic units referred to in the following sections.

Santa Fe Group

Rocks of the Santa Fe Group crop out in lower Los Alamos Canyon, near the mouth of Guaje Canyon, and along the margins of the Rio Grande from Otowi Bridge south to White Rock. Galusha and Blick (1971, 21526) subdivided the Santa Fe Group into formations and members based on geologic mapping and fossil assemblages of late Tertiary mammals (Figure 2.2-5). Manley (1979, 11714) refined the stratigraphy of the Santa Fe Group with additional mapping and dates of interbedded volcanic ash layers, lava flows, and dikes. The description herein (see Figure 2.2-4 and Figure 2.2-5) follows the nomenclature of Galusha and Blick (1971, 21526) as modified by Manley (1979, 11714) and Purtymun (1995, 45344).

In the vicinity of the Pajarito Plateau, the stratigraphy and geochronology of the Santa Fe Group is poorly understood because of the near continuous blanket of younger volcanic deposits. Based on exposures near the Rio Grande, the Santa Fe Group beneath the Pajarito Plateau is believed to include, in ascending order, the Tesuque Formation and the Chamita Formation. Purtymun (1995, 45344) has also given the name “Chaquehui Formation” to distinctive coarse-grained sediments at the top of the Santa Fe Group on the Pajarito Plateau based on evidence from deep well boreholes on the Pajarito Plateau.

“Chaquehui Formation” is not a formal geologic name at present and there is disagreement among geologists as to whether it should be recognized separately from the Chamita Formation. In this document, these rocks are referred to as the upper facies of the Santa Fe Group.

Tesuque Formation. The Tesuque Formation is a massive, thick unit consisting of arkosic sediments, derived primarily from Precambrian basement and Tertiary volcanic sources to the east and northeast of the Española basin. This unit is a light pink-to-buff siltstone and silty sandstone with a few lenses of pebbly conglomerate and clay. It is poorly to moderately consolidated and has an age range of about 7 to 21 million yr (Manley, 1979, 11714; Cavazza 1989, 21501). Spiegel and Baldwin (1963, 54259) describe the Tesuque Formation at the southern end of the Española basin, including the exposures in the vicinity of Otowi Bridge and along White Rock Canyon. This formation exists in deep well boreholes under the Pajarito Plateau and is the primary aquifer for municipal and industrial water supply in Los Alamos County. The Tesuque Formation contains basalt at a depth of 2219 ft in Otowi well O-1 (Purtymun 1995, 45344).

Chamita Formation. The Chamita Formation overlies and interfingers with the Tesuque Formation. It consists of arkosic siltstones, sandstones, and pebbly conglomerate, and includes two prominent beds of white ash. This formation is thickest in the northern part of the Española basin and thins to less than 30 ft or is absent under most of the Laboratory. Aldrich and Dethier (1990, 49681) suggest that the Chamita Formation north of the Pajarito Plateau may be as old as 12 million yr and the age estimates for the overlying upper facies of the Santa Fe Group ("Chaquehui Formation") support that suggestion. However, paleomagnetic data in the area indicate an age range of 4.5 to 6 million yr (MacFadden 1977, 21569), and tephra dates by Manley (1979, 11714) support a younger age of about 5 million yr for at least part of the formation. Because the Chamita and Tesuque Formations may not be distinguishable in borehole cores and cuttings, it is sometimes necessary to group these formations as "undifferentiated Santa Fe Group" during borehole investigations.

Upper Facies of the Santa Fe Group. Sedimentary deposits referred to as the "Chaquehui Formation" by Purtymun (1995, 45344), and shown as upper facies of the Santa Fe Group on Figure 2.2-4 and Figure 2.2-5, are made up of mixtures of volcanic debris from the Jemez Mountains and arkosic materials from the highlands to the north and east. Because of their coarse-grained nature, these rocks are an important aquifer for municipal and industrial water supply in the Los Alamos area (Purtymun 1995, 45344). The upper facies of the Santa Fe Group overlie the Chamita Formation in well boreholes on the Pajarito Plateau. However, because it contains interbedded basalt lava flows dated at 8 to 9 million yr (Laughlin et al. 1993, 54424), it is equivalent in age to older parts of the Chamita Formation. The upper facies of the Santa Fe Group form a transitional interval between older Santa Fe Group rocks and overlying volcaniclastic rocks derived from the Jemez Mountains. The presence of coarse-grained arkosic materials within the upper facies of the Santa Fe Group suggests that these deposits may represent axial deposits of an ancestral Rio Grande within the Chamita Formation.

Tschicoma Formation

The Tschicoma Formation of the Polvadera Group makes up the rugged highlands west of Los Alamos and crops out in the headwaters of the larger canyons that cut the Pajarito Plateau. Deep well boreholes along the western perimeter of the Laboratory intersect this unit at depths of several hundred feet or more, but the Tschicoma Formation is generally absent in boreholes penetrating the central and eastern parts of the Laboratory.

The Tschicoma Formation consists of numerous thick lava flows derived from a series of volcanic domes that predate the Bandelier Tuff. Fragmental deposits of ash and lava debris occur in the distal parts of the formation. It has a variable thickness due to the lenticular shape of its lava flows, and is at least 2500 ft thick in the Sierra de los Valles. The Tschicoma Formation thins eastward beneath the Pajarito Plateau where it interfingers with the penecontemporaneous Puye Formation. The lower parts of the Tschicoma Formation may interfinger with the upper Santa Fe Group.

Tschicoma Formation lava flows range in composition from andesite to low-silica rhyolite but are dominantly dacites. The rocks are mainly gray to purplish gray, but in places they are reddish brown. These flows display pronounced jointing and have bottoms commonly marked by blocky breccia. Lavas contain glassy and microcrystalline groundmass; the glass is generally devitrified, giving the rocks a stony appearance.

Radiometric ages for the Tschicoma Formation in the vicinity of Los Alamos range between 3.7 and 6.7 million yr (Dalrymple et al. 1967, 49924). Turbeville et al. (1989, 21587) report an age of 2.53 million yr for a Tschicoma ignimbrite within the Puye Formation. In the northern part of the Jemez volcanic field, the Tschicoma Formation is bracketed in age by the underlying Lobato basalt (7.4 million yr) and the overlying El Rechuelos Rhyolite (2.0 million yr) (Loeffler et al. 1988, 54409).

Puye Formation

The Puye Formation is an apron of large alluvial fans that were shed eastward from the Jemez volcanic field into the Española basin, covering the Santa Fe Group rocks west of and along the Rio Grande. Intersected by most deep water wells on the Pajarito Plateau (Dransfield and Gardner 1985, 6612; Purtymun 1995, 45344), this formation crops out in canyons north of Los Alamos Canyon. Turbeville et al. (1989, 21587) estimated its areal distribution at 518 mi^2 (200 km^2) and its volume at approximately 3.6 mi^3 (approximately 15 km^3). Its age is generally placed at between 1.9 and 3.5 million yr, but it may be as young as 1.6 million yr and as old as 6.7 million yr because of its expected temporal and spatial association with eruption of the Tschicoma Formation. The lithology of the Puye Formation is dominated by conglomerates and gravels consisting of subrounded dacitic and andesitic lava clasts in a sandy matrix. At least 25 ash beds of dacitic to rhyolitic composition are interbedded with the conglomerates and gravels (Turbeville et al. 1989, 21587), and basaltic ash and lacustrine layers are present along the eastern margins of this formation. Showing considerable lateral variation in textures and composition, the formation reaches a maximum thickness of approximately 700 ft in Pueblo Canyon (Griggs 1964, 8795) but thins to 50 ft in areas north of the Pajarito Plateau (Dethier and Manley 1985, 21506). In the central and eastern portions of the Laboratory, it is approximately 600 ft thick and is interbedded with basaltic lavas of the Cerros del Rio volcanic field. The Puye Formation as defined by Griggs (1964, 8795) originally included three units, in ascending order: an axial facies (called the “Totavi Lentil” by Griggs [1964, 8795]); a fanglomerate facies; and a lacustrine facies (called “older alluvium” by Griggs [1964, 8795]) (Figure 2.2-4 and Figure 2.2-5).

Axial Facies of the Puye Formation. The axial facies of the Puye Formation (also called “Totavi Lentil” or “Totavi Formation”) overlies the Santa Fe Group and crops out at Totavi and in areas to the east in lower Los Alamos Canyon and within White Rock Canyon to the south (Griggs 1964, 8795). It is generally approximately 50 ft thick under the eastern Pajarito Plateau but thickens in a northwest direction. It consists of coarse, poorly consolidated conglomerate containing cobbles and boulders of quartzite, granite, and pegmatite. The axial facies forms the oldest deposits in the Puye Formation in many areas but also interfingers with the lower part of the fanglomerate facies.

The axial facies is thought by many geologists to represent ancestral Rio Grande channel gravels and is believed to be a separate unit from either the finer grained Chamita Formation or the fanglomerate facies of the Puye Formation, resulting in considerable disagreement on the preferred nomenclature for this unit. It is a channel fill deposit as opposed to an alluvial fan deposit, which characterizes most of the overlying fanglomerate facies, and its composition is more akin to the Chamita Formation than to the fanglomerate facies, which is of dominantly volcanic rock types. For these reasons Turbeville et al. (1989, 21587) distinguished the Totavi deposits from the Puye Formation and assigned them a formation rank. However, because the stratigraphic uncertainties are not yet fully resolved, this document retains the assignment of these rocks to the Puye Formation as originally defined by Griggs (1964, 8795). The age of the axial facies is poorly constrained but is probably between 2.4 and 3.5 million yr (Turbeville et al. 1989, 21587).

Fanglomerate Facies of the Puye Formation. The fanglomerate facies is the dominant unit of the Puye Formation beneath most of the Laboratory areas. “Fanglomerate” is a general term meaning a rock unit composed of conglomerates deposited in an alluvial fan setting. The fanglomerate facies contains angular-to-subangular cobbles and boulders of latite, quartz latite, dacite, rhyolite, and tuff in a matrix of silts, clays, and sands. Lenses of silt, clay, and pumice are common. It is interbedded with basaltic rocks of the Cerros del Rio volcanic field in the eastern and central part of the Laboratory. The fanglomerate facies is widespread beneath the Pajarito Plateau and caps the prominent cliffs (Puye Escarpment) along the Rio Grande north of Otowi Bridge.

Lacustrine Facies of the Puye Formation. Griggs (1964, 8795) included lake beds (the lacustrine facies) as the uppermost part of the Puye Formation. He differentiated them from the fanglomerate facies based on the presence of lake clays and ancient stream gravels that fill channels cut into the fanglomerates. In R-12, these stream gravels include quartzite and granite clasts, indicating they are probably ancestral Rio Grande channel deposits similar to the axial facies of the Puye Formation. Basaltic rocks of the Cerros del Rio volcanic field are also found in these channels (Griggs 1964, 8795). The lacustrine facies is present in lower Los Alamos Canyon and extends both northward and southward in discontinuous outcrops for several miles. However, it is apparently of limited extent beneath the Pajarito Plateau, being reported only in the borehole for well R-12 and PM-1 near the eastern edge of the plateau.

Basaltic Rock of the Cerros del Rio Volcanic Field (ÒBasaltic Rocks of Chino MesaÓ)

The basaltic rocks of the Cerros del Rio volcanic field crop out primarily on the eastern side of the Rio Grande, and occur in the subsurface below much of the Pajarito Plateau (Dransfield and Gardner 1985, 6612; Broxton and Reneau 1996, 55429). Outcrops within the Laboratory area occur in most canyons along the southern and eastern margins of the plateau. The stratigraphic nomenclature for these basalts has varied with different workers (e.g., Smith et al. 1970, 9752; Kelley 1978, 11659; Griggs 1964, 8795; Aubele 1978, 54426; Galusha and Blick 1971, 21526). Kelley (1978, 11659) mapped four different units of the Cerros del Rio Basalts, one of which (the Cubero Basalts) includes the five units of the basaltic rocks of Chino Mesa (Griggs 1964, 8795). Some of the older basalt flows that have been included in this formation may belong to the Santa Fe Group.

The basaltic rocks of the Cerros del Rio volcanic field form thick lava flows separated by interflow breccia, scoria, and ash. The lavas were erupted from numerous vents both east and west of the Rio Grande. In the vicinity of the Pajarito Plateau, these basalts form a north-south trending highland (now buried by the Bandelier Tuff) extending from the western edge of White Rock to the confluence of Los Alamos and Pueblo Canyons (Broxton and Reneau, 1996, 55429). These basalts are interbedded with the upper part of the fanglomerate facies of the Puye Formation. Griggs (1964, 8795) identified five lava-flow units (see Figure 2.2-4). The lower unit, Unit 1, crops out near river level in White Rock Canyon. Unit 2 overlies Unit 1 and forms the main cliffs along White Rock Canyon. It is the most prominent basalt found in boreholes below the central and eastern portions of the plateau, reaching a maximum thickness of 500 ft in well PM-4. Unit 3 includes a series of flows emplaced in old stream channels, cropping out in lower Los Alamos Canyon, Sandia Canyon, and Mortandad Canyon. Unit 4 consists of two lava flows that cap the mesa south of lower Los Alamos Canyon where they overlie the Puye and Tesuque Formations. Unit 5 comprises cinder cones and surface basalt flows on Chino Mesa and on the mesa between lower Ancho Canyon and Chaquehui Canyon.

The basaltic rocks of the Cerros del Rio volcanic field include buried remnants of maar volcanoes in White Rock Canyon (Aubele, 1978, 54426; Heiken et al. 1989, 54425). The aprons of fragmental debris surrounding these buried craters consist of thin layers of basaltic ash and sediments such as those found in wells R-9 and R-12. The maar deposits resulted from steam explosions that occurred where basalt erupted through an aquifer or standing body of water.

Bandelier Tuff

The Bandelier Tuff consists of the Otowi and Tshirege Members, which are stratigraphically separated in many places by the tephras and volcaniclastic sediments of the Cerro Toledo interval. The Bandelier Tuff was emplaced during cataclysmic eruptions of the Valles caldera between 1.61 and 1.22 million yr ago. It is perhaps one of the best-studied tuff units in the world, and it has been the subject of numerous geological studies since the early 1960s. The tuff is composed of pumice, minor rock fragments, and crystals supported in an ashy matrix. It is a prominent cliff-forming unit because of its generally strong consolidation. In the Tshirege Member, this consolidation is largely due to compaction and welding at high temperatures after the tuff was emplaced. Its light brown, orange brown, purplish, and white cliffs have numerous, mostly vertical fractures (called joints) that show average spacing of between several feet and several tens of feet. The Tshirege Member includes thin but distinctive layers of bedded sand-sized particles, called surge deposits, that demark separate flow units within the tuff. Most Laboratory facilities are located on the tuff, which is covered by thin discontinuous soils on mesa tops and alluvial deposits of variable thickness on canyon floors. Because the Bandelier Tuff is the most prominent rock type on the Pajarito Plateau, its detailed stratigraphy is of considerable importance and is discussed further below (see also Broxton and Reneau 1995, 49726).

Otowi Member. The Otowi Member crops out in several canyons but is most extensive in Los Alamos Canyon and in canyons to the north. Griggs (1964, 8795), Smith and Bailey (1966, 21584), Bailey et al. (1969, 21498), and Smith et al. (1970, 9752) are important references describing the nature and extent of the Otowi Member. It consists of moderately consolidated (indurated), porous, and nonwelded vitric tuff (ignimbrite), that forms gentle, colluvium-covered slopes along the base of canyon walls. The Otowi ignimbrites contain light gray-to-orange pumice, supported in a white-to-tan ash matrix (Broxton et al. 1995, 50119; Broxton et al. 1995, 50121; Goff 1995, 49682). The ash matrix consists of glass shards, broken pumice and crystal fragments, and fragments of perlite.

The Guaje Pumice Bed occurs at the base of the Otowi Member, making a significant and extensive marker horizon in many well boreholes. The Guaje Pumice Bed (Bailey et al. 1969, 21498; Self et al. 1986, 21579) contains well-sorted pumice fragments whose mean size varies between 0.8 and 1.6 in. (2.0 and 4.1 cm). Its thickness averages approximately 28 ft below most of the plateau with local areas of thickening and thinning. Its distinctive white color and texture make it easily identifiable in well borehole cuttings and core, and it is an important marker bed for the base of the Bandelier Tuff.

Tephras and Volcaniclastic Sediments of the Cerro Toledo Interval. The Cerro Toledo interval is an informal name given to a sequence of volcaniclastic sediments and tephras of mixed provenance that separate the Otowi and Tshirege Members of the Bandelier Tuff (Broxton et al. 1995, 50121; Goff 1995, 49682; Broxton and Reneau 1995, 49726). Although it is intercalated between the two members of the Bandelier Tuff, it is not considered part of that formation (Bailey et al. 1969, 21498). Outcrops of the Cerro Toledo interval generally occur wherever the top of the Otowi Member appears in Los Alamos Canyon and in canyons to the north. The unit contains primary volcanic deposits normally assigned to the Cerro Toledo Rhyolite as described by Smith et al. (1970, 9752) as well as intercalated and reworked volcaniclastic sediments not normally included in the Cerro Toledo rhyolite. The occurrence of the Cerro Toledo interval is widespread; however, its thickness is variable ranging from several feet to more than 100 ft thick.

The predominant rock types in the Cerro Toledo interval are rhyolitic tuffaceous sediments and tephra (Stix et al. 1988, 49680; Heiken et al. 1986, 48638; Broxton et al. 1995, 50121; Goff 1995, 49682). The tuffaceous sediments are the reworked equivalents of Cerro Toledo rhyolite tephra that erupted from the Cerro Toledo and Rabbit Mountain rhyolite domes (see Figure 2.2-2) located in the Sierra de los Valles. Primary pumice-fall and ash-fall deposits occur in some locations. The pumice falls tend to form porous and permeable horizons within the Cerro Toledo interval, and locally they may provide important pathways for moisture transport in the vadose zone. Clast-supported gravel, cobble, and boulder deposits made up of porphyritic dacite derived from the Tschicoma Formation are interbedded with the tuffaceous rocks, and in some deposits, dacitic materials are volumetrically more important than rhyolitic detritus. These coarse dacitic deposits are generally confined to areas near the axes of paleochannels (Broxton and Reneau 1996, 55429; Broxton et al. 1995, 50121; Goff 1995, 49682). Poorly developed soils occur at several stratigraphic horizons within the Cerro Toledo interval.

Tshirege Member. The Tshirege Member is the upper member of the Bandelier Tuff and is the most widely exposed bedrock unit of the Pajarito Plateau (Griggs 1964, 8795; Smith and Bailey 1966, 21584; Bailey et al. 1969, 21498; Smith et al. 1970, 9752). Emplacement of this unit occurred during eruptions of the Valles caldera approximately 1.2 million yr ago (Izett and Obradovich 1994, 48817; Spell et al. 1996, 55542). The Tshirege Member is a multiple-flow, ash-and-pumice sheet that forms the prominent cliffs in most canyons on the Pajarito Plateau. It also underlies the canyon floor in all but the middle and lower reaches of Los Alamos Canyon and in canyons to the north. The Tshirege Member is generally over 200 ft thick. Its thickness exceeds 600 ft near the southern edge of the Laboratory at TA-49 but is thinner (often <200 ft) to the north and east (Broxton and Reneau 1996, 55429).

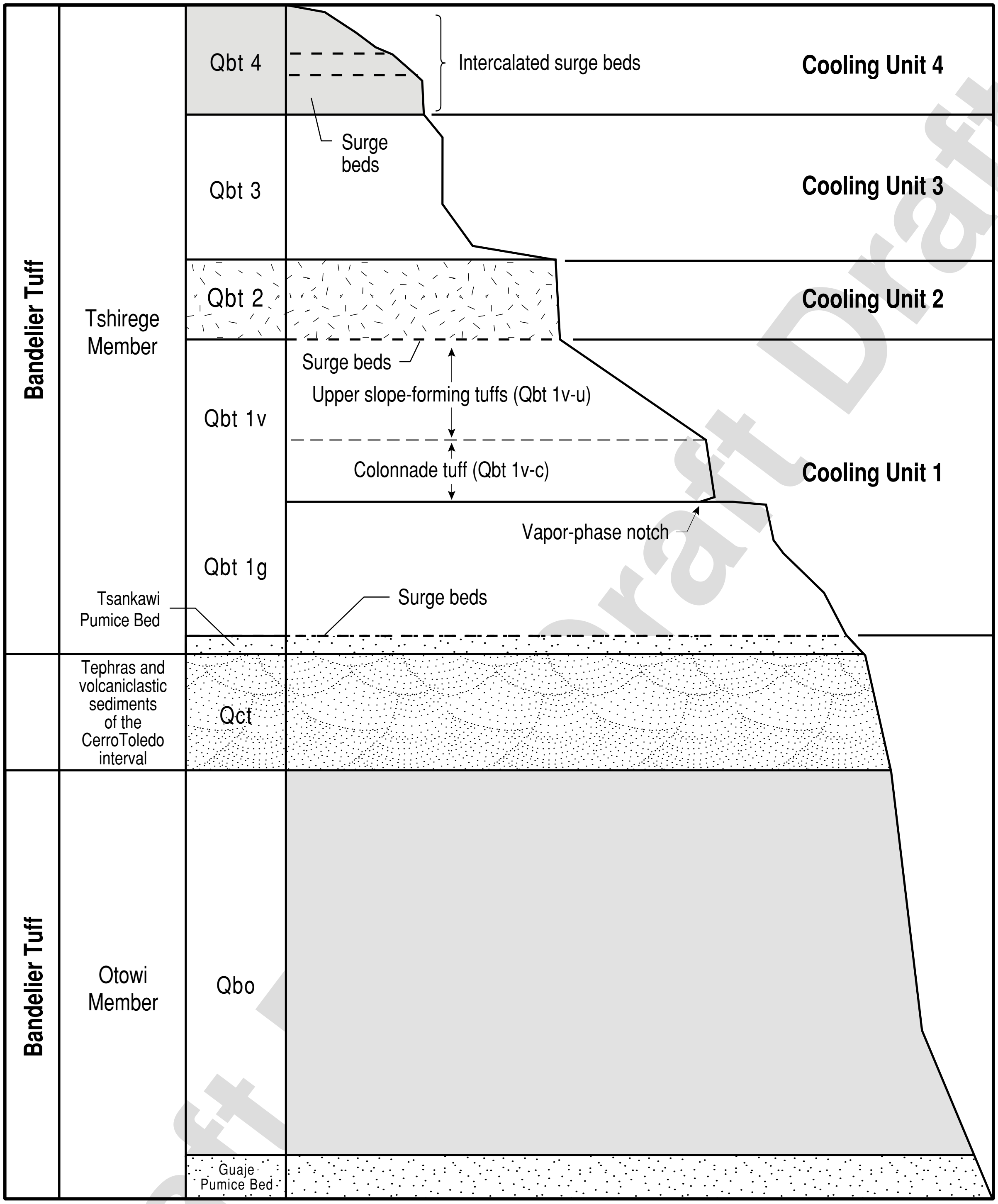
The Tshirege Member differs from the Otowi Member most notably in its generally greater degree of welding compaction. Time breaks between the successive emplacement of flow units caused the tuff to cool as several distinct cooling units. For this reason the Tshirege Member is a compound cooling unit, consisting of at least four cooling subunits that display variable physical properties vertically and horizontally (Smith and Bailey 1966, 21584; Crowe et al. 1978, 5720, Broxton et al. 1995, 50121). These variations in physical properties reflect zonal patterns of varying degrees of welding and glass crystallization that accompany welding (Smith 1960, 48819; Smith 1960, 48820). The welding and crystallization variability in the Tshirege Member produce recognizable vertical variations in its properties such as density, porosity, hardness, composition, color, and surface weathering patterns.

The Tshirege Member can be divided into mappable subunits (Figure 2.2-6) based on a combination of hydrologic properties and lithologic characteristics. A certain amount of confusion is due to the inconsistent use of subunit names for the Tshirege Member (Baltz et al. 1963, 8402; Weir and Purtymun 1962, 11890; Crowe et al. 1978, 5720; Vaniman and Wohletz 1990, 21589; Vaniman 1991, 9995; Goff 1995, 49682; Broxton et al. 1995, 50121). Figure 2.2-7 shows correlations of subunit designations applied by various workers. To avoid such confusion, this discussion follows the nomenclature of Broxton and Reneau (1995, 49726), which has been adopted by the ER Project.

Broxton et al. (1995, 50121) provide extensive descriptions of the Tshirege Member cooling units. Because the canyons crossing the Pajarito Plateau cut through the Tshirege Member with increasing depth to the east, all of these units crop out at some point in the floors and walls of most canyons. Also, the degree of welding in each of the cooling units generally decreases from west to east, reflecting the higher emplacement temperatures near the tuff's source in the Valles caldera. Densely welded in the Sierra de los Valles and the western part of the Laboratory, the Tshirege Member shows a gradual decrease in welding eastward, such that only cooling unit 2 shows much welding in most canyons in the eastern part of the Laboratory. The following paragraphs describe, in ascending order, subunits of the Tshirege Member.

(a) Tsankawi Pumice bed

The Tsankawi Pumice Bed forms the base of the Tshirege Member. Where exposed, it is commonly 20 to 30 in. (51 to 76 cm) thick. This pumice-fall deposit contains moderately well sorted pumice lapilli (diameters reaching about 2.5 in. [6.4 cm]) in a crystal-rich matrix. Several thin ash beds are interbedded with the pumice-fall deposits.



Source: Broxton and Reneau 1995, 49726.

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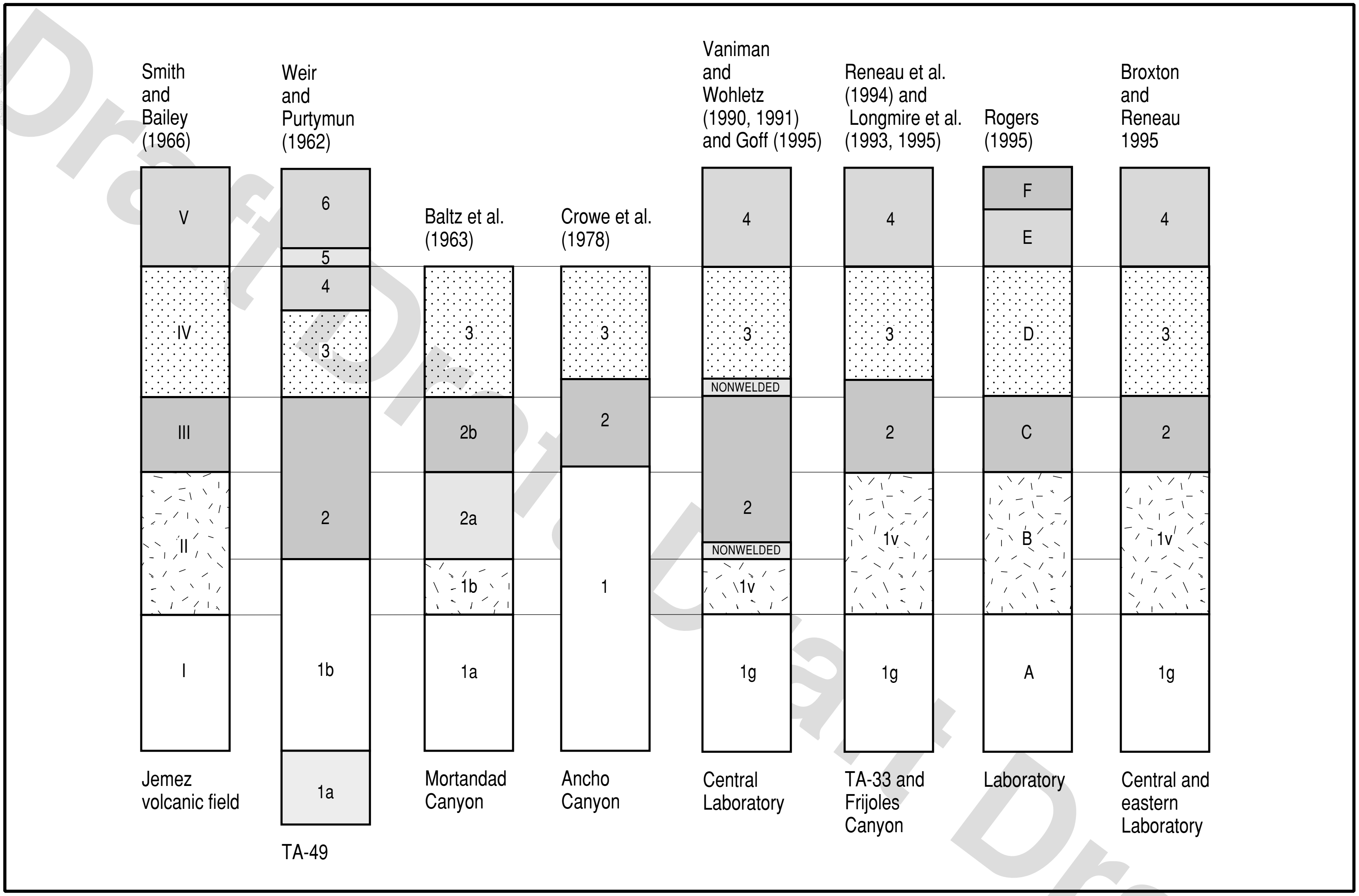
Figure 2.2-6. Illustration of the Bandelier Tuff weathering profile and unit subdivisions



Source: Slightly modified from Broxton and Reneau 1995, 49726.

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Figure 2.2-7. Correlation of rock unit names applied to the Tshirege Member of the Bandelier Tuff

(b) Qbt 1g

Qbt 1g is the lowermost subunit of the thick ignimbrite sheet overlying the Tsankawi Pumice Bed. It consists of porous, nonwelded, and poorly sorted ash flow tuffs. The “g” in this designation stands for “glass” because none of the glass in ash shards and pumices shows crystallization by devitrification or vapor phase crystallization. This unit is poorly indurated but nonetheless forms steep cliffs because of a resistant bench near the top of the unit which forms a harder, protective cap over the softer underlying tuffs. A thin (4 to 10 in. [10 to 25 cm]), pumice-poor, surge deposit commonly occurs at the base of this unit.

(c) Qbt 1v

Qbt 1v forms alternating cliff-like and sloping outcrops composed of porous, nonwelded, but crystallized tuffs. The “v” stands for vapor-phase crystallization, which together with in situ crystallization (devitrification), has converted much of the glass in shards and pumices into microcrystalline aggregates. The base of this unit is a thin, horizontal zone of preferential weathering that marks the abrupt transition from glassy tuffs below to crystallized tuffs above. This feature forms a widespread mappable marker horizon (locally termed the vapor-phase notch) throughout the Pajarito Plateau, which is readily visible in many canyon walls. The lower part of Qbt 1v is orange-brown, resistant to weathering, and has distinctive columnar (vertical) joints; hence the term colonnade tuff is appropriate for its description. A distinctive white band of alternating cliff- and slope-forming tuffs overlies the colonnade tuff. The tuffs of Qbt 1v are commonly nonwelded (pumices and shards retain their initial equant shapes) and have an open, porous structure.

(d) Qbt 2

Qbt 2 forms a distinctive, medium brown, vertical cliff that stands out in marked contrast to the slope-forming, lighter-colored tuffs above and below. A series of surge beds commonly mark its base in the eastern part of the Laboratory, and it displays the greatest degree of welding in the Tshirege Member. It is typically nonporous and has low permeability relative to the other units of the Tshirege Member. Vapor-phase crystallization of flattened shards and pumices is extensive in this unit.

(e) Qbt 3

Qbt 3 is a nonwelded to partially welded, vapor-phase altered tuff, which forms many of the upper cliffs in the mid to lower reaches of canyons on the Pajarito Plateau. Its base consists of a purple gray, unconsolidated, porous, and crystal-rich nonwelded tuff that underlies a broad, gently sloping bench developed on top of Qbt 2. This basal, nonwelded portion forms relatively soft outcrops that weather into low, rounded mounds with a white color, which contrast with the cliffs of partially welded tuff in the middle and upper portions of Qbt 3. In the western part of the Pajarito Plateau, the Qbt 3 unit is further subwelded into Qbt 3, as described above, and Qbt 3t, a series of welded tuffs with chemical and petrological features that are transitional between units Qbt 3 and Qbt 4. Qbt 3t crops out in canyon walls at TA-16 and in areas west of the Pajarito fault.

(f) Qbt 4

Qbt 4 is a partially welded to densely welded ignimbrite characterized by small, sparse pumices and numerous intercalated surge deposits. This unit crops out on the mesa tops in the western part of the Laboratory, but it is missing from mesa tops over the mid to eastern Pajarito Plateau. It forms the bedrock unit in the canyon floors along the western part of the Laboratory near the Sierra de los Valles. Devitrification and vapor-phase crystallization are typical in this unit, but thin zones of vitric ignimbrite occur within the upper part of the unit near Material Disposal Area (MDA) P.

Post-Bandelier Units

Thin (typically less than 15 ft thick) discontinuous deposits of Quaternary alluvial units overlie the Bandelier Tuff on mesa tops and as deposits in canyons. Alluvial fans consisting mostly of dacite debris are being shed over the Bandelier Tuff at the western boundary of the Laboratory. Well-sorted to poorly sorted sandy and gravelly alluvium occurs in the major drainages of the Pajarito Plateau, ranging up to at least 70 ft thick in some drill holes (Baltz et al. 1963, 8402). Additional, older alluvium occurs on stream terraces on the sides of the canyons, which can be buried by colluvial deposits from the canyon walls. The distribution of alluvial deposits on the mesas has not been mapped, but these deposits are most widespread on the western part of the Pajarito Plateau. Post-Bandelier alluvial units represent a range of ages from 1.1 million yr ago to the present. Generally, alluvial units on the surface of the mesas are probably oldest, becoming inactive as drainages were incised into the plateau. Those units lowest in the drainages grade into the active alluvium along canyon floors.

The alluvial sediments in the canyon floors probably record a complex history of erosion and deposition, in part related to regional climatic changes. In Cabra Canyon, immediately north of Los Alamos, several cycles of erosion and deposition of sediment have occurred over the last 6000 yr, during which most of the previously stored sediment was eroded (Gardner et al. 1990, 48813). Similar cycles of erosion and deposition have been documented in many parts of the southwestern United States, and the older alluvial units in the vicinity of Los Alamos may also record the effects of regional climatic changes (Dethier et al. 1988, 57003).

The mesas of the Pajarito Plateau are also covered in part by deposits of the El Cajete pumice, erupted from El Cajete crater in the Jemez Mountains. Deposits of pumice on the mesas have been mapped by Rogers (1995, 54419). They are generally most common in the southern part of the Laboratory, and the axis of the volcanic dispersal plume is south of Los Alamos County. Available data suggest that the El Cajete pumice is 50,000 to 60,000 yr old (Toyoda et al. 1995, 57001; Reneau et al. 1996, 57002).

Pre-El Cajeta, post-Bandelier pumice falls and reworked tuffs have been recently recognized at a number of sites on the Pajarito Plateau. These pumice beds are believed to be associated with eruptions of the Deer Creek and Valle Grande members of the Valles Rhyolite of Bailey et al. (1969, 21498) and Smith et al. (1970, 9752).

2.2.1.3 Soils

Soils on the Pajarito Plateau were initially mapped and described by Nyhan et al. (1978, 5702). The Nyhan study included only Laboratory-controlled lands and certain US Forest Service lands within Los Alamos County.

The soils were formed in a semiarid climate and were derived from chemical, biological, and physical weathering of local bedrock units, fallout pumice deposits, eolian deposits, and sediments derived from these geological materials (Nyhan et al. 1978, 5702). A large variety of soils have developed on the Pajarito Plateau as the result of interactions of the underlying bedrock, slope, and climate. The mineral components of the soils are in large part derived from the Bandelier Tuff, but dacitic lavas of the Tschicoma Formation, basalts of the Cerros del Rio volcanic field, and sedimentary rocks of the Puye Formation are locally important, and additional material may be transported to the canyons from the mesa tops by wind. Alluvium derived from the Pajarito Plateau and from the east side of the Jemez Mountains contributes to soils in the canyons and also to those on some of the mesa tops.

The soils on the slopes between the mesa tops and canyon floors have been mapped as mostly steep rock outcrops consisting of approximately 90% bedrock outcrop and patches of shallow, undeveloped colluvial soils. South-facing canyon walls are steep and usually have little or no soil material or vegetation; in contrast, the north-facing walls generally have areas of very shallow, dark-colored soils and are more heavily vegetated. The canyon floors generally contain poorly developed, deep, well-drained soils (Nyhan et al. 1978, 5702).

2.2.1.4 Geologic Structure

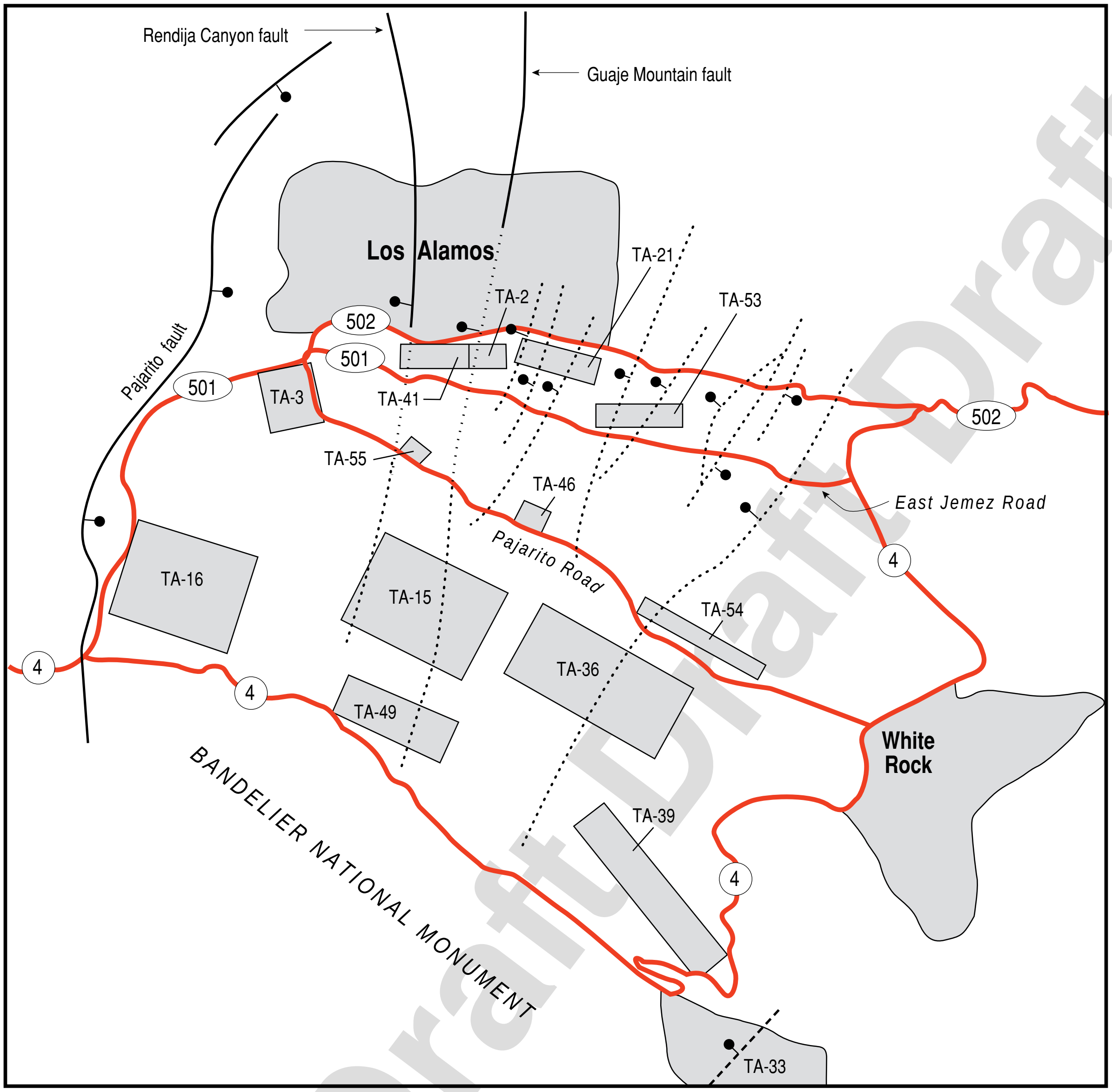
The Pajarito Plateau is on the western margin of the Española basin of the Rio Grande rift, a tectonically active region. The Pajarito fault system, the major border fault on the west side of the basin, delineates the boundary between the eastern Sierra de Los Valles and the western part of the plateau. This fault system has experienced Holocene movement and historic seismicity (Gardner and House 1987, 6682; Gardner et al. 1990, 48813). Characterized by northerly trending normal faults that intertwine along their traces, the Pajarito fault system shows dominantly down-to-the-east movement and produces a series of prominent fault scarps west of the Laboratory (Figure 2.2-8). The vertical throw on this fault system is over several hundred feet south and west of the Laboratory but decreases north of Los Alamos Canyon where the fault system is less prominent.

In addition to the main traces of the Pajarito fault system, other faults cut the Pajarito Plateau. The Rendija Canyon fault is a normal fault trending north-south in the west-central part of the plateau; it crosses Pueblo Canyon near its confluence with Acid Canyon and Los Alamos Canyon near TA-41 but does not have clear surface expression south of Sandia Canyon. The Guaje Mountain fault parallels the Rendija Canyon fault and is projected to cross Los Alamos Canyon near TA-2 although there is no clear offset of the Tshirege Member south of North Mesa. North of the Laboratory both of these faults have down-to-the-west movement and zones of gouge and breccia up to several meters wide, and produce visible offset of stratigraphic horizons and recognizable scarps. However, these features are not apparent within most of the Laboratory. Vaniman and Wohletz (1990, 21589) and Wohletz (1995, 54404) project these faults south of Los Alamos Canyon, based on Tshirege Member rock fracture density variations, orientations, and size. Such methods of fault identification in the Tshirege Member may be valuable means by which to help identify other tectonic zones in canyons that could be potential pathways for water infiltration.

Dransfield and Gardner (1985, 6612) integrated a variety of data to produce structure contour maps and paleogeologic maps of the pre-Bandelier-Tuff surface beneath the Pajarito Plateau. Their maps reveal down-to-the-west normal faults cutting subsurface rock units. These buried faults do not obviously displace the overlying Bandelier Tuff south of Los Alamos Canyon, indicating that most of these fault movements predate deposition of the Bandelier Tuff. More recent structure contour maps, isopach maps, and paleogeologic maps of the Pajarito Plateau are presented in Davis et al. (1996, 55446) and Broxton and Reneau (1996, 55429).

2.2.1.5 Seismicity and Volcanism

The Laboratory lies within a region that possesses a long and rich history of volcanic and tectonic activity dating from the distant past into the Late Pleistocene and present, respectively. Volcanism began in the Jemez Mountains volcanic field more than 13 million yr ago and continued without significant hiatus up through about 50,000 yr ago (Gardner et al. 1986, 21527; Toyoda et al. 1995, 57001; Reneau et al. 1996, 57002). Reports of questionable reliability describe what were apparently phreatic explosions and possible associated earthquakes within the volcanic field around 100 yr ago (Santa Fe *Daily New Mexican* 1882, 57005). Regardless, given the long history of spatially focused, geologically continuous volcanic activity, future volcanism can be expected. Although volcanic activity directly affecting the Laboratory may prove unlikely, sufficient data to quantify the probabilities and nature of future volcanism are lacking.



Sources: Dransfield and Gardner 1985, 6612; Gardner and House 1987, 6682.

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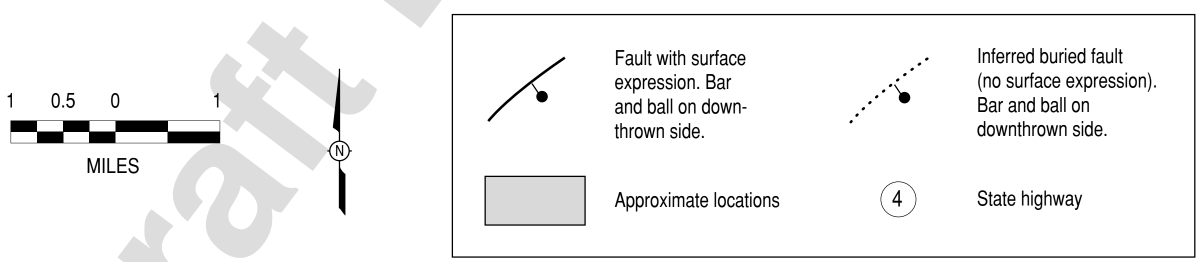


Figure 2.2-8. Locations of known and inferred faults at the Laboratory and in the surrounding areas

Direct effects of future seismicity at the Laboratory are likely, although quantification of probabilities is not possible at present. Numerous small earthquakes are recorded in the Los Alamos area and northern New Mexico each year (Sanford et al. 1979, 11858; Cash and Wolff 1984, 57041; Gardner and House 1987, 6682). Since establishment of the Laboratory, several earthquakes of Richter magnitude 3 to 4 have shaken Los Alamos (Gardner and House 1987, 6682). Recent work has shown that three fault segments in Los Alamos County are seismically active and that they are capable of generating large earthquakes of about 7 or more on the Richter scale (Gardner and House 1987, 6682; House and Cash 1988, 6878; Gardner et al. 1990, 48813; Gardner and House 1994, 57006). Unknown at this time are how frequently these large earthquakes occur and their potential for generating surface rupture and mass wasting (occurrences such as rockfalls and landslides, which are not caused primarily by the movement of water) within the confines of the Laboratory.

2.2.1.6 Geomorphic Processes

Significant geomorphic processes active on the Pajarito Plateau include (1) erosion of mesa top soils by runoff, (2) retreat of canyon walls by rockfalls and landslides, (3) colluvial transport on sloping portions of canyon walls, and (4) erosion and deposition of sediments by streams in the canyon floors. Few data exist on the rates of erosion and landscape change caused by these different processes on the Pajarito Plateau. Estimates of long-term vertical erosion rates on mesa tops have been made based on stripping of overlying units (Purtymun and Kennedy 1971, 4798), but these estimates may be of limited value because the resistant, cliff-forming units may be eroded primarily by lateral cliff retreat rather than by vertical erosion. Erosion rates vary considerably on the mesa tops; the highest rates occur in and near drainage channels and in areas of locally steeper slope gradient, and the lowest rates occur on relatively gently sloping portions of the mesa tops removed from channels. Areas where runoff is concentrated by roads and other development are especially prone to accelerated erosion.

The rates and processes of erosion may differ significantly between the north and south slopes of canyons. Given current vegetation and climate, the more extensive exposures of bedrock on south-facing sides and greater soil cover on north-facing sides suggest that erosion rates of fine-grained material that can be transported by runoff are higher on the drier, less-vegetated, south-facing sides of canyons, although this material is largely retained on the north-facing slopes. No studies have been conducted to quantify the rates and processes of erosion on canyon sides. However, the Laboratory is systematically evaluating the erosion potential in areas associated with corrective action sites in order to identify the need for and prioritize stabilization efforts to minimize or eliminate potential contaminant transport.

The recent alluvial history of the canyons on the Pajarito Plateau is complex—some sediments within the stream channels are mobilized during every flood and others adjacent to or deeper beneath the channels are progressively buried and remain stable for long periods (Reneau and McDonald 1996, 55538; Reneau et al. 1996, 55539). For example, a 13-ft-deep trench excavated in Cabra Canyon, a tributary to Rendija Canyon immediately north of the Los Alamos townsite, revealed cycles of alternating sediment deposition and channel incision over the last 6000 yr (Gardner et al. 1990, 48813). In Cabra Canyon there has been a net accumulation of sediment over this period, although sediment deposition was interrupted by at least three episodes when channels were incised at least 3 to 6 ft, and the previously stored sediments were transported downstream. In DP Canyon, a tributary to Los Alamos Canyon on the north side of TA-21, up to 6 ft of sediment has been locally deposited since 1943. These young sediments in DP Canyon have been partially excavated by renewed channel incision (Reneau 1995, 50143), a process also observed in other canyons. In many canyons on the Pajarito Plateau the burial of the base of young trees indicates that a foot or more of historic (post-1942) sediment deposition on floodplains or low terraces (banks) is common. Erosion of sedimentary deposits and associated contaminants is probably caused by both vertical scouring and lateral cutting of streams during large floods. Plateau-wide summaries and syntheses of canyon-floor alluvial history are presented in Reneau and McDonald (1996, 55538) and Reneau et al. (1996, 55539).

Mass wasting processes are potentially important because they can move large volumes of material from the canyon walls to the canyon floors (e.g., Reneau 1995, 50143; Reneau et al. 1995, 54405; and Reneau and MacDonald 1996, 55538). In part, they create a geologic hazard in the canyon floors. For example, records for the last four decades indicate that fences in Los Alamos Canyon at TA-2 have been impacted by one boulder weighing 300 lb or more every two years on average (McLin 1993, 50127). Burial of alluvium by rockfall debris would tend to reduce the ability of the streams to erode and transport the sediment and locally increase the residence times of contaminated sediment in the canyon floors.

2.2.2 Hydrology

2.2.2.1 Surface Water

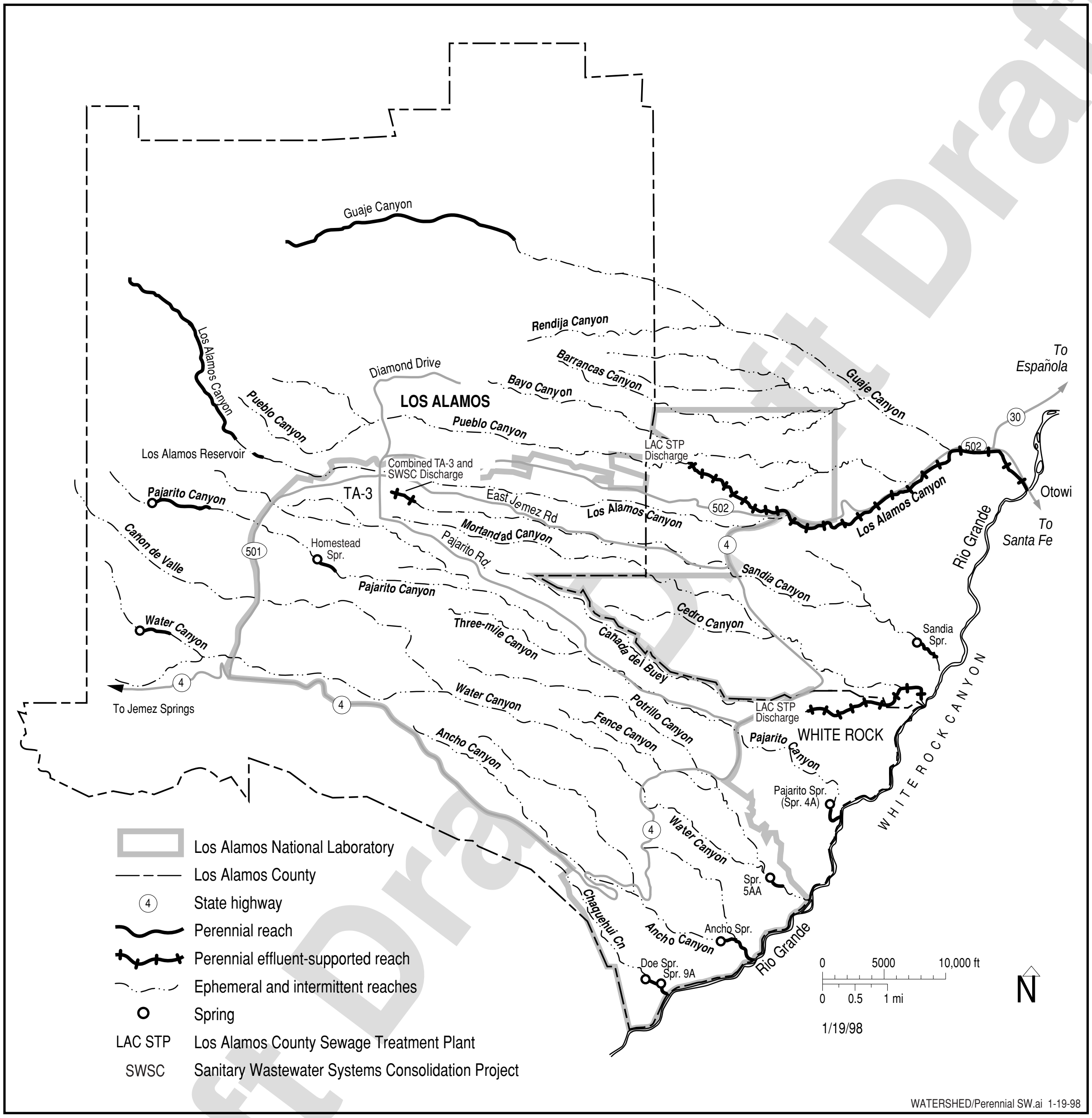
The Rio Grande is the primary river in north-central New Mexico. All surface water drainage and groundwater discharge from the plateau ultimately arrives at the Rio Grande. The Rio Grande at Otowi, just east of Los Alamos, has a drainage area of 14,300 mi^2 in southern Colorado and northern New Mexico. The discharge for the period of record has ranged from a minimum of 60 cubic feet per second (cfs) in 1902 to 24,400 cfs in 1920. The river transports about 1 million tons of suspended sediments past Otowi annually (Graf 1993, 23251).

Essentially all Rio Grande flow downstream of the Laboratory passes through Cochiti Reservoir, which began filling in 1976. It is designed to provide flood control, sediment retention, recreation, and fishery development. Flood flows are temporarily stored and released at safe rates. The dam is expected to trap at least 90% of the sediments carried by the Rio Grande (Graf 1993, 23251).

Most Los Alamos surface water occurs as ephemeral, intermittent, or interrupted (alternation of perennial, ephemeral, and intermittent stretches) streams in canyons cut into the Pajarito Plateau. (Ephemeral streams flow in response to precipitation; intermittent streams flow in response to the availability of snowmelt or groundwater discharge; perennial streams flow at all times except during extreme drought.) Springs on the flanks of the Jemez Mountains, west of the Laboratory's western boundary, supply flow to the upper reaches of Cañon de Valle and in Guaje, Los Alamos, Pajarito, and Water Canyons (Purtymun 1975, 11787; Stoker 1993, 56021). These springs discharge water perched in the Bandelier Tuff and Tschicoma Formation at rates from 2 to 135 gal./min (Abeele et al. 1981, 6273). The volume of flow from the springs maintains natural perennial reaches of varying lengths in each of the canyons. Figure 2.2-9 shows the locations of perennial reaches in the Los Alamos area.

Perennial flow in Guaje Canyon is north of the Laboratory boundary. The perennial reach extends from springs upstream of Guaje reservoir to some distance downstream of the reservoir. The perennial reach in Los Alamos Canyon is above the Los Alamos reservoir and extends to within a few hundred yards of the reservoir. Springs in the upper reaches of Pajarito Canyon support flow in a perennial reach followed by an intermittent reach to within about 0.5 mi of the Laboratory's western boundary. Flow in Water Canyon does not reach the western boundary (Stoker 1993, 56021) (see Figure 2.2-9).

Springs on DOE property near the western Laboratory boundary occur in Pajarito Canyon and Cañon de Valle. Perennial flow has been associated with Homestead Spring in Pajarito Canyon. The length of the reach extends for several hundred yards (Stoker 1993, 56021). Additional springs have been located within the Laboratory boundary by Dale et al. (1996, 57014) and others. Further investigation and flow documentation is needed to validate their location and periodicity of flow.



Source for perennial and effluent-supported reaches: Stoker 1993, 56021.

F2.2-9 / IWP / 012500 / PTM

Figure 2.2-9. Surface water occurrences at Los Alamos

Springs near the Rio Grande in Sandia, Pajarito, Water, Ancho, and Chaquehui Canyons are considered discharge points of the regional aquifer because of similar water chemistry. Flow from these springs maintains natural perennial reaches of varying lengths. Three of these reaches, in Water, Ancho, and Chaquehui Canyons, are within the eastern Laboratory boundary. Flows from Ancho Spring in Ancho Canyon and Pajarito Spring (also known as Spring 4A) in Pajarito Canyon are known to reach the Rio Grande. Flow from Spring 9A in Chaquehui Canyon extends to a point where it meets perennial flow from Spring 9. Combined flow from Springs 9 and 9A reaches the Rio Grande (Stoker 1993, 56021). Flow from Sandia Spring in Sandia Canyon extends about 300 ft and does not reach the Rio Grande. Flow from Spring 5AA in Water Canyon is very short and does not reach the Rio Grande.

In addition to these limited natural perennial reaches, three effluent-supported reaches also exist within the watershed. Laboratory and Los Alamos County effluent discharges provide surface water flow to Pueblo and Sandia Canyons, and Cañada del Buey. The Los Alamos County Sewage Treatment Plant discharges effluent into Pueblo Canyon. Effluent-supported flow reaches Los Alamos Canyon and is sampled at State Highway 4 as part of the environmental surveillance program. By 1993, flow occasionally extended to the Rio Grande. Effluent discharged into Cañada del Buey from the Los Alamos County sanitary wastewater treatment plant in White Rock extends to the Rio Grande when the discharge is not diverted for irrigation of county parks. Effluent-supported flow in Sandia Canyon results from the discharge of Laboratory-treated sanitary sewage. Flow typically extends 2.5 to 3 mi (Stoker 1993, 56021).

Eleven drainage areas, with a total area of 82 mi^2, pass through the Laboratory's eastern boundary. Runoff from heavy thunderstorms and heavy snowmelt reaches the Rio Grande several times a year in some drainages. Los Alamos, Pajarito, and Water Canyons have drainage areas at the east boundary that are greater than 10 mi^2. Pueblo Canyon has approximately 8 mi^2; the rest (Barrancas [a tributary to Guaje Canyon], Bayo, Sandia, Mortandad, Cañada del Buey, Ancho, and Chaquehui Canyons) have less than 6 mi^2 each. Theoretical maximum flood peaks range from 24 cfs for a 2-yr frequency to 686 cfs for a 50-yr frequency (McLin 1992, 12014). The overall flooding risk to community and Laboratory buildings is low because nearly all the structures are located on the mesa tops, from which runoff drains rapidly into the adjacent canyons.

Environmental monitoring for chemical and radiochemical quality in surface water began with US Geological Survey (USGS) investigations (Purtymun 1964, 11822; 1975, 11787; Purtymun and Kunkler 1967, 11782; Purtymun 1967, 8987) and has been continued by the Laboratory (ESG until 1971; Environmental Protection Group 1994, 35363).

2.2.2.2 Groundwater

Descriptions and data for groundwater systems beneath the Pajarito Plateau are summarized from numerous technical reports in the hydrogeologic work plan (LANL 1998, 59599) and in individual canyons work plans. In addition, the annual report for the hydrogeologic work plan documents changes to the hydrogeologic conceptual model and presents new information developed as part of the installation of the regional aquifer characterization wells.

Groundwater occurs in three modes in the Los Alamos Area: (1) water in shallow alluvium in some of the larger canyons, (2) intermediate perched groundwater (a perched groundwater body lies above a less permeable layer and is separated from the underlying aquifer by an unsaturated zone), and (3) the regional aquifer of the Los Alamos area.

Numerous wells have been installed over the past several decades at the Laboratory and in the surrounding area to investigate the presence of groundwater in these three zones and to monitor groundwater quality. The locations of existing wells are shown in Figure 2.2-10.

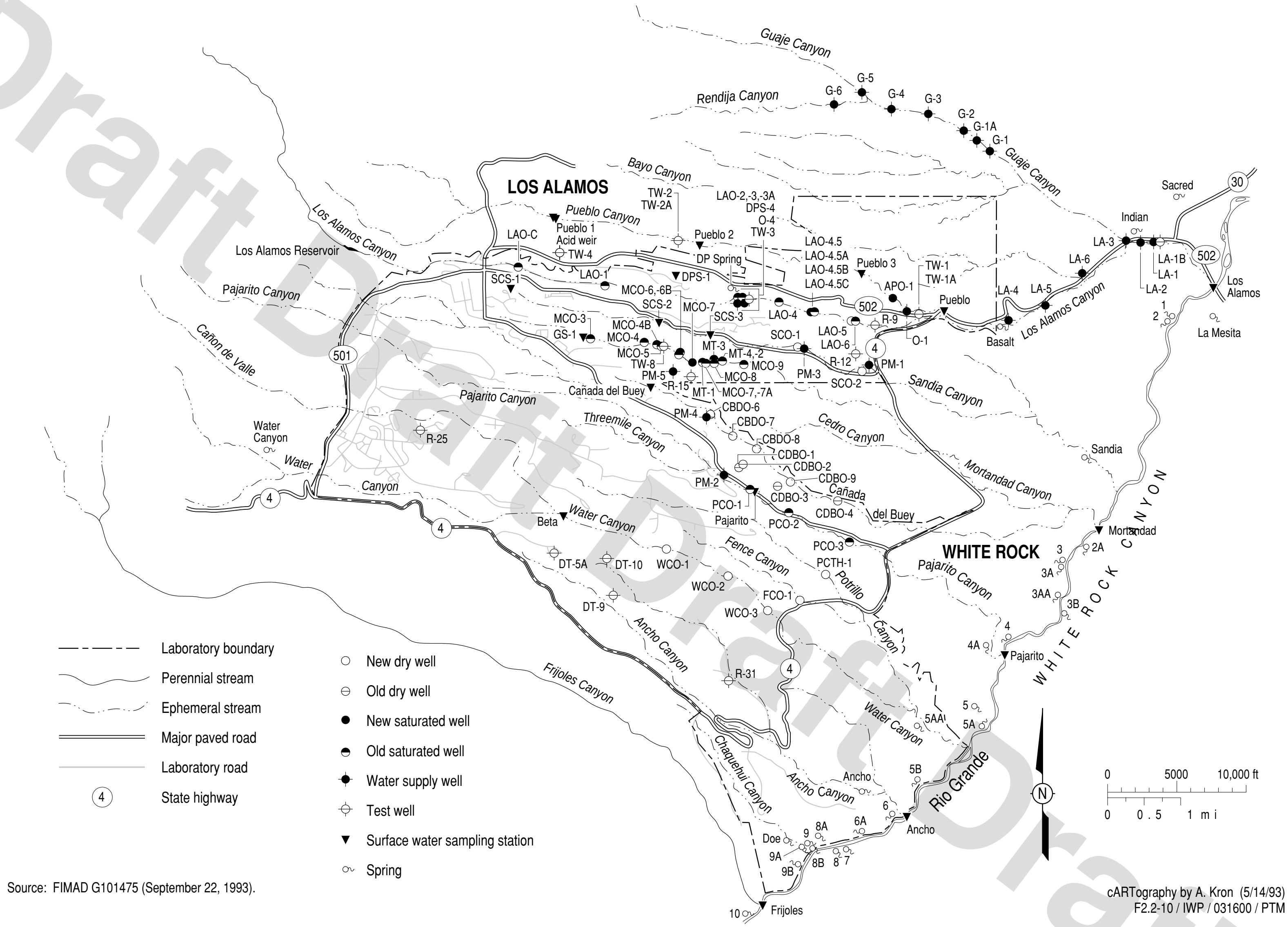


Figure 2.2-10. Well locations in Los Alamos County and adjacent areas

The Laboratory has formulated a comprehensive groundwater protection plan (LANL 1995, 50124) for an enhanced set of characterization and monitoring activities. The hydrogeologic work plan (LANL 1998, 59599) details the implementation of extensive groundwater characterization across the Pajarito Plateau within an area potentially affected by Laboratory operations. This characterization program is being implemented jointly by the ER Project and DOE Defense Programs (DP). The locations of the characterization wells (Figure 2.2-11) and their proposed drilling and sampling plans address many objectives, in particular,

- delineating individual zones of saturation, and defining the hydraulic interconnection between them;
- delineating the recharge areas for the regional aquifer and intermediate perched zones;
- groundwater flow directions of the regional aquifer and intermediate perched zones, and the influence of resource withdrawal by production wells; and
- assessment of aquifer characteristics using the additional data from wells installed within specific intervals of the various aquifers beneath the Laboratory.

Installation of the boreholes and the information gained from them are coordinated with ongoing ER Project and environmental surveillance activities, including use of common resources and data collection/retrieval techniques.

Perched Groundwater in Alluvium

Intermittent and ephemeral streamflows in the canyons of the Pajarito Plateau have deposited alluvium that is as much as 100 ft thick. The alluvium in canyons that head on the Jemez Mountains is generally composed of sands, gravels, pebbles, cobbles, and boulders derived from the Tschicoma Formation and Bandelier Tuff. The alluvium in canyons that head on the plateau is comparatively more fine grained, consisting of clays, silts, sands, and gravels derived from the Bandelier Tuff. Saturated hydraulic conductivity of the alluvium typically ranges from 10^{-2} cm/sec for a sand to 10^{-4} cm/sec for a silty sand (Abeele et al. 1981, 6273).

In contrast to the underlying volcanic tuff and sediments, the alluvium is quite permeable. Ephemeral runoff in some canyons infiltrates the alluvium until downward movement is impeded by the less-permeable tuff and sediments, which results in a buildup of a shallow alluvial groundwater body. Depletion by evapotranspiration and movement into the underlying rocks limits the horizontal and vertical extent of the alluvial water (Purtymun et al. 1977, 11846). The limited saturated thickness and extent of the alluvial groundwater preclude its use as a viable source of municipal and industrial supply to the community and the Laboratory. Lateral flow of the alluvial perched groundwaters is in an easterly, downcanyon direction. Tracer studies in Mortandad Canyon have shown that the velocity of water ranges from about 60 ft/day in the upper reach to about 7 ft/day in the lower reach of the canyon (Purtymun 1974, 5476).

Purtymun (1975, 11787; 1973, 4971) has written reviews of alluvial perched groundwaters by drainage area. The results of an extensive monitoring study of the alluvial perched groundwater in Mortandad Canyon are presented by Abrahams et al. (1962, 8140), Baltz et al. (1963, 8402), Purtymun (1973, 4971), Purtymun (1974, 5476), Purtymun et al. (1977, 11846), Purtymun et al. (1983, 6407), and Stoker et al. (1991, 7530).

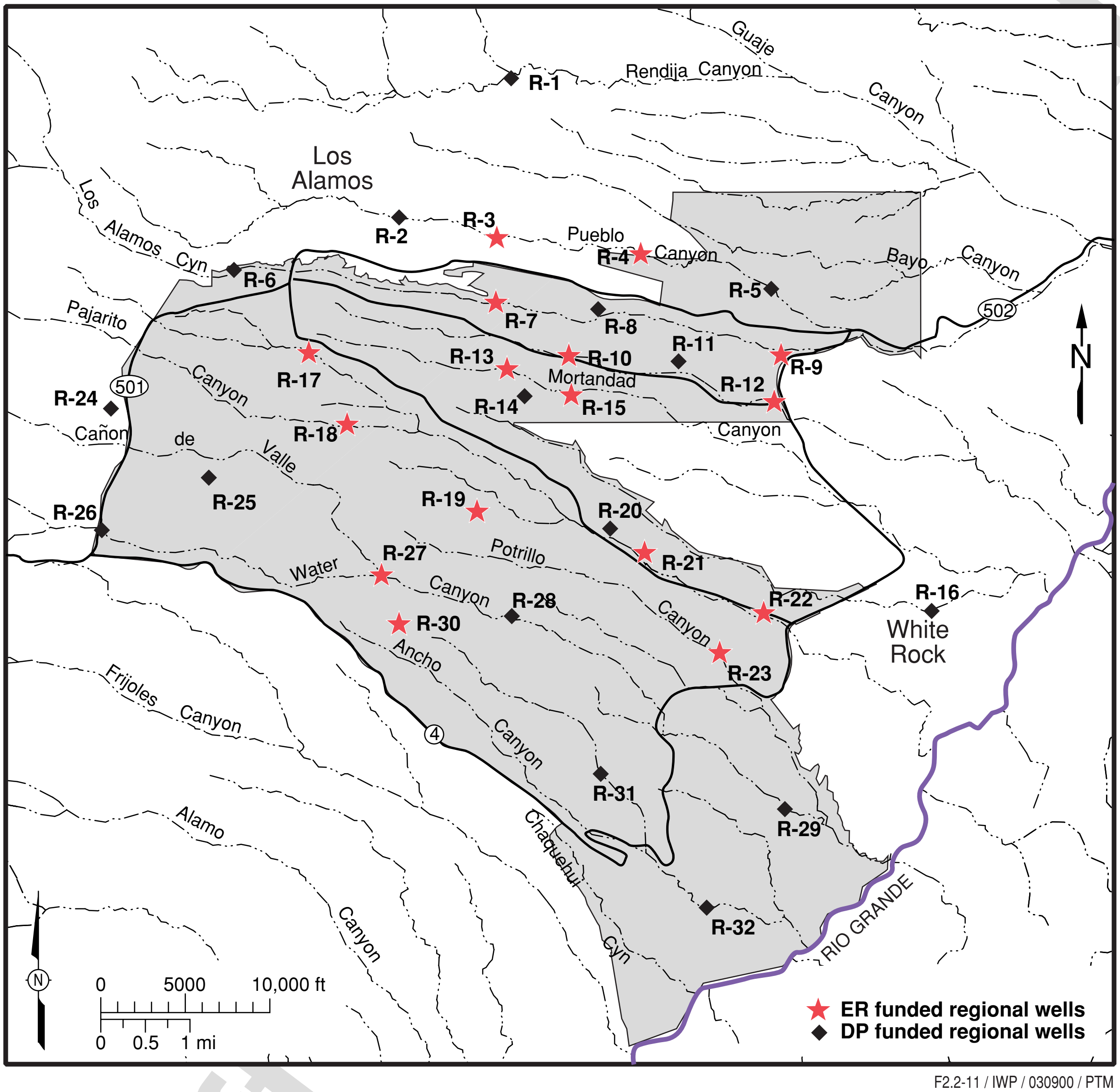


Figure 2.2-11. **Planned locations for regional aquifer characterization wells in the hydrogeologic work plan (LANL 1998, 59599)**

Intermediate Perched Groundwater

Localized bodies of perched groundwater occur beneath several canyons in the eastern portion of the Laboratory, along the eastern flanks of the Jemez Mountains west of the Laboratory, and beneath the mesas and canyons at TA-16, located in the southwestern part of the Laboratory near the Jemez Mountains. Perched groundwater may exist beneath other canyons in the south and central portions of the Laboratory, which have not yet been investigated by drilling. These perched groundwater bodies are found in areas where a sufficient water source is present to maintain saturation within the deeper units. Thus, perched groundwater beneath canyon floors may be maintained by infiltration from the overlying stream, and perched groundwater within the Bandelier Tuff along the Jemez Mountains may be maintained by seepage from streams exiting the mountains. The presence of these perched groundwater bodies is controlled by the occurrence of a perching layer, whose lower permeability causes water to pond in a more permeable horizon above it. Perching layers are found within the interlayered Cerros del Rio Basalt flows and the sediments of the Puye Formation, for example, where they underlie the more permeable Guaje Pumice Bed in Los Alamos Canyon. The presence of perched water at TA-16 and on the flanks of the Jemez Mountains is evidently controlled by contrasts in lithologic proper-ties within the Bandelier Tuff, which might exist at boundaries between flow units.

Perched water bodies occur in the conglomerates and basalts beneath the alluvium in the mid- and lower reaches of Pueblo and Los Alamos Canyons and in the lower reach of Sandia Canyon (Purtymun 1995, 45344; Broxton et al. 1998, 59158.3; Broxton et al. 1998, 59665.4). Depth to perched water ranges from about 90 ft in the midreach of Pueblo Canyon to about 450 ft in lower Sandia Canyon. The vertical and lateral extent of the perched groundwaters, the nature and extent of perching units, and the potential for migration of perched water to the main aquifer is not yet fully understood.

Patterns of chemical quality and water level measurements indicate that the intermediate perched groundwater in Pueblo Canyon is hydrologically connected to the stream in Pueblo Canyon (Abrahams and Purtymun 1966, 8141). Water from this perched groundwater discharges below the base of the basalt at Basalt Spring, which is located in lower Los Alamos Canyon on San Ildefonso Pueblo land. The rate of movement of the perched groundwater in this vicinity has been estimated at about 60 ft/day or about 6 mo. from recharge to discharge (Purtymun 1975, 11787). Similar hydrologic connections are believed to occur between surface water and intermediate perched water in Los Alamos Canyon (Broxton et al. 1998, 59158.3) and Sandia Canyon (Broxton et al. 1998, 59665.4).

It is unknown whether the intermediate perched water systems are hydraulically interconnected. Available data, however, suggest that some of the systems are of limited extent: testing of the perched system in mid-Pueblo Canyon depleted the perched groundwater after about an hour's pumping at 2 to 3 gal./min (Weir et al. 1963, 11892). Perched water was encountered in mid-Los Alamos Canyon during the drilling of the Otowi 4 supply well (Stoker et al. 1992, 12017), but it was not reported in an adjacent well (test well 3) located 300 ft to the east. (However, test well 3 was drilled with a cable tool rig in 1947, and the driller may not have noticed the perched groundwater if it was present.)

Some perched water occurs in volcanics on the flanks of the Jemez Mountains off-site to the west of the Laboratory. This water discharges in several springs (including American and Armistead Springs) and provides flow for the gallery in Water Canyon. The gallery contributed to the Los Alamos water supply for 41 yr, producing 23 to 96 million gal. annually.

Several springs have been noted in the area of TA-16 by the New Mexico Environment Department (NMED) DOE Oversight Bureau. Some of these springs are located within canyon-floor alluvium where groundwater return flow to the dry stream channel occurs; they do not represent springs in the usual sense. In other cases flow issues from canyon walls well above the alluvium. The origin of water supplying these springs is uncertain at present. In some cases the flow source may be nearby outfalls. The ER Project and NMED DOE Oversight Bureau have discovered high-explosives residuals in samples from some of these springs.

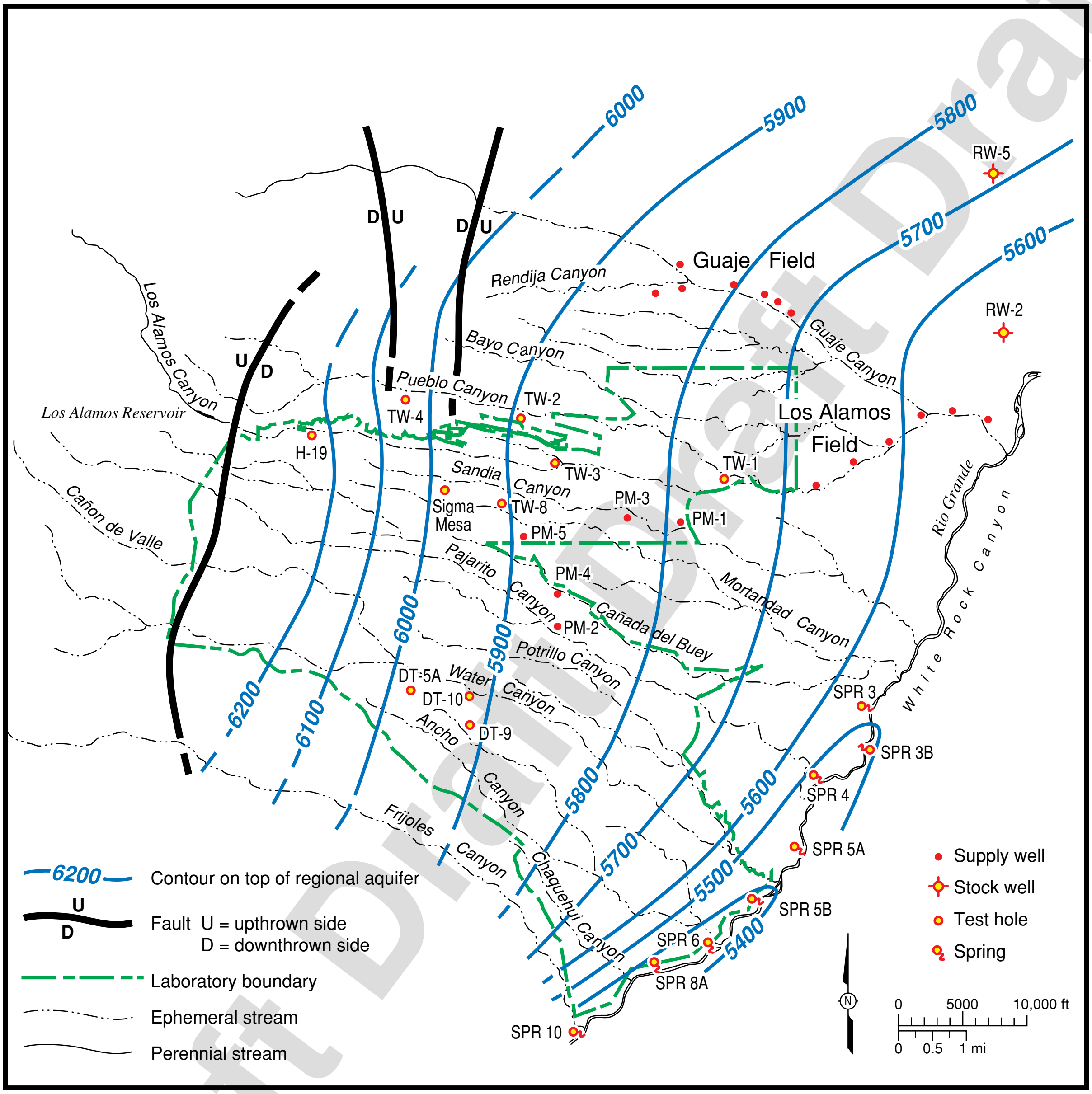
Regional Aquifer

The regional aquifer of the Los Alamos area is the only aquifer capable of large-scale municipal water supply (Purtymun 1984, 6513). In 1989, water for the Laboratory, the communities of Los Alamos and White Rock, and Bandelier National Monument was supplied from 11 deep wells in 3 well fields. The wells are located on the Pajarito Plateau and in Los Alamos and Guaje Canyons east of the plateau. Municipal and industrial water supply pumpage during 1992 was 1.43 billion gal. Yields from individual wells ranged from about 175 to 1400 gal/min (Stoker et al. 1992, 12017). Purtymun (1984, 6513) summarized the hydraulic characteristics of the aquifer as determined during aquifer tests and during periods of production of supply wells and test holes.

The regional aquifer water table slopes eastward, occurring at approximately 6200 ft elevation in the western part of the Laboratory and 5500 ft elevation near the Rio Grande (Figure 2.2-12). The depths to groundwater below the mesa tops range from about 1200 ft along the western margin of the plateau to about 600 ft at the eastern margin. The regional aquifer occurs within the Santa Fe Group near the Rio Grande, and occurs within the lower part of the Puye Formation in the central and western part of the Laboratory. The regional aquifer is typically separated from the alluvial groundwater and intermediate perched zone groundwater by 350 to 620 ft of tuff, basalt, and sediments (Environmental Protection Group 1993, 23249). The regional aquifer exhibits artesian conditions in the eastern part along the Rio Grande (Purtymun 1984, 6513). Continuously recorded water level measurements collected in test wells since the fall of 1992 indicate that, throughout the plateau, the regional aquifer responds to barometric and earth tide effects in the manner typical of confined aquifers.

The hydraulic gradient of the regional aquifer averages about 60 to 80 ft/mi within the Puye Formation but increases to 80 to 100 ft/mi along the eastern edge of the plateau as the groundwater enters the less-permeable sediments of the Santa Fe Group. The rate of movement of groundwater in the upper section of the aquifer varies, depending on the materials in the aquifer. Aquifer tests indicate that the rate of movement ranges from 20 ft/yr in the Tesuque Formation to 345 ft/yr in the more permeable Puye Formation (Purtymun 1984, 6513). The highest yielding water supply wells are located within the late Miocene trough described by Purtymun (1984, 6513).

The exact source of recharge to the regional aquifer is unknown. Groundwater elevation measurements suggest that groundwater flows from the Jemez Mountains towards the Rio Grande to the east and east-southeast where a portion discharges into the river through seeps and springs (Purtymun 1984, 6513). Springs fed by the regional aquifer discharge an estimated 4300 to 5000 ac-ft of water annually into White Rock Canyon along an 11-mi reach between Otowi Bridge at State Highway 502 and the mouth of Rito de Frijoles (Cushman 1965, 8584). Major recharge of the regional aquifer from the west is inferred because the piezometric surface slopes downward to the east (Figure 2.2-12). Cushman (1965, 8584) suggested three sources of recharge: infiltration of runoff in canyons; underflow from the Valles caldera through the Tschicoma Formation; and infiltration on mesas. However, a large quantity of hydrologic, structural, and geochemical data indicate that the caldera may not serve as an appreciable source of recharge to the regional aquifer (Conover et al. 1963, 57044; Griggs 1964, 8795; Goff 1991, 57039). Furthermore, natural recharge through undisturbed Bandelier Tuff on the mesa tops is believed to be insignificant (Purtymun and Kennedy 1971, 4798; Kearl et al. 1986, 8414; Newman 1996, 59371; Newman et al. 1997, 59372), and few or no data exist to support an evaluation of canyon runoff as a recharge source.



Source: modified from Purtymun 1984, 6513.

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Figure 2.2-12. Generalized water level contours on top of the regional aquifer

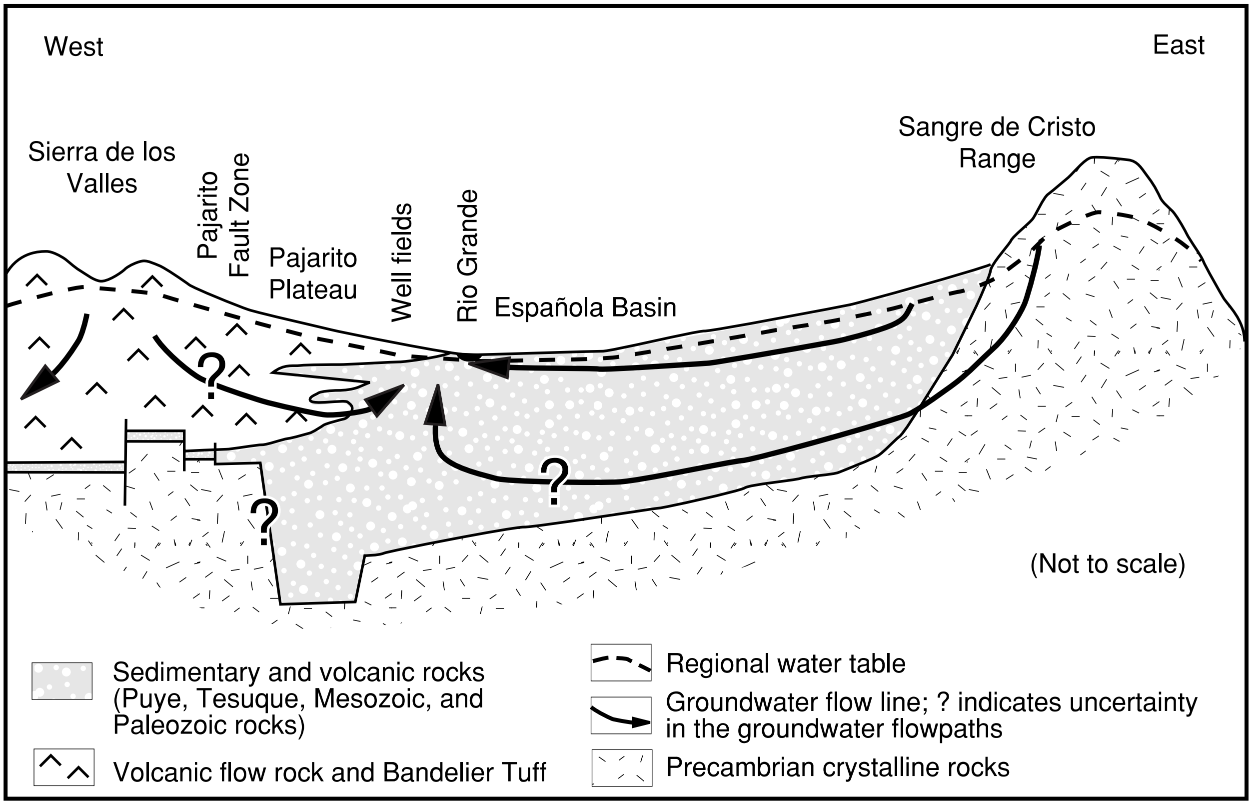
To estimate recharge rates beneath the Pajarito Plateau, Rogers and Gallaher (1995, 55334) tabulated Bandelier Tuff core hydraulic properties from several boreholes beneath the Laboratory. Rogers et al. (1996, 55543) evaluated the direction and flux of water through the unsaturated zone using hydraulic properties from seven boreholes that had sufficient data. These seven boreholes represent mesa top and canyon-floor locations, which are two of the distinct hydrologic regimes on the Pajarito Plateau. Most head gradients determined for the boreholes are approximately unity, implying that flow is nearly steady state. An exception to the unit gradient was found for boreholes at MDA G (TA-54), where gradient reversals at depths of about 100 ft suggest that evaporative drying may be taking place. Rogers et al. (1996, 55543) used vertical head gradients and unsaturated hydraulic conductivity estimates (using geometric means) to approximate infiltration rates for liquid water at the seven sites. The flux estimates presume that flow is vertical only; that is, that no lateral flow is occurring along lithologic interfaces. Apparent fluxes beneath mesa top sites range from about 0.06 cm/yr beneath MDA G to 245 cm/yr beneath surface impoundments at TA-53. High precipitation or surface disturbances, including disposal ponds, lead to higher fluxes beneath some mesas. Natural tracer studies completed on three mesas across the Pajarito Plateau provide compelling evidence of a natural evaporative barrier to vertical liquid flow (Newman 1996, 59731; Newman et al. 1997, 59732).

Apparent canyon floor infiltration rates are about 0.4 to 8.3 cm/yr beneath two dry canyons (Cañada del Buey and Potrillo Canyon), and 1 to 10 cm/yr beneath Mortandad Canyon, which receives effluent from the Laboratory's Radioactive Liquid Waste Treatment Facility at TA-50. Canyon floor infiltration rates beneath Los Alamos Canyon vary laterally from 2 cm/yr to 11 cm/yr (Robinson et al. 1999, 63082.5).

Data on stable isotope (deuterium and oxygen-18) geochemistry of groundwaters from the regional aquifer and the Valles caldera indicate that most regional aquifer wells were recharged from elevations lower than the Sierra de los Valles, and do not show the trace elements characteristic of deeper Valles caldera thermal waters (Blake et al. 1995, 49931). An exception to this pattern of recharge elevations is found at former Los Alamos well field wells LA-6 and LA-1B located near the Rio Grande in lower Los Alamos Canyon (Figure 2.2-10). These are among the deepest of the wells in this area, and recharge elevations determined from stable isotopes suggest that the recharge area could be the Sangre de Cristo Mountains (Goff and Sayer 1980, 40083.7; Vuataz and Goff 1986, 40083.8), as suggested by flow paths in Figure 2.2-13.

On the basis of recharge elevations estimated from stable isotope data, Blake et al. (1995, 49931) conclude that most of the regional aquifer recharge comes from the Española Basin or regions to the north along the Rio Grande, but not from the surrounding mountains. Based on stable isotope and other geochemical evidence, the Pajarito Plateau portion of the regional aquifer system appears to be recharged by a combination of lateral flow parallel to the Rio Grande rift supplemented by inflow from the Sangre de Cristo Mountains (Goff and Sayer 1980, 40083.7; Vuataz and Goff 1986, 40083.8; Blake et al. 1995, 49931).

In an effort to better understand the nature of recharge to the regional aquifer, additional isotope and age-dating measurements were made. Samples were collected from test wells and water supply wells that penetrate the regional aquifer. Carbon-14 and low-level tritium measurements permit some tentative estimates of the age of the water in the regional aquifer at various locations. "Age of water" means the time elapsed since the water, as precipitation, entered the ground to form recharge and became isolated from the atmosphere. The precipitation at the time of entry into the ground is assumed to have contained atmospheric equilibrium amounts of both tritium and carbon. Radioactive carbon-14 comes mainly from natural sources. Tritium comes from both natural sources and fallout from nuclear weapons testing in the atmosphere.



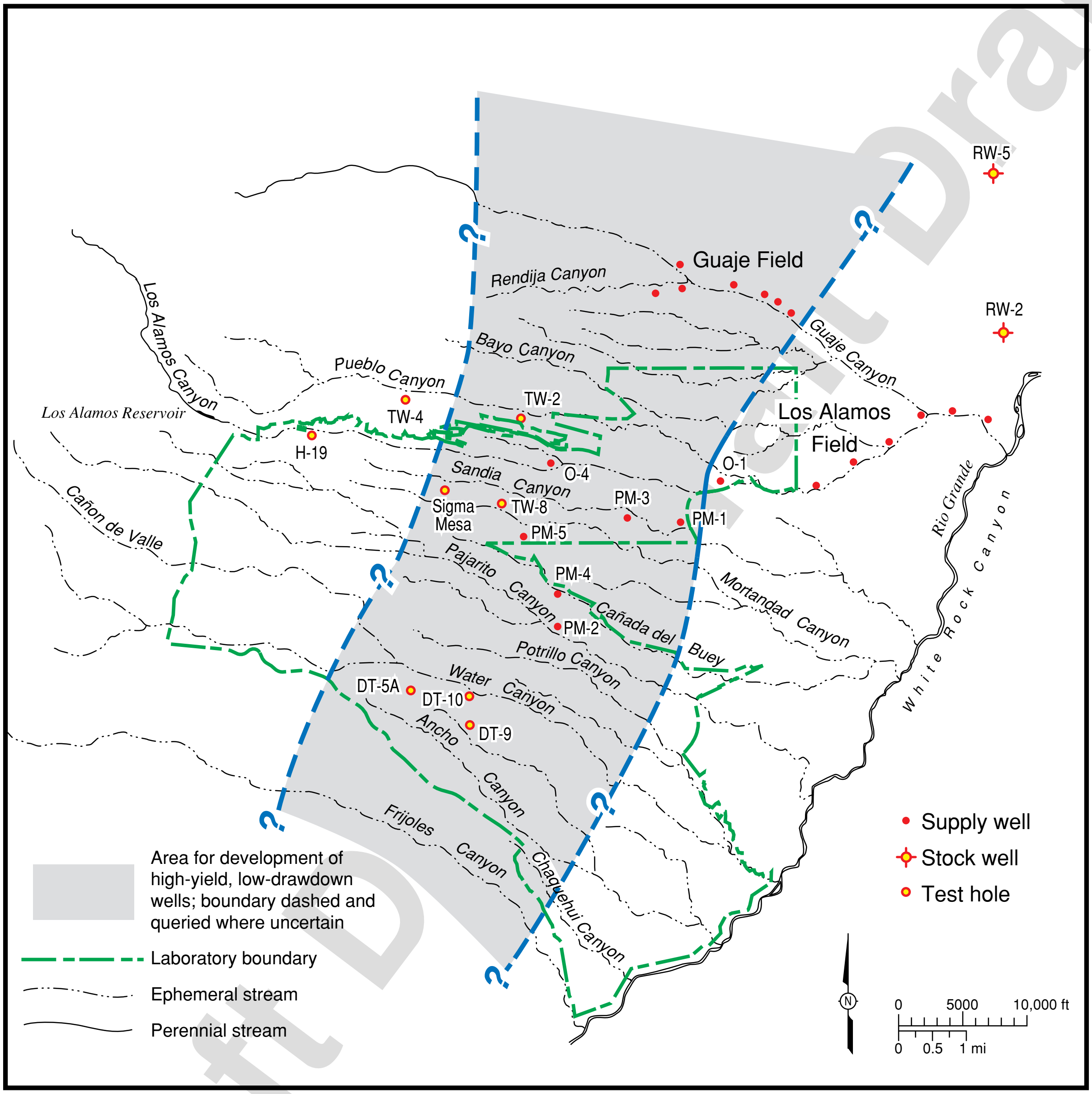
Source: Modified from Stephens et al. 1993, 56863.

F2.2-13 / IWP / 030900 / PTM

Figure 2.2-13. Conceptual sketch of groundwater flow paths in the Española portion of the northern Rio Grande basin

The interpretation of 10 carbon-14 analyses indicates that the minimum age of water in the regional aquifer ranges from about 1000 yr under the western portion of the Pajarito Plateau, increasing as it moves eastward, to about 30,000 yr near the Rio Grande (Rogers et al. 1996, 54714). It is tempting to conclude that these ages support an easterly flow direction with younger water recharged at the western boundary of the plateau, and flowing towards the east. However, another possibility is that two separate groundwater bodies of different ages are represented, and that a groundwater divide in the regional aquifer lies west of the Rio Grande (Figure 2.2-13). The radiocarbon data consist of two geographically isolated sets of data. The older ages near the Rio Grande correspond to the region of waters with higher recharge elevations identified by Goff and Sayer (1980, 40083.7). The much older ages found here could reflect the longer flow path from the possible Sangre de Cristo recharge area, and support the hypothesis that the regional aquifer groundwater divide lies west of the Rio Grande. In addition, a separate flow regime may exist within the late Miocene trough of Purtymun (1984, 6513) (Figure 2.2-14), with major recharge occurring by southerly groundwater flow of younger water within the Rio Grande rift basin fill.

The existence of two separate groundwater masses of different ages is further supported by a discrepancy between carbon-14 ages and regional aquifer flow rates determined by Purtymun (1984, 6513). The flow rates range from about 250 ft/yr in the Puye Formation near well O-4, to about 20 ft/yr in the Tesuque Formation below the Los Alamos well field. For the 5.5 mi distance between wells PM-3 and LA-1B, these flow rates give a range of groundwater travel times between the wells of 115 to 1450 yr. These travel times are far shorter than the 22,000- to 27,000-yr difference in the carbon-14 ages for these wells (Rogers et al. 1996, 54714).



Source: Modified from Purtymun 1984, 6513.

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Figure 2.2-14. Area of inferred Late Miocene trough within upper Santa Fe Group

2.2.3 Ecology

The Pajarito Plateau is a biologically diverse area. This diversity is due partly to the dramatic 5000-ft elevation gradient from the Rio Grande to the east and the Jemez Mountains 12 mi to the west and partly to the many steep canyons that dissect the area. The pronounced east-west canyon and mesa orientations, with concomitant differences in soils, moisture, and solar radiation, produce an interlocking finger effect among ecological life zones, resulting in many transitional overlaps of plant and animal communities within small areas.

2.2.3.1 Flora

Five major vegetative cover types are found in Los Alamos County: juniper-savannah, piñon-juniper, ponderosa pine, mixed conifer, and spruce-fir. The juniper-savannah community is found along the Rio Grande on the eastern border of the plateau and extends upward on the south-facing sides of canyons, at elevations between 5600 to 6200 ft. The piñon-juniper cover type, generally in the 6200- to 6900-ft elevation range, covers large portions of the mesa tops and north-facing slopes at the lower elevations. Ponderosa pines are found in the western portion of the plateau in the 6900- to 7500-ft elevation range. The piñon-juniper and ponderosa pine cover types are present over most of the Laboratory. The mixed conifer cover type, at an elevation of 7500 to 9500 ft, overlaps the ponderosa pine community in the deeper canyons and on north slopes and extends from the higher mesas onto the slopes of the Jemez Mountains. The subalpine grassland is at higher elevations of 9500 to 10,500 ft. Twenty-seven wetlands and several riparian areas enrich the diversity of plants and animals found on Laboratory lands.

2.2.3.2 Fauna

Before the Laboratory was established, Native Americans and European settlers farmed the mesas, disturbing areas that are now in various stages of succession. These areas afford suitable feeding locations for herbivores, especially mule deer and Rocky Mountain elk. Adjacent timbered canyon slopes provide protective cover for these species. Large mammals such as black bear, coyote, gray fox, mountain lion, and bobcat range in large areas of the Laboratory through numerous habitat types. Sheer canyon walls at all elevations serve as important nesting and foraging habitats for birds of prey. Generally, smaller mammals, songbirds, reptiles, and invertebrates are most sensitive to variations in habitat and are confined to smaller ranges.

Past Laboratory-wide information on the fauna within the Laboratory complex was largely qualitative; however, much quantitative information has been gathered in recent years in support of the biological assessment process. Biological assessments have been written for a great many projects and sampling activities throughout the Laboratory, but the assessments do not provide a comprehensive quantitative coverage of the entire Laboratory. Species lists have been compiled from observational data, biological research, and published data. Special studies are currently under way to provide a more comprehensive list of vertebrate fauna.

Based on ongoing surveys, at least four federally protected animal species, the American peregrine falcon (endangered), the bald eagle (endangered), the Mexican spotted owl (threatened), and the southwestern willow flycatcher (endangered) have been recorded on Laboratory and Los Alamos County lands.

The American peregrine falcon establishes breeding territories near cliffs in areas of mixed-conifer, ponderosa pine, and piñon pine. A historical aerie exists in the county, and American peregrine falcons are known to forage on Laboratory lands.

The bald eagle winters along the Rio Grande and has been observed over Laboratory lands. The entire Laboratory is considered suitable foraging habitat for the bald eagle.

Mexican spotted owls have been documented nesting on Laboratory lands, Bandelier National Monument, and US Forest Service lands in Los Alamos County. Nesting Mexican spotted owls inhabit canyons characterized as mixed-conifer and ponderosa pine-Gamble oak forests and forage on mesa tops surrounding the canyons. Suitable habitat for this species exists throughout the Laboratory.

The southwestern willow flycatcher has been recorded during surveys in the wetlands in lower Pajarito Canyon and along the Rio Grande. To date, the southwestern willow flycatcher has been detected only during its migration and has not nested on Laboratory lands; however, suitable nesting habitat does exist at the Laboratory. Southwestern willow flycatchers inhabit areas near water with 13- to 23-ft-high thickets of willow, buttonbush, seepwillow, and tamarisk (Sogge et al. 1997, 57040).

Three other federally protected species may inhabit the Laboratory and the county and must be considered when evaluating a proposed project: the whooping crane (endangered), black-footed ferret (endangered), and Arctic peregrine (threatened). Of these three species, the Arctic peregrine and the whooping crane have been recorded in New Mexico in recent history. The black-footed ferret is extremely unlikely to be found in the state.

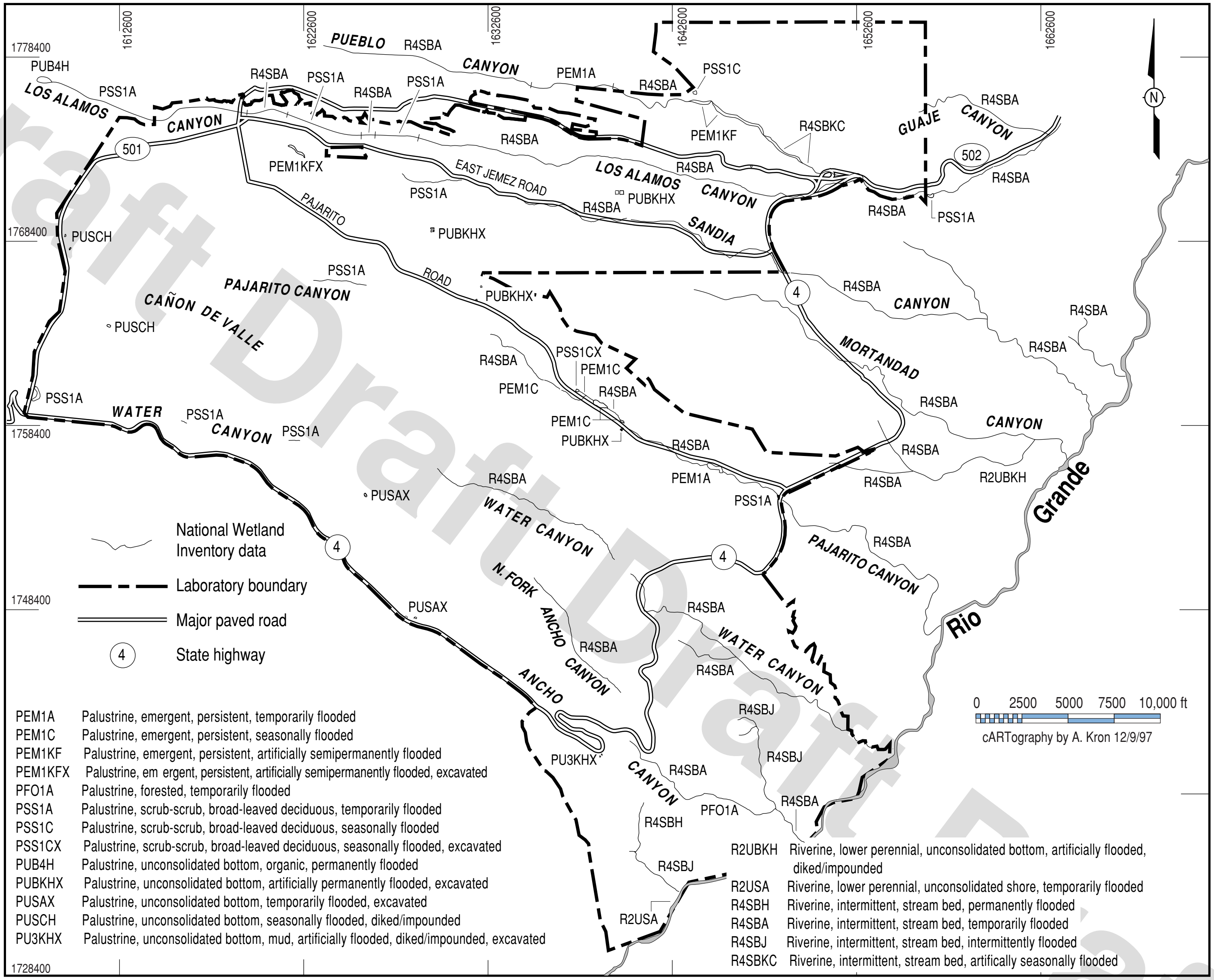
Several federal species of concern (formal federal candidate species) and state protected faunal species have been documented in Los Alamos County. They include the Northern Goshawk, Goat Peak pika, Jemez Mountains salamander, spotted bat, and several Myotis bat species. Other species that may occur in the area, but their presence has not been confirmed, include the New Mexico jumping mouse, loggerhead shrike, and gray vireo. (Hinojosa and Nguyen 1996, 57042).

2.2.3.3 Wetlands

Under the Resource Conservation and Recovery Act and Module VIII of the Laboratory's Hazardous Waste Facility Permit, the EPA required a determination of all wetlands located in areas that either lie within Laboratory boundaries or that drain Laboratory land (Figure 2.2-15; Figure 2.2-9 shows perennial and intermittent streams).

US Fish and Wildlife personnel mapped the wetlands around Los Alamos, using USGS quadrangle maps as base maps and infrared high-altitude aerial maps. To cover all of the watersheds that drain the Laboratory site, five quadrangles were mapped (Frijoles, White Rock, Guaje, Valle Toledo, and Puye). In addition to the watershed of the Laboratory proper, the Seven Springs quadrangle, which gives the location of the Laboratory's geothermal site at Fenton Hill, was mapped. Personnel in the Ecology Group (ESH-20) have delineated and characterized individual wetlands by conducting a detailed on-the-ground and historical analysis of single sites containing wetland vegetation.

Wetlands within Laboratory boundaries fall primarily into two classifications: palustrine and riverine. Palustrine wetlands (ponds and marshes) have been identified in Sandia, Pajarito, and Pueblo canyons, and smaller ones have been identified in other parts of the Laboratory. Wetlands in Sandia and Pueblo canyons are primarily maintained by effluent releases. Beds of ephemeral and intermittent streams that traverse the Laboratory have been classified as temporarily flooded riverine wetlands. In addition, the Laboratory has several small wetlands associated with outfalls that have existed long enough to have wetland vegetation associated with them.



Source: Modified from FIMAD G105984 11/3/97

F2.2-15 / IWP / 030900 / PTM

Figure 2.2-15. Map of wetlands

2.2.4 Meteorology

Bowen (1990, 6899) has compiled and interpreted climatological data for the Los Alamos area. This information is summarized below.

Los Alamos has a semiarid, temperate mountain climate. The area receives 18–19 in. annual precipitation; of that amount, 35% to 40% normally occurs from thundershowers during July and August. Winter precipitation falls primarily as snow, with accumulations of 50–60 in. annually.

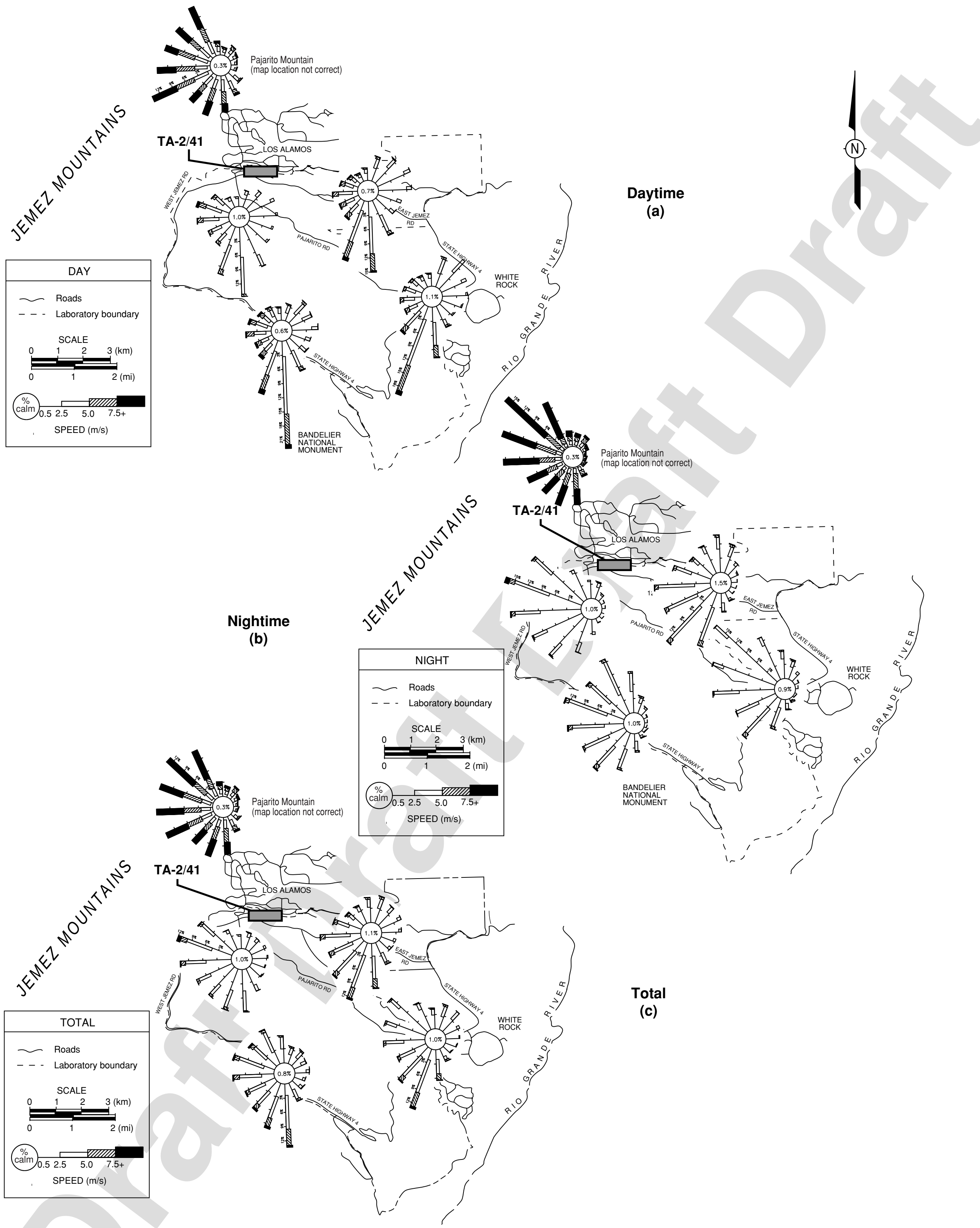
Summers are generally sunny, with moderate, warm days and cool nights. Maximum daily temperatures are usually below 90°F. Brief afternoon and evening thundershowers are common, especially in July and August. High altitude, light winds, clear skies, and dry atmosphere allow night temperatures to drop to the 50s (°F) after even the warmest day. Winter temperatures typically range from about 15°F to 25°F during the night and from 30°F to 50°F during the day. Occasionally, temperatures drop to 0°F or below. Many winter days are clear with light winds, allowing strong sunshine to make conditions comfortable even when air temperatures are cold. Snowstorms with accumulations exceeding 4 in. are common in Los Alamos, and some of these storms are associated with strong winds, frigid air, and dangerous wind chills, especially in the mountains.

Because of the complex terrain of the Pajarito Plateau, surface winds vary greatly with time of day and location. Generally, measurements of wind speed and direction taken from meteorologic stations located on mesas (Figure 2.2-16 from the Laboratory's Air Quality Group [ESH-17]) are more variable than measurements from stations located within canyons (Figure 2.2-17 also from the Laboratory's Air Quality Group [ESH-17]). Averaged over a day, mesa-top winds blow in almost every direction, while canyon winds are almost strictly bimodal, flowing up canyon (toward the west-northwest) during the day and down canyon (toward the east-southeast) at night.

The daily wind cycle on mesas often consists of a light southerly upslope wind during the day and a light westerly to northwesterly drainage wind during the night (Figure 2.2-16). However, several miles to the east toward the edge of Pajarito Plateau near the Rio Grande valley, a different daily wind cycle is common: a moderate southwesterly up-valley wind during the day and either a light northwesterly to northerly drainage wind or moderate southwesterly wind at night. The predominant winds are southerly to northwesterly over western Los Alamos County and southwesterly and northeasterly toward the Rio Grande valley. Historically, no tornadoes have been reported to have touched down in Los Alamos County. Strong dust devils can produce winds up to 75 mph at isolated spots in the county, especially at lower elevations. Strong winds with gusts exceeding 60 mph are common during the spring.

Lightning is common over the Pajarito Plateau. Fifty-eight thunderstorm days occur during an average year, mostly during the summer. Lightning protection is an important design factor for most facilities at the Laboratory. Hail damage can also occur. Hailstones with diameters up to 0.25 in. are common; 0.5-in.-diameter hailstones are infrequent.

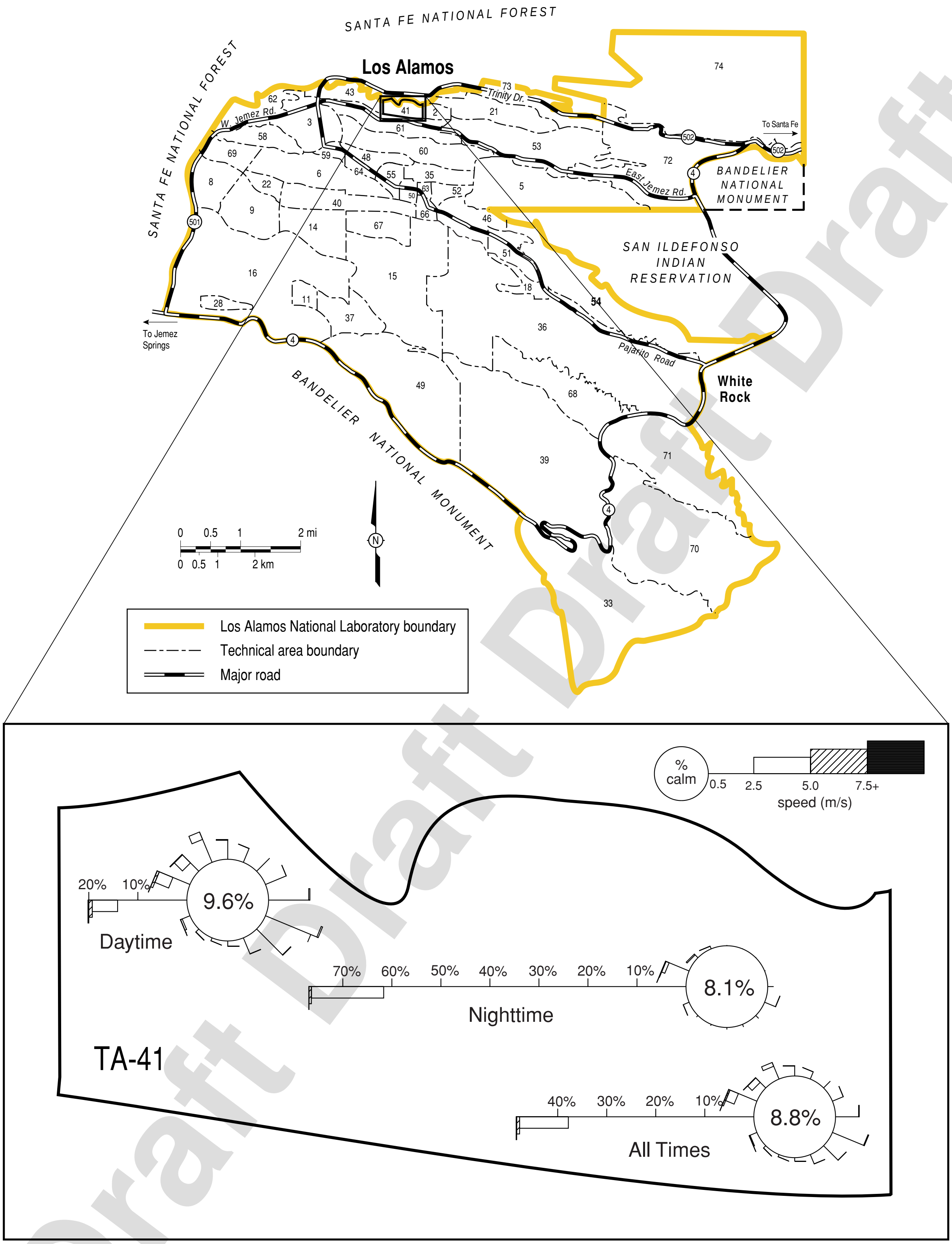
The irregular terrain at Los Alamos affects atmospheric turbulence and dispersion, sometimes favorably and sometimes unfavorably. Enhanced dispersion promotes greater dilution of contaminants released into the atmosphere. The complex terrain and forests create an aerodynamically rough surface, forcing increased horizontal and vertical dispersion. Dispersion generally decreases at lower elevations, where the terrain becomes smoother and less vegetated. The frequent clear skies and light, large-scale winds cause good vertical daytime dispersion, especially during the warm season. Strong daytime heating during the summer can force vertical mixing up to 3000 to 6000 ft above ground level, but the effectiveness of the generally light winds in diluting contaminants horizontally is limited.



Source: Air Quality Group, 1999.

2.2-16 / IWP / 032700 / PTM

Figure 2.2-16. Wind roses at Laboratory stations located on mesas



F2.2-17 / IWP / 032000 / PTM

Figure 2.2-17. Wind roses at Laboratory stations located within TA-41 in Los Alamos Canyon

Clear skies and light winds have a negative effect on nighttime dispersion, causing strong, shallow surface inversions to form. These inversions can severely restrict near-surface vertical and horizontal dispersion. Inversions are especially strong during the winter. Drainage winds can fill lower areas with cold air, thereby creating deeper inversions, which are common toward the Rio Grande valley on clear nights with light winds. Canyons can also limit dispersion by channeling air flow. Strong, large-scale inversions during the winter can limit vertical mixing to under 3000 ft above ground level.

Dispersion is generally greatest during the spring, when winds are strongest. However, deep vertical mixing is greatest during the summer. Dispersion is generally low during summer and autumn, when winds are light. Even though low-level winter dispersion is generally greater, intense surface inversions can cause least-dispersive conditions during the night and early morning.

During the winter, the frequencies of atmospheric dispersive capability sampled at TA-59 are 52% unstable (Stability Classes A through C), 21% neutral (Class D), and 27% stable (Classes E and F). The frequencies are 44%, 22%, and 34%, respectively, during the summer. These stability category frequencies are based on measured vertical wind variations. Stability generally increases (the winds become less dispersive) toward the valley.

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Copies of the reference library are maintained at the New Mexico Environment Department Hazardous and Radioactive Materials Bureau, the Los Alamos Area Office of the US Department of Energy, the US Environmental Protection Agency, and the ER Project Office. This library is a living document that was developed to ensure that the administrative authority has all the necessary material to review the decisions and actions proposed in this report. However, documents previously submitted to the administrative authority are not included in the reference library.

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3.0 QUALITY ASSURANCE PROJECT PLAN

This chapter describes the manner in which the Los Alamos National Laboratory (the Laboratory) Environmental Restoration (ER) Project conducts the Resource Conservation and Recovery Act (RCRA) corrective action process. Section 3.1 presents background information related to the documentation and management of sites being addressed by the ER Project. Section 3.2 describes the technical assessment strategy, which is designed to be applicable at various spatial scales required by the variety of sites under investigation. Section 3.3 presents field sampling procedures. Section 3.4 discusses site management and record keeping procedures.

3.1 Background

The ER Project approach to implementing the corrective action process at the Laboratory is based on the Subpart S initiative (Proposed Rule, 40 CFR Parts 264, 265, 270, and 271, "Corrective Action for Solid Waste Management Units (SWMUs) at Hazardous Waste Management Facilities," *Federal Register*, Vol. 55, pp. 30798–30884) to RCRA. This approach integrates

- a modified version of the US Department of Energy's (DOE's) streamlined approach for environmental restoration (DOE 1996, 59598);
- the US Environmental Protection Agency's (EPA's) data quality objective (DQO) process (EPA 1994, 44324), Region 6 draft risk management strategy (EPA 1998, 63140), risk assessment guidance for Superfund (EPA 1989, 08021; 1991, 58234; 1998, 59600), and accelerated cleanup model (EPA 1993, 45358); and
- "The Plug-In Approach: A Generic Strategy to Expediting Cleanup" (DOE 1999, 64792).

The ER Project corrective action approach follows the requirements of DOE Order 414.1, "Quality Assurance," and 10 CFR 830.120, "Quality Assurance Requirements," as implemented in the ER Project Quality Management Plan (Environmental Restoration Project 1998, 59575). In addition, the ER Project approach is responsive to the guidance provided by the New Mexico Environment Department (NMED) Hazardous and Radioactive Materials Bureau guidance document, "RPMP Document Requirement Guide" (NMED 1998, 57897).

All work conducted under this plan is done in accordance with internal administrative controls such as quality procedures and/or standard operating procedures (SOPs). In addition, the work that is performed meets Laboratory requirements for Integrated Safety Management.

The ER Project collaborates with other Laboratory environmental organizations. Three institutional plans that require close interaction with the ER Project include the hydrogeologic work plan (LANL 1998, 59599), the watershed management plan (in development), and the habitat management plan (in development).

3.1.1 Corrective Action Sites

EPA regulations [40 CFR 270.14(d)] require that applicants for operating or post-closure permits submit "reasonably available" information that identifies SWMUs at the facility requesting the permit. In addition, 40 CFR 270.14(d) requires that the facility identify the potential for release at each SWMU. To meet these requirements and to fulfill the site assessment phase of the RCRA process, the ER Project identified potentially contaminated sites at the Laboratory and listed those sites within the SWMU report (International Technology Corporation 1988, 11646; 11647; 11648; 11649; LANL 1990, 7511; 7512;

7513; 7514). These sites were identified based on records searches, open literature surveys, interviews with (then) current and former employees, preliminary assessments, and site inspections.

Based on the findings of the SWMU report, EPA Region 6 identified a subset of sites to be included in Module VIII of the Laboratory's Hazardous Waste Facility Permit, issued to the Laboratory in 1989 (EPA 1990, 1585). The remaining sites identified in the SWMU report but not listed in the permit were retained within the ER Project for investigation as areas of concern (AOCs). Unless an investigation reveals that the AOC should be added to Module VIII, AOCs are investigated and, if necessary, remediated under DOE authority and other applicable authorities (such as the Toxic Substances Control Act) in compliance with applicable regulations.

SWMUs and AOCs collectively are called potential release sites (PRSs). In the SWMU report, each PRS was assigned a unique alphanumeric identifier. To make the corrective action process for these PRSs more manageable, the ER Project originally grouped them into 24 operable units (OUs). These PRSs are discussed in detail in the 24 RCRA facility investigation (RFI) work plans (one for each OU) prepared by the ER Project between 1990 and 1996. These plans are available in the Laboratory's Public Reading Room.

From October to December 1997, the ER Project reorganized to improve the efficiency and effectiveness of corrective actions at the Laboratory. PRSs were assigned to three major areas of investigation: the canyons and PRSs situated in canyons; the major material disposal areas (MDAs) and the PRSs located near them; and all other RCRA corrective action sites not assigned to canyons or MDAs.

To further facilitate corrective actions, in December 1998, the ER Project and the NMED developed criteria for and started the process of consolidating PRSs that are related by contaminant source, geographic location, and potential cumulative risk. All sites in the original Module VIII of the Laboratory's Hazardous Waste Facility Permit (EPA 1990, 1585) were evaluated. A crosswalk between the consolidated PRSs and the original PRSs is included as Appendix B of this document. The consolidation process is revisited as new information becomes available, and changes are formalized annually in connection with the annual unit audit.

In 1999, the ER Project developed a strategic roadmap to project completion. This initiative examined alternative paths to project completion and objectively identified the optimal (i.e., compliant and cost-effective) path. The optimal path is a more fully integrated approach to corrective actions, focusing on PRSs within watersheds together, rather than independently. The integrated technical strategy resulting from the roadmap exercise incorporates these elements:

- characterization and assessment of the nature, extent and migration pathways of potentially interacting contamination within watersheds (or aggregates therein);
- integrated risk-based corrective-action decisions, taking into account not only human health based risks, but also ecological risks and other regulatory considerations;
- an objective basis for prioritizing ER project work; and
- early and proactive interactions with regulatory agencies regarding work process and products.

The technical aspects of the integrated strategy provide a consistent platform for the ER Project to conduct RCRA corrective action process within a watershed, linking work performed by the Canyons, MDAs, and the RCRA Corrective Action Sites Focus Areas.

Hereafter, for simplicity in this document, the term corrective action site, or simply "site," is used to refer to a single PRS; a consolidated PRS; an aggregate of single and/or consolidated PRSs (including MDAs) and affected media (soil, sediment, and/or water) within a canyon; or an entire watershed.

3.1.1.1 Watershed Aggregates

In conjunction with the administrative authority, the ER Project grouped the canyons that comprise and immediately surround the Laboratory into eight watersheds. A watershed comprises one or more mesas, all the drainages from those mesas, and the major canyon into which the drainages converge.

Within each watershed, all potentially contaminated sites located on the mesa tops and slopes and the canyon floors were grouped into site aggregates. In addition, the major canyon in each watershed and the drainages that converge into that canyon were grouped into an aggregate. There are eight canyon aggregates (one for each watershed). The following criteria were used to group aggregates within watersheds:

- geologic and hydrologic features,
- manageability of the number and size of known or potentially contaminated sites,
- proposed surface water monitoring stations, and
- parcels slated for land transfer.

Figure 3.1-1 shows the watersheds and delineates the site aggregates within each watershed. Table 3.1-1 lists, by watershed,

- each canyon aggregate and site aggregate within the eight watersheds;
- regional wells scheduled for installation, following the hydrogeologic work plan (LANL 1998, 59599); and
- MDAs and technical areas (TAs) within the watersheds.

The ER integrated approach to corrective actions is consistent with the EPA's philosophy described in the Clean Water Action Plan: "Focusing on the whole watershed helps strike a balance among efforts to control point source pollution and polluted runoff, and protect drinking water sources and sensitive natural resources such as wetlands. A watershed focus also helps to identify the most cost-effective pollution control strategies [including corrective actions] to meet clean water goals. Working at the watershed level encourages the public to get involved in efforts to restore and protect their water resources and is the foundation for building strong clean water partnerships. The watershed approach is the best way to bring state, tribal, federal, and local programs together to more effectively and efficiently clean up and protect waters." (EPA 1998, 64009).

3.1.1.2 Regional Aquifer

The Laboratory places a high priority on protecting the regional aquifer as a source of drinking water. The regional groundwater system is being investigated outside the watershed corrective action framework through the institutional hydrogeologic work plan (LANL 1998, 59599). This characterization program is jointly implemented by the Laboratory's Water Quality and Hydrology Group (ESH-18) and the ER Project. Through the installation of 32 regional groundwater wells, the Laboratory will characterize the groundwater hydrology in the region of the Laboratory, and will, if necessary, evaluate the potential impact of past and current environmental releases on groundwater quality. Working in conjunction with the administrative authority, the ER Project acts as the construction manager for the regional wells and ensures that the Laboratory's groundwater monitoring program meets regulatory requirements.

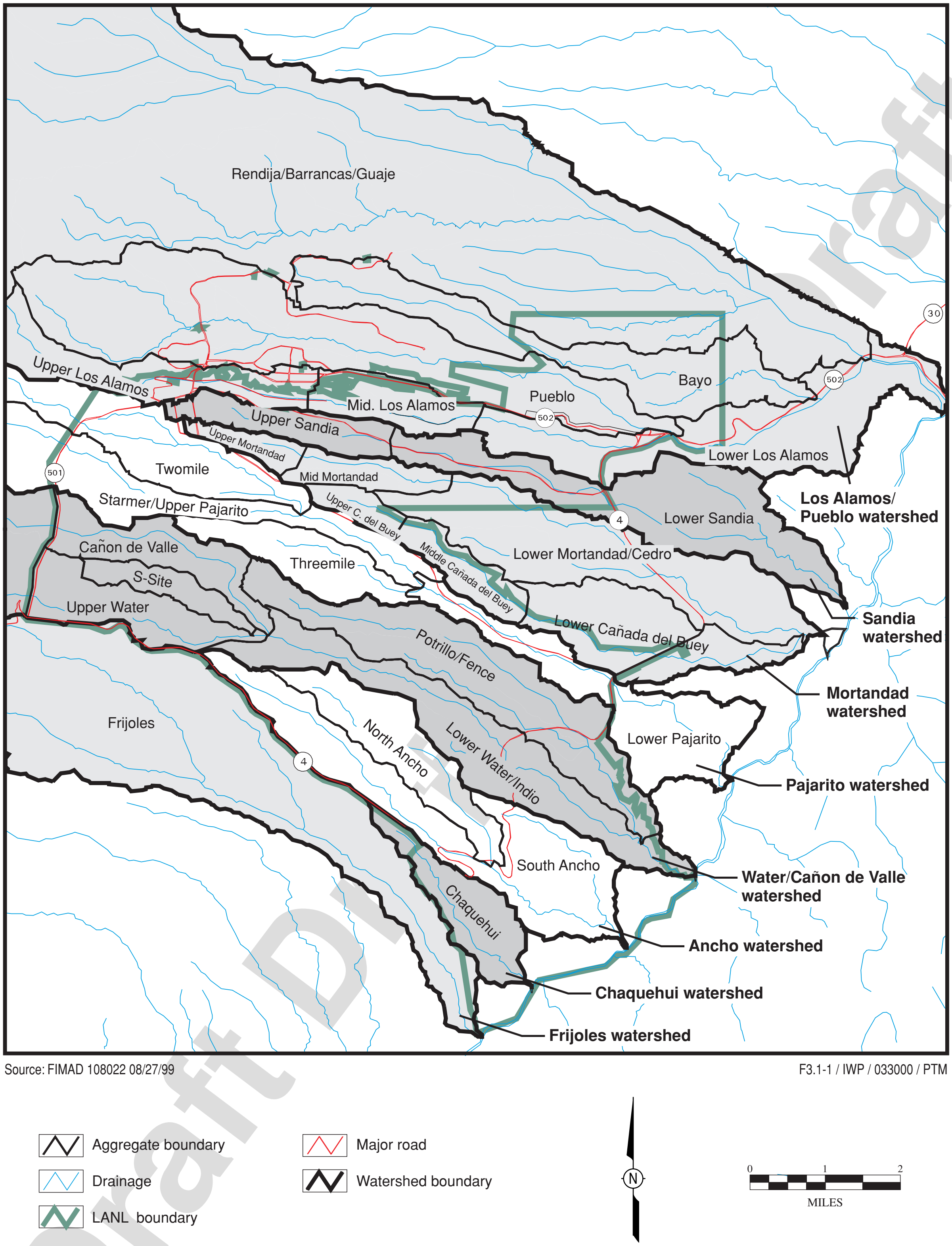

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Figure 3.1-1. Watersheds and the aggregates they contain

Table 3.1-1
Canyon and Site Aggregates Within Watersheds

Watershed	Site Aggregates	MDAs Within Watersheds	Regional Wells Within Watersheds*	TAs Within Watersheds
Los Alamos/ Pueblo (1)	Los Alamos/ Pueblo Canyons (1) Middle Los Alamos/DP (2) Pueblo (3) Upper Los Alamos (8) Bayo (9) Rendija/Barrancas/Guaje (23) Lower Los Alamos (24)	MDA B MDA V MDA T MDA A MDA U	R-1. R-2, R-3, R-4, R-5, R-6, R-7, R-8, R-9	00, 02, 03, 19, 21, 26, 30, 31, 32, 41, 43, 45, 53, 61, 73
Mortandad (2)	Mortandad Canyon (4) Middle Mortandad/Ten-Site (5) Upper Mortandad (10) Middle Cañada del Buey (13) Upper Cañada del Buey (14) Lower Mortandad/Cañada del Buey (25) Lower Mortandad/Cedro (26)	MDA C MDA W MDA X	R-13, R-14, R-15, R-16	00, 03, 04, 05, 35, 42, 46, 48, 50, 51, 52, 54, 55,
Water/ Cañon de Valle (3)	Water Canyon/Cañon de Valle (6) Cañon de Valle (7) S-Site/Martin (15) Potrillo/Fence (16) Upper Water (27) Lower Water/Indio (28)	MDA P MDA R MDA Z MDA S MDA N MDA AA	R-23, R-24, R-25, R-26, R-27, R-28, R-29	08, 11, 13, 14, 15, 16, 25, 36, 37, 49
Pajarito(4)	Pajarito Canyon (11) Lower Pajarito (12) Threemile (19) Starmer/Upper Pajarito (20) Twomile (30)	MDA G MDA H MDA L MDA M MDA F MDA Q	R-17, R-18, R-19, R-20, R-21, R-22	03, 06, 07, 08, 09, 12, 14, 15, 18, 22, 27, 36, 40, 50, 54, 59, 64, 69
Sandia (5)	Sandia Canyon (17) Upper Sandia (18) Lower Sandia (29)	None	R-10, R-11, R-12	03, 20, 53, 60, 61, 72
Ancho (6)	Ancho Canyon (21) North Ancho (22) South Ancho (31)	MDA AB MDA Y	R-30, R-31, R-32	33, 39, 49
Chaquehui (7)	Chaquehui Canyon (32) Chaquehui (33)	MDA D MDA E MDA K	None	33
Frijoles (8)	Frijoles Canyon (34) Frijoles (35)	None	None	00, 57

Note: Numbers within parentheses indicate work schedule priority ranking for each watershed and for site aggregates within each watershed.

* Includes wells that are planned or installed.

If groundwater contamination is found during the installation of the regional groundwater characterization wells, the source, extent, and potential impact of that contamination is determined. If contamination in accessible groundwater is found to be associated with historic releases from an ER Project site, contaminant concentrations are compared with maximum contaminant levels (MCLs). When MCLs are exceeded at a site, the site is evaluated for further action, such as risk assessment, corrective remedy, or other action agreed upon by the ER Project and the NMED.

3.1.2 Work Schedule

The efficient investigation of its corrective action sites requires that the ER Project prioritize the work it is to accomplish. In 1999, the watershed aggregates were prioritized with the consensus of the administrative authority. Each characterization and assessment activity within an aggregate was prioritized based on site information, such as risk reduction, regulatory commitments, and stakeholder concerns.

Each year after receiving information regarding annual budget targets, the ER Project prepares a draft work schedule based on the prioritization and presents it to the administrative authority for concurrence. Upon concurrence, the ER Project submits the final work schedule as Appendix E of this document.

3.1.3 Corrective Action Process

The objective of the ER Project is to complete corrective actions at every site under its purview or, in some cases, to turn the site over to the appropriate Laboratory facility or operational group for long-term monitoring. Corrective actions are considered complete at a site when

- the ER Project has demonstrated and documented that the site either poses no risk to human and ecological receptors or that the risk is acceptable; or a final remedy is evaluated, selected, and implemented to reduce or eliminate risk, and
- the administrative authority has concurred.

Originally, the EPA prescribed a three-step process for completing corrective action for releases: the RFI, the corrective measures study (CMS), and corrective measures implementation (CMI). The purpose of the RFI is to characterize the nature and extent of, and risk posed by, contamination. The purpose of the CMS is to optimize an approach to reduce risks identified in the RFI. The purpose of the CMI is to execute the optimal remedy identified in the CMS. The EPA reevaluated this prescriptive three-step process through the Subpart S initiative to identify and implement improvements to the program's speed, efficiency, protectiveness, and responsiveness, and to focus the program more clearly on environmental results. Subpart S replaces the RFI/CMS/CMI process with the following evaluations necessary to make good cleanup decisions:

- initial site assessment,
- site characterization,
- interim actions,
- remedy evaluation, and
- implementation.

Generally, initial site assessment and site characterization achieve the objectives of the RFI, while remedy evaluation and implementation achieve the objectives of the CMS/CMI. However, Subpart S provides flexibility in attaining these objectives.

Initial site assessment and characterization may be completed with existing information, but generally require additional investigation. These investigations are performed according to specifications within work plans or sampling and analysis plans (SAPs).

Based on the results of the site assessment and characterization, interim actions (IAs) and/or final remedies may be warranted. IAs and final remedies may include one or more of the following:

- removing contamination at a site such that it poses acceptable risk,
- stabilizing contamination at a site such that it poses acceptable risk,
- treating contamination at a site such that it poses acceptable risk, and/or
- controlling exposure to contamination at a site such that it poses acceptable risk.

Any one of these methods toward completion may involve short- or long-term monitoring of environmental media at the site to ensure protectiveness.

At sites that require some remedial action to reduce risk, remedial action may be implemented through the process of interim action, accelerated corrective action (ACA), conditional remedy, or CMS/CMI. An interim action (proceeding at risk) or interim measure (IM) (requiring NMED approval) may be implemented to reduce a risk to human health or the environment that was identified during assessment or characterization. However, the interim action or IM does not necessarily represent the final remedy. Module VIII of the Laboratory's Hazardous Waste Facility Permit lists nine factors that may be considered in determining the need for IMs (EPA 1994, 44146). ACAs are appropriate for sites that have both a clear remediation goal and a known means of achieving this goal, and may be conducted as voluntary corrective actions (VCAs) (proceeding at risk) and voluntary corrective measures (VCMs) (requiring NMED approval). Conditional remedies may be necessary for sites that are associated with active facilities, thus precluding the timely application of a final remedy. Finally, CMSs/CMIs are appropriate for unique complex sites, where the optimal remedy is not known.

In implementing the corrective action process, the ER Project is consistent with the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) regarding natural resource protection.

3.1.4 Reporting

Independent of the particular approach undertaken at a site (e.g., RFI/IM, RFI/ACA, RFI/CMS/CMI), all phases of the corrective action process are thoroughly documented by the ER Project as work progresses. All reports meet the requirements specified in Module VIII of the Laboratory's Hazardous Waste Facility Permit. Module VIII reporting requirements are summarized in Appendix D of this document.

In general, proposed work is documented in plans that are approved by the administrative authority. Completed work and final remedial actions are documented in reports that also must be approved by the administrative authority. Each plan/report is discussed in the remainder of Section 3.1.4.

3.1.4.1 Implementation Plans

To further document specific technical approaches, the ER Project is writing implementation plans for the Canyons Investigations Focus Area and for the MDAs Focus Area. The purpose of these implementation plans is to further describe the technical approach for completing investigations and assessments for canyons (i.e., canyon sediment, surface water, and alluvial systems) and MDAs, specifically. The Canyons implementation plan will be based on the administrative authority-approved core document for Canyons investigations (LANL 1997, 62316), and the MDAs Focus Area implementation plan will be developed in coordination with the administrative authority, based on the draft MDAs core document (LANL 1999, 63984) and "The Plug-In Approach: A Generic Strategy to Expediting Cleanup" (DOE 1999, 64792). These implementation plans will be used in conjunction with this IWP to implement the integrated technical strategy.

(a) Implementation Plan for Canyons Investigations Focus Area

To attain sufficient understanding of the presence and movement of contamination within each watershed, the ER Project completes canyon investigations prior to completing investigations at PRSs within an aggregate. Canyons investigations are implemented in accordance with previously approved work plans developed under the core document for canyons investigations (LANL 1997, 62316), or new work plans developed under the Canyons implementation plan. The Canyons implementation plan will describe technical approaches used for characterization of sediment, surface-water, and alluvial groundwater and assessment of human-health and ecological risk. Data collected in an investigation of each of the media are evaluated in the context of a conceptual model to identify potentially important uncertainties; to focus subsequent data collection to reduce those uncertainties; and to support corrective action decisions. The approach is designed to efficiently identify and focus on the nature and extent of chemicals of potential concern (COPCs) and their fate and transport. These data are used to support quantitative assessments of human health and ecological risk, and the reasonably anticipated potential impact of contaminant migration.

(b) Implementation Plan for MDAs Focus Area

Investigations at MDAs will, in general, proceed according to the priority of the aggregate within which each MDA exists. MDA investigations will be documented in newly generated work plans approved by the administrative authority, and the work plans will be based on the investigation approach described in the MDAs Focus Area implementation plan. In keeping with the ER Project strategy of early and proactive interactions with the administrative authority, the MDAs Focus Area implementation plan is being developed by representatives from the University of California/LANL, DOE, and NMED.

The larger mesa-top MDAs under investigation by the ER Project are complex sites, having multiple contaminants and multiple exposure pathways, and likely requiring corrective measures and long-term surveillance and monitoring. Many of these MDAs are characterized by common histories, common affected media, and common contaminant types. The premise of the MDAs implementation plan is that similarities between many MDAs can be used to efficiently focus data collection, risk evaluations, and alternative analyses while reducing repetitive documentation and enhancing consistent corrective-action decisions.

The MDA implementation plan will describe a generic approach to MDA investigations and assessments, applying the knowledge gained from previous experience at a lead MDA as the basis and justification for investigations and assessments at other similar MDAs. A lead site is one that is judged to most likely represent expected site conditions for a group of sites. The lead site is evaluated first and serves as the basis for determining appropriate response actions. Once the lead site is evaluated in terms of appropriate response-action alternatives, the decision basis is formed. The lead-site evaluation and the decision rules used to determine the applicability of generic remedies evaluated for the lead site will be included in the MDAs Focus Area implementation plan.

This concept of using similarities between sites to streamline response planning and implementation is embodied in EPA's presumptive remedy policy (EPA 1993, 65209). The ER Project decision process for MDAs, uses an effective and widely used generic strategy known as the "plug-in" approach.

3.1.4.2 RFI Work Plans/SAPs and Reports

The ER Project developed initial work plans for each of the 24 OUs within which originally defined sites were organized. These work plans are implemented to the extent that they achieve the objectives of the watershed approach to site aggregation. When significant deviations from the original work plans are necessary to achieve the objectives of aggregate assessments, new work plans (or SAPs) are written and submitted to the administrative authority. Generally, a work plan is approved by the administrative authority before fieldwork begins. However, the ER Project may decide to proceed at risk and initiate RFI activities through a modified investigation or an accelerated cleanup. A modified investigation is performed without regulatory approval if the fundamental scope of the investigation has not changed.

In executing the integrated technical strategy, prioritized aggregates may require integrated SAPs. At an aggregate scale, integrated SAPs allow multiple PRSs to be evaluated using existing integrated data sets and allow more efficient identification of data gaps for risk determination at the appropriate scale.

The ER Project documents the results of site assessment and characterization in RFI reports. RFI reports either propose corrective action recommendations (such as no further action [NFA], additional sampling and analysis, ACA, conditional remedies, CMS), or in some cases provide sufficient data (describing contaminant nature, extent, fate, and transport) to support a site decision.

3.1.4.3 No Further Action Proposals

Sites that are investigated by the ER Project may be composed of a single PRS, a consolidated PRS, an aggregate of several single and/or consolidated PRSs, or a canyon system. Each PRS or consolidated grouping of PRSs is proposed for NFA when the ER Project documents that it meets one or more of the following criteria.

Criterion 1. The site does not exist, is a duplicate of another site, cannot be located, or is located within another site and has been or will be investigated as part of that site.

Criterion 2. The site was never used for the management (i.e., generation, treatment, storage, or disposal) of RCRA solid or hazardous wastes and/or constituents.

Criterion 3. The site is not known to have released nor is it suspected of releasing or having released RCRA solid or hazardous wastes and/or constituents to the environment. The term "release" means any spilling, leaking, pouring, emitting, emptying, discharging, injecting, pumping, escaping, leaching, dumping, or disposing of hazardous wastes (including hazardous constituents) into the environment.

Criterion 4. The site is regulated under another state and/or federal authority. If the site is known to have released or is suspected of releasing or having released RCRA solid or hazardous wastes and/or constituents to the environment, it has been or will be investigated and/or remediated in accordance with applicable state and/or federal regulations.

Criterion 5. The site was characterized or remediated in accordance with current applicable state and/or federal regulations, and the available data indicate that contaminants pose an acceptable level of risk, assuming current and projected future land use.

3.1.4.4 ACA Plans and Reports

The ER Project proposes ACA for sites that have both a clear remediation goal and an obvious method for implementing that goal. Proposed ACAs are described in fact sheets submitted to the administrative authority. Completed ACAs are documented in final reports. The administrative authority reviews the fact sheets and may request more information in the form of a site visit or presentation to determine if the site is appropriate for ACA and if the site needs enhanced regulatory involvement. Sites that do not require enhanced administrative authority involvement are VCAs. Sites that do require enhanced administrative authority involvement are VCMs.

VCA plans are provided to NMED for informational purposes. VCM plans must be approved by NMED before activities described in the plan are implemented. The ER Project proceeds with the implementation of a VCM plan if approval from NMED is not received within 45 days of submittal. Both VCA and VCM final reports describing the corrective action must be approved by NMED to achieve NFA. An ACA is considered a final corrective action when it is documented to meet Criterion 5 of the NFA criteria listed in Section 3.1.4.3 of this document.

3.1.4.5 CMS/CMI Plans and Reports

When a CMS is required in order to evaluate multiple alternative remedies, the ER Project submits a CMS plan to the administrative authority. The CMS plan describes how the ER Project proposes to evaluate alternative remedies. In general, the alternative remedies are evaluated according to the EPA threshold and balancing criteria, and a preferred remedy is proposed based on the outcome of the evaluation. The preferred remedy is described in a CMS report.

Proposed remedies must

- be protective of human health and the environment;
- attain media cleanup standards;
- control the source(s) of releases so as to reduce or eliminate, to the extent practicable, further releases; and
- comply with applicable standards for waste management.

Those remedies that meet the previously mentioned threshold criteria are then evaluated against a set of balancing criteria to identify the optimal remedy that provides the best relative combination of attributes. The five balancing criteria are

- long-term reliability and effectiveness;
- reduction in toxicity, mobility or volume of waste;
- short-term effectiveness;
- implementability; and
- cost.

After approval of the CMS report and upon NMED request, the ER Project prepares a CMI plan. The CMI plan includes detailed construction plans for implementing the preferred remedy. In some cases, the technical details may have been provided in the CMS report. CMI plans contain the criteria used to demonstrate the implementation of the remedy. Upon completion of a remedy, the ER Project submits a request for a Class III permit modification for removal of the site from Module VIII of the Laboratory's Hazardous Waste Facility Permit. The request must contain certification that the CMI was implemented in accordance with the approved plan and the corrective action meets Criterion 5 of the NFA criteria listed in Section 3.1.4.3 of this document.

3.1.4.6 Watershed Reports

Upon completion of all site assessments and required corrective actions within each of the eight watersheds under investigation by the ER Project, watershed reports may be prepared and submitted to the administrative authority for informational purposes. Each watershed report documents any long-term stewardship activities, such as monitoring and contingency responses to be assumed by the institution after completion of ER Project activities and may be part of the ER Project closeout document submittal to the DOE.

3.1.4.7 Groundwater Plans and Reports

In general, the ER Project characterizes the regional groundwater system through the implementation of the Laboratory's hydrogeologic work plan (LANL 1998, 59599). The objective of the hydrogeologic work plan is to characterize the presence and movement of groundwater through the Pajarito Plateau to the regional aquifer. Through the installation of groundwater wells, data sufficient to model the groundwater system as a whole will be collected. The results of well installation, data collection, modeling, analysis, and interpretation are reported to the administrative authority on an annual basis by the Laboratory. These results are integrated into the ER Project watershed-focused corrective action process. If groundwater contamination is detected in accessible water during well installation, the source, extent and potential impact of the contamination is investigated jointly by the ER Project and the Laboratory's Water Quality and Hydrology Group. If contamination detected in accessible groundwater is found to exceed MCLs, subsequent actions occur according to plans developed in consultation with the administrative authority. If groundwater contamination is directly attributable to a historic release from a corrective action site, the corrective action process for that site specifically incorporates groundwater investigations, assessment, and (if necessary and practicable) remediation. Other organizations within the Laboratory have the responsibility to investigate and remediate any release resulting from current operations.

When the hydrogeologic system beneath a watershed is characterized to the extent that it can be confidently integrated with the other components of the watershed system already investigated and remediated (as necessary), the ER Project completes a deep groundwater aggregate report for the watershed, which is provided to the NMED for informational purposes.

3.1.5 Permit Modifications

Elimination of sites for which corrective actions have been completed and the identification of new sites are formalized through modification of Module VIII of the Laboratory's Hazardous Waste Facility Permit (EPA 1994, 44146). The permit modification must be conducted according to the procedure established in Module VIII. The modification process includes a formal public comment and revision period before written notice of the modification to the permit is issued.

A determination of NFA does not preclude the administrative authority from requiring continued or periodic monitoring of environmental media and/or further investigations, studies, or remediation at a later date under circumstances specified in Module VIII of the Laboratory's Hazardous Waste Facility Permit (EPA 1994, 44146).

3.2 Assessment Strategy

The ER Project assessment strategy is based on the EPA DQO process (EPA 1994, 44324) and on EPA and NMED guidance for risk-based decision-making (EPA 1989, 08021; 1997, 59370; 1998, 59600; NMED 1998, 57761). Section 3.2 describes the ER Project approach to defining, collecting, and evaluating the data needed to make decisions in the ER Project corrective action process illustrated in Figure 3.2-1. The assessment strategy incorporates the following basic operating principles identified by the EPA to guide each element of the corrective action process (Subpart S):

- Corrective action activities focus on results. Ultimately, all activities in the ER Project corrective action process support a demonstration of NFA, signifying that the site does not pose unacceptable risks.
- Corrective action activities are phased. A demonstration that NFA is achieved can be accomplished at various stages within the corrective action process.
- Corrective action decisions are based on degree of risk. At sites where a release is known to have occurred, the site is characterized and remediated (as necessary) in accordance with current applicable state or federal regulations to the degree that contaminants pose an acceptable level of risk, assuming current and projected future land use.

The ER Project makes cleanup decisions on the basis of ecological risks and risks to the environment, in addition to human-health risks. While human-health risk can be evaluated over a relatively small area, ecological risk assessment requires an understanding of the nature and extent of contamination across much larger areas, such as aggregates. Decisions that are protective of water resources in general also require an understanding of the presence and movement of contamination within an entire watershed.

Sites are combined at the appropriate spatial scale to support risk-based corrective action decision-making. In addition, sites are combined based on size, geography, common contaminants, common transport pathways, common land use or receptor habitat, and programmatic considerations.

To attain sufficient understanding of the presence and movement of contamination within each watershed, the ER Project completes canyon investigations prior to completing investigations at PRSs within an aggregate. The canyon sediment, surface water, and alluvial water data provide information on the presence or absence of specific contaminants within an aggregate or a watershed. This information is used to focus characterization efforts at PRSs within the aggregate or watershed, and to establish the nature and extent of contamination associated with those PRSs. For example, if there is no evidence of migration of a particular contaminant within a watershed, then that information will support the decision that contaminant nature and extent have been characterized for a PRS where that same contaminant is not detected outside the perimeter of the site.

3.2.1 Corrective Action Process Decisions

Management decisions are required throughout the corrective action process (see oval boxes, Figure 3.2-1). These decisions are addressed at various spatial scales to ensure protectiveness at both the site and the watershed levels.

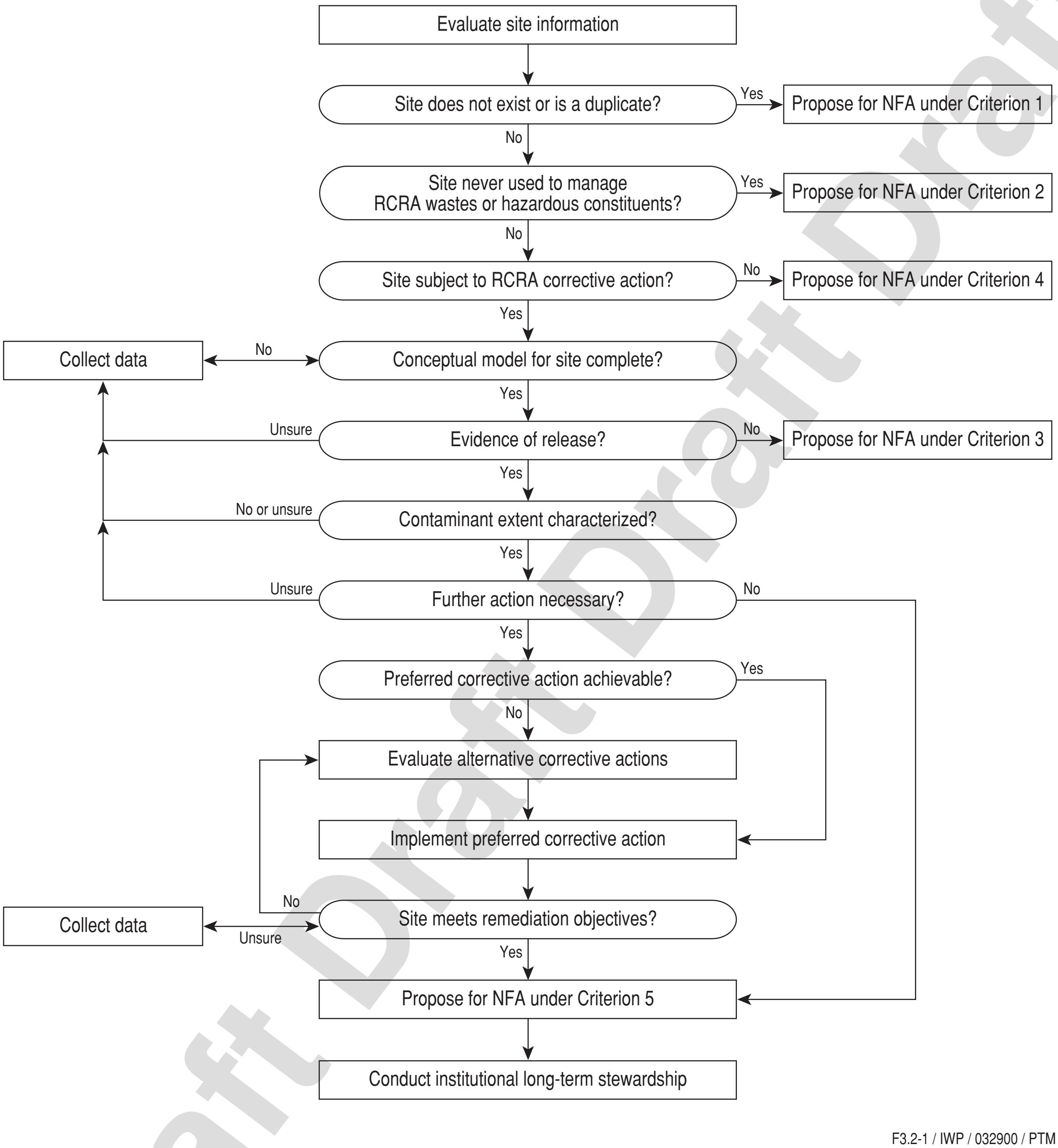

Figure 3.2-1. ER Project approach to decision-making in the corrective action process

3.2.1.1 Qualification for NFA Criterion 1 or 2

For some sites, NFA is proposed without undertaking fieldwork. Existing information must be of sufficient quality and quantity to document that one of the following conditions for NFA exists at the site:

- the site does not exist, is a duplicate site, or is located within and will be investigated as another site (NFA Criterion 1), or
- the site was never used for management of RCRA solid wastes or hazardous wastes and or/constituents (NFA Criterion 2).

3.2.1.2 Qualification for NFA Criterion 4

Some sites initially identified as ER Project sites are more appropriately managed under an authority other than RCRA corrective action. Sites that are now or have ever been managed in accordance with a state or federal authority other than RCRA corrective action are proposed for NFA under NFA Criterion 4. Sites where a release has occurred can be proposed under NFA Criterion 4 only if it can be documented that the release was or will be investigated and/or remediated in accordance with the applicable state and/or federal requirements.

If the site does not meet Criterion 1, 2, or 4, a site conceptual model is developed. (Qualification for NFA Criterion 3 is discussed in Section 3.2.1.4.)

3.2.1.3 Site Conceptual Model Development

Corrective actions are based on a site conceptual model. The conceptual model is a representation of site conditions and conveys what is known or suspected about sources, releases and release mechanisms, contaminant fate and transport, exposure pathways, and potential receptors. A conceptual model incorporates information available at any given time and evolves as more information becomes available. Figure 3.2-2 presents the ER Project conceptual model for a generic watershed aggregate.

A conceptual model is used to test hypotheses, to support risk-based decision-making, and to aid in the identification and design of potential remedial alternatives. Thus, the conceptual model is refined as new data become available until it supports a demonstration of acceptable risk.

The ER Project follows a systematic approach for developing and revising site conceptual models (including mathematical and computational tools) to ensure that conceptual models are consistent for sites within a common environmental system (e.g., groundwater basin or watershed). In addition, the conceptual model of the deep groundwater system is entirely consistent with the conceptual model updated annually through the hydrogeologic work plan. The ER Project approach for developing a conceptual model is based on guidance from the EPA Region 6 draft risk management strategy (EPA 1998, 63140) and incorporates the recommendations of the international working group of the biospheric model validation study (Davis et al. 1999, 63521; van Dorp et al. 1999, 63522; Watkins et al. 1999, 63523).

To develop conceptual models, the ER Project uses the following tools:

- land-use, physical, ecological, and release profiles (EPA 1998, 63140);
- comprehensive and site-specific interaction matrices (Davis et al. 1999, 63521; van Dorp et al. 1999, 63522; Watkins et al. 1999, 63523); and
- mathematical and computer models.

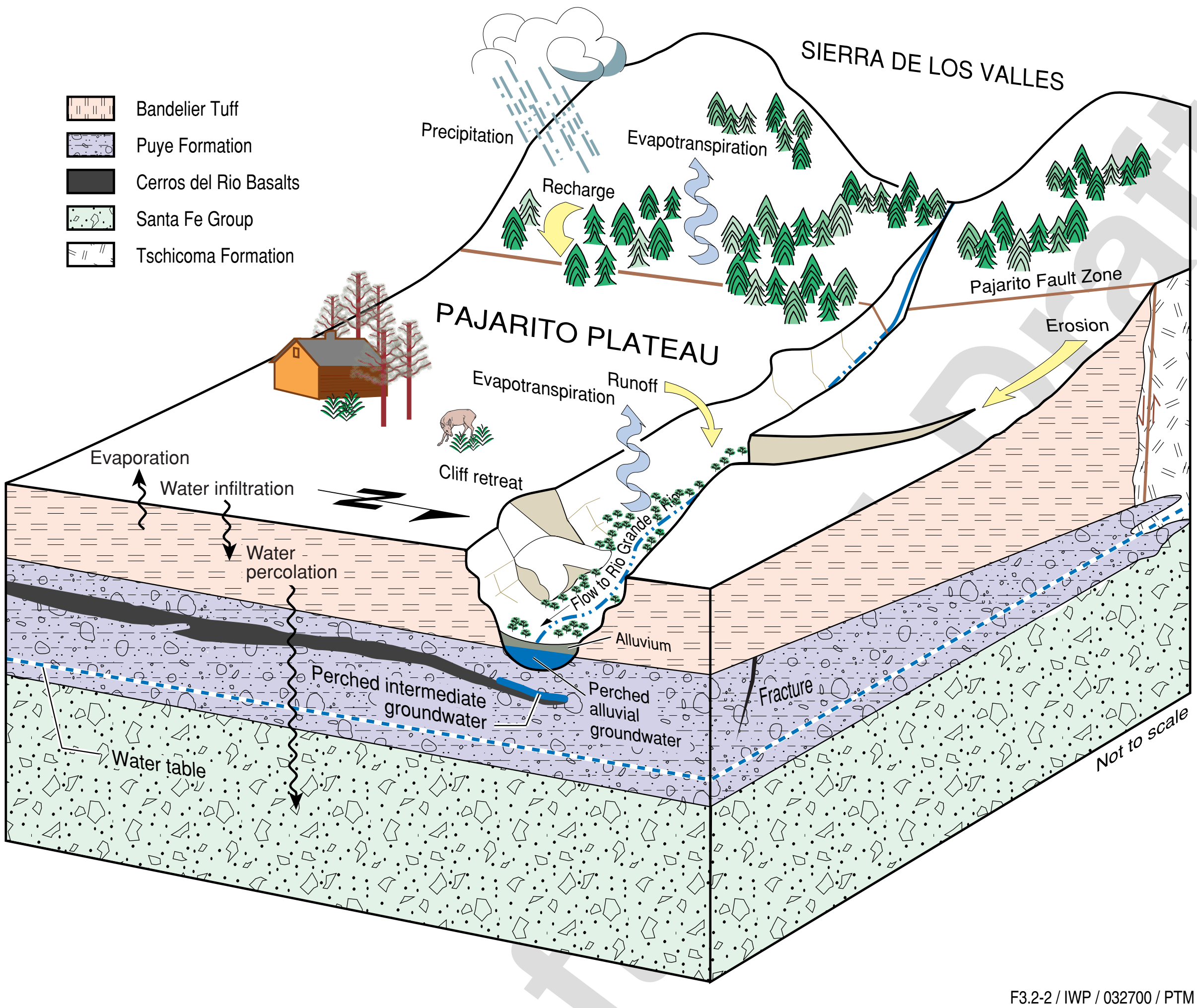

Figure 3.2-2. Generic watershed-aggregate conceptual model

In the development of conceptual models, the ER Project uses the following data sources:

- PRS and MDA data;
- canyons sediment data;
- groundwater, alluvial water, and surface water data;
- hydrologic or geologic data, including model results;
- Environment, Safety, and Health Division (ESH) surveillance data;
- Pueblo sampling data when available; and
- other non-ER data that may be applicable.

(a) Land-Use Profile

The land-use profile represents the various man-made features present on or near a site that may affect the characterization of the site and its assessment of potential risk. Land-use features may include

- buildings,
- other surface or near-surface structures,
- property boundaries,
- nearby population centers, and
- land-use plans (both current and long-range).

(b) Physical Profile

The physical profile represents the features and processes of the site that affect the release, fate and transport, and biological receptors of contaminants. The physical profile includes topographic characteristics and any natural conditions, industrial conditions, and disturbances that affect the site, including other known or potential sources of environmental contamination. Physical profile features include

- topography,
- meteorology,
- amount of vegetation cover,
- surface-water hydrology,
- surface geology,
- subsurface geology,
- groundwater hydrology, and
- ambient media chemistry.

(c) Ecological Profile

The ecological profile represents the ecosystems and habitats present at and surrounding the site and defines the potential ecological receptors for the site. Because of its elevation gradient and complex terrain, the Pajarito Plateau supports multiple ecosystems and habitats. For the past several years, the ER Project and other Laboratory environmental programs have studied components of the regional ecosystem. These efforts have resulted in several data sets maintained by the Laboratory's ESH Division. The ER Project uses these data sets as its primary sources in developing ecological profiles for conceptual models.

Generally, multiple ecological profiles are required to assess sites. The variability of available water on the Pajarito Plateau results in a highly inhomogeneous habitat distribution, especially throughout the watersheds. Use of the ER Project ecological scoping checklist ensures that all appropriate ecological components are included in the conceptual model (Environmental Restoration Project 1999, 64783).

(d) Release Profile

The release profile represents the contaminant release processes and the nature and extent of COPCs at a site. The release profile is combined with the physical profile to complete information about the nature, extent, fate, and transport of chemical contaminants within the conceptual model. One or more release profiles may be required to provide sufficient information about residual contamination at a site, depending on the persistence, mobility, and toxicity of COPCs present, and the physical profiles of the system.

Existing information and field data are the primary sources used to develop the release profile. Fate and transport models may be used in combination with existing information and field data to develop the release profile for complex sites, watershed aggregates, and entire watersheds. Ultimately, data characterizing all residual contamination is combined to complete a composite release profile for a watershed. The composite release profile identifies simultaneous exposures across multiple media and pathways.

(e) Interaction Matrices

The ER Project uses the interaction matrix as a tool to aid in the documentation of decisions and identification of data gaps in the context of the site conceptual model.

To derive an interaction matrix, the main features of a site are represented in the blocks that form the main diagonal of the matrix. The events and processes that link the main features are placed into the remaining blocks of the matrix following a clockwise convention. A chain of interactions through the matrix identifies a pathway. Figure 3.2-3 shows an example of a limited interaction matrix.

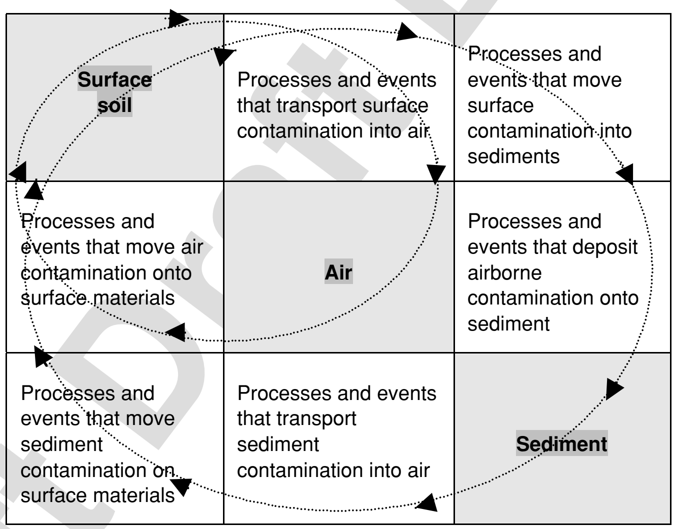

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Figure 3.2-3. Limited interaction matrix (modified from Watkins et al. 1999, 63523, p. 359)

A comprehensive interaction matrix is one that includes all the features, events, and processes for an entire system. The ER Project has developed a comprehensive interaction matrix for a generic Laboratory watershed (Figure 3.2-4).

1.1 **Air**	1.2 Deposition Gas exchange Condensation	1.3 Deposition Gas exchange Condensation	1.4	1.5 Deposition Gas exchange Condensation	1.6	1.7 Barometric pumping Gas exchange	1.8 Deposition Gas exchange	1.9	1.10 Gas exchange Deposition	1.11 Inhalation Immersion Gas exchange
2.1 Volatilization Entrainment Evaporation Transpiration	2.2 **Mesa-Top Soils**	2.3 Erosion Run-off	2.4	2.5 Runoff Erosion	2.6 Dissolution Infiltration	2.7	2.8 Dissolution Transport	2.9 Dissolution Transport	2.10 Root uptake Deposition	2.11 Ingestion Deposition Resource use
3.1 Aerosolization Gas exchange Evaporation	3.2 Precipitation Erosion Irrigation Diffusion	3.3 **Surface Water**	3.4	3.5 Dissolution Precipitation Infiltration Erosion Diffusion	3.6	3.7 Infiltration Unsaturated flow	3.8 Infiltration Fracture Flow	3.9 Infiltration Fracture Flow	3.10 Root uptake Deposition	3.11 Ingestion Deposition Resource use
4.1	4.2	4.3 Mixing	4.4 **Storm Water**	4.5 Deposition Erosion Precipitation	4.6 Infiltration	4.7 Infiltration Unsaturated flow	4.8 Infiltration Unsaturated flow	4.9	4.10 Flooding Uprooting Seed transport	4.11
5.1 Entrainment Evaporation Volatilization Transpiration	5.2	5.3 Erosion Dissolution	5.4 Entrainment Erosion Dissolution	5.5 **Slope and Canyon Sediment and Soils**	5.6 Desorption Filtration	5.7 Infiltration Dissolution	5.8 Dissolution	5.9 Dissolution	5.10 Root uptake Deposition	5.11 Ingestion Deposition Resource use
6.1 Evaporation	6.2	6.3 Diffusion Capillary rise	6.4	6.5 Sorption	6.6 **Alluvial Water**	6.7 Saturated flow Unsaturated flow Capillary rise Evaporation	6.8 Unsaturated flow Saturated flow Fracture flow	6.9 Unsaturated flow Saturated flow Fracture flow	6.10 Root uptake	6.11 Ingestion Immersion
7.1 Volatilization Vapor flow Diffusion Transpiration	7.2 Vapor transport Capillary rise	7.3 Capillary rise	7.4	7.5 Capillary rise Vapor flow Sorption	7.6 Vapor flow Percolation	7.7 **Vadose Zone**	7.8 Unsaturated flow	7.9 Unsaturated flow Vapor flow	7.10 Root uptake	7.11 Gas exchange Resource use
8.1 Volatilization Vapor flow	8.2 Capillary rise Vapor flow	8.3 Discharge	8.4	8.5	8.6	8.7 Capillary rise Vapor flow	8.8 **Intermediate Water**	8.9 Saturated flow Unsaturated flow Fracture flow	8.10	8.11
9.1 Volatilization Vapor flow	2.9	9.3 Discharge	9.4	9.5 Dicharge	9.6	9.7 Capillary rise Vapor flow	9.8	9.9 **Regional Aquifer**	9.10 Root uptake Immersion	9.11 Immersion Ingestion
10.1 Biogas Pollen	10.2 Biomass Bioturbation	10.3 Biomass	10.4	10.5 Biomass Bioturbation	10.6 Biomass Infiltration	10.7 Biomass Infiltration	10.8	10.9	10.11 **Flora**	10.11 Ingestion Resource use
11.1 Biogas Biomass	11.2 Bioturbation Resource use Biomass	11.3 Biomass Resource use	11.4	11.5 Biomass Bioturbation	11.6 Biomass	11.7 Bioturbation Biomass	11.8	11.9	11.10 Fertilization Contact Resource use	11.11 **Fauna**

Figure 3.2-4. Comprehensive interaction matrix for generic site

A site-specific interaction matrix is one that is constructed to determine and document the contaminant transport and exposure pathways that will be included in the conceptual model for a specific site. The comprehensive watershed matrix provided in Figure 3.2-4 is the starting point for developing site-specific interaction matrices. Information gathered to describe the land-use, physical, ecological, and release profiles of a specific site is screened against the comprehensive matrix to identify site-specific transport and exposure pathways that will be included or excluded.

Evaluating site-specific data in the context of the comprehensive matrix helps determine whether data are

- demonstrated or judged to have significant impact,
- demonstrated or judged to have insignificant impact, or
- poorly understood.

The process of screening site-specific information against the all-inclusive comprehensive interaction matrix ensures that all potential contaminant transport and exposure processes are considered explicitly. Thus, the derivation of the site-specific interaction matrix provides an additional means of documenting the decision process.

Most information used to derive site-specific interaction matrices is obtained from the same reference documents (e.g., Chapter 2 of this installation work plan, RFI work plans and SAPs, environmental surveillance reports, biological assessments, threatened and endangered species habitat management plans, and the preliminary hydrogeologic atlas for Los Alamos National Laboratory [Environmental Restoration Project 1999, 64039]).

(f) Mathematical and Computer Models for Conceptual Model Development

In addition to feature profiles and interaction matrices, mathematical and computer models can be used in the development of conceptual models. For example, at sites containing persistent and mobile contaminants, computer models are used to estimate future conditions and to evaluate the potential consequences of rare events, such as large floods, or processes too slow to measure, such as groundwater flow and contaminant transport in unsaturated bedrock.

The ER Project uses models that have undergone documented verification processes. Models are calibrated using site-specific data to ensure that measured conditions are captured. Models that simulate slow or long-term processes (i.e., greater than 50 years) cannot be validated in the strict sense of the term because there are no data with which to compare model predictions.

A conceptual model forms the basis of addressing corrective action decisions at a site. The first decision the conceptual model addresses is determining if a release has occurred at a site. It also narrows the list of potentially risk-significant contaminants.

3.2.1.4 Determination of a Release and Qualification for NFA Criterion 3

Samples of environmental media are collected from the area within and/or surrounding a site and are analyzed for specific chemicals to determine whether a contaminant release has occurred. Evidence of a contaminant release is based primarily on whether COPCs are present at the site. The identification of a chemical as a COPC is determined differently for inorganic chemicals, radionuclides, and organic chemicals.

The process for determining if a release of an inorganic chemical or radionuclide has occurred at a site involves a two-step process. First, site concentrations of the chemical are compared with the background value (BV) or regional fallout concentration for that site.

- Inorganic chemicals are compared with Laboratory media-specific BVs.
- Naturally occurring radionuclides are compared with media-specific BVs.
- Man-made radionuclides are compared with regional media-specific fallout concentrations.

BV/fallout concentrations are provided in “Inorganic and Radionuclide Background Data for Soils, Canyon Sediments, and Bandelier Tuff at Los Alamos National Laboratory” (LANL 1998, 58093).

Exceeding the media-specific BVs/fallout concentration for a single chemical does not necessarily indicate a release of that chemical because BVs are based on 95% upper tolerance limits and thus do not represent the maximum background concentration. For example, 1 concentration exceeding the BV out of a total site concentration data set of 100 samples would not indicate a release. Whereas 1 concentration exceeding the BV out of 5 samples generally would indicate evidence of a release. Thus, when a BV is exceeded, the entire data set of site concentrations is compared with the entire data set of background/fallout concentrations to determine if site concentrations are, indeed, distinguishable from background concentrations. Statistical methods are used to compare data sets. If the media-specific BV/fallout concentration is exceeded and the set of site concentrations is distinguishable from the background data set, then the chemical is identified as a COPC for the site.

The determination of an organic chemical release at a site is based on whether the organic chemical is detected in a specific sample matrix using a specific analytical method. The analytical laboratory that analyzes samples reports the organic chemicals that were detected in each sample, and the ER Project validation process verifies each reported detection. Organic chemicals that are detected in one or more samples are identified as COPCs.

If site-specific data indicate that no release has occurred (i.e., no COPCs are identified), the site is proposed for NFA under NFA Criterion 3. If COPCs are identified, the next step in the corrective action process is to characterize the extent of contamination at the site.

3.2.1.5 Characterization of Contaminant Extent

Determining the extent of contamination at a site ensures that corrective action decisions comprehensively consider all potentially risk-relevant contaminants. To accommodate the evaluation of multiple sources within an integrated watershed corrective-action framework, canyons data are used to determine investigation and assessment boundaries of aggregates. The ER Project then uses risk thresholds to bound extent of contamination. Contaminant extent is bounded when sufficient field data are available to demonstrate where these risk-based concentrations are not exceeded.

This approach is consistent with EPA guidance, which states that “In delineating the nature and extent of contamination it may not be necessary to delineate to background concentrations in all cases. In some cases, information adequate to support cleanup decisions can be obtained through delineation to risk-based concentrations or other investigation endpoints.” For simple sites containing one or more discrete sources of contamination, more traditional means of determining contaminant extent will be used, such as delineation to background concentrations or demonstrating a decreasing trend in contaminant concentrations.

Where natural processes such as contaminant degradation are expected to control risk due to contamination, mathematical models, field data, and laboratory data may be used together to establish the presence and effectiveness of natural attenuation mechanisms (e.g., transport times that exceed contaminant persistence). For certain complex sites, the ER Project uses information regarding the presence of natural attenuation mechanisms to demonstrate that contaminant extent is sufficiently well known to determine the need for risk-based corrective actions, and to evaluate potential remedies.

After the extent of contamination is bounded sufficiently to ensure that potential risks can be assessed, the need for further action is determined.

3.2.1.6 Determination of Further Action

Once a release has been identified and quantified and the extent of contamination has been defined, the need for further action at an ER site generally is determined using a standard, phased, risk-assessment approach. In Figure 3.2-1, risk assessment is implicitly represented in the actions identified within the ovals and boxes that determine if further action is necessary, ultimately leading to proposal for NFA under Criterion 5.

(a) Risk Screening

Chemicals that are identified as COPCs in the release determination process are evaluated by human health and ecological screening assessments. In a human health screening assessment, potential risk to human health is estimated by calculating excess incremental cancer risk, annual dose rate, and/or hazard quotients/hazard indices (HQ/HI). During this process, maximum COPC concentrations (or 95% upper confidence limit [UCL] value of the means for each COPC) are compared with human health screening levels. Appropriate water quality standards are used for comparing maximum COPC concentrations or 95% UCL values of the mean of COPCs in surface and/or groundwater. In an ecological screening assessment, risk to ecological receptors is estimated by calculating HQ/HIs and estimating doses that indicate whether there is a potential for toxic effects to ecological receptors. Maximum COPC concentrations or 95% UCL values of the means of COPCs in soil and/or water are compared with appropriate ecological screening levels or water quality standards. When screening levels cannot be calculated because of insufficient chemical toxicity information, the chemical may be retained as a COPC requiring further evaluation (e.g., included in a baseline risk assessment). If the screening evaluation demonstrates that maximum chemical concentrations or 95% UCL values of the mean are below screening levels, further analyses of these chemicals are not necessary.

Human Health Risk Screening

The ER Project performs human health risk screening based on a residential exposure scenario only. Human health screening action levels (SALs) are developed for surface soils using this scenario. The application of SALs below 12 ft (the depth at which construction activities reasonably may be expected to occur) in solid environmental media (e.g., soil or tuff) is determined on a site-by-site basis. For most human health applications, risk-related soil SALs are appropriate for making site-screening decisions. SALs are derived and implemented as follows:

- Nonradionuclide SALs are calculated using the most current available human health toxicity data, standard default values, algorithms, and equations. The derivation of nonradionuclide SALs adheres to the process detailed in Appendix C of this document. Parameters and equations used to calculate SALs are equivalent to those presented in EPA Region 6 media-specific screening levels (EPA 1999, 64637)
- The values of excess incremental cancer risk (ICR) used to calculate nonradionuclide SAL values are consistent with the National Contingency Plan (40 CFR 300, "National Oil and Hazardous Substances Pollution Contingency Plan," Final Rule, *Federal Register*, Vol. 55, No. 46) and with

EPA guidance (EPA 1991, 58234), where risks at or below 10^{-6} are considered negligible. An ICR of 10^{-6} is used to calculate SALs for EPA cancer Class A, B1, and B2 carcinogens. An ICR of 10^{-5} is used to calculate SALs for EPA cancer Class C carcinogens. EPA uses the less-restrictive risk level of 10^{-5} for Class C carcinogens because evidence for their carcinogenicity is not compelling.

- Screening values for noncarcinogens are based on an HQ of 1. An HQ of 1 represents the concentration below which an adverse effect is not expected even for sensitive populations. Based on NMED guidance in a screening assessment, SALs for noncarcinogens are divided by 10 when 2 or more noncarcinogenic COPCs are identified. The purpose of the additional safety margin is to address the potential that 2 or more COPCs may affect similar target organs or organ systems.
- For lead, a SAL of 400 mg/kg is used in lieu of an independently calculated SAL because EPA-approved toxicity values have not been published for this chemical. This value is from an EPA guidance document for screening soil lead concentrations (EPA 1994, 59894).
- For polychlorinated biphenyls (PCBs), a SAL of 1 mg/kg is used for screening in residential and industrial areas. This value is applied to the individual and summed concentrations of all PCB congeners and is based on the cleanup level for PCBs provided in the Toxic Substances Control Act (40 CFR 750 and 761, "Disposal of Polychlorinated Biphenyls (PCBs)," Final Rule, *Federal Register*, Vol. 63, No. 124).
- Radionuclide SALs are calculated using the RESRAD computer code developed by Argonne National Laboratory for use by DOE sites. This model uses standard residential default values for variables that affect risk such as body weight, intake rate, and exposure duration. Doses are summed over multiple pathways, including inhalation, external gamma, soil ingestion, and plant ingestion. Environmental parameters required by the RESRAD model are set conservatively, but appropriately, for the Laboratory (Yu et al. 1993, 1177).
- The target dose level used for radionuclide SAL calculations is 15 mrem/yr, which is one-tenth of DOE's annual effective dose limit of 100 mrem/yr from all sources (DOE Order 5400.5, "Radiation Protection of the Public and the Environment" [Proposed Rule, 10 CFR 834]). Further investigation of sites exceeding 15 mrem/yr is consistent with DOE regulatory guidance. Where SALs are not applicable (e.g., for canyon sediments), site-specific human health screening levels may be calculated to more realistically reflect site conditions such as affected media (other than surface soil) and potential land use (other than residential). In all cases, screening levels are used in the manner described above for SALs.

Ecological Risk Screening

The ecological screening methodology used by the Laboratory ER Project is detailed in "Screening Level Ecological Risk Assessment Approach for the Environmental Restoration Project at Los Alamos National Laboratory" (Environmental Restoration Project 1999, 64783). For most ecological applications, risk-related ecological screening levels (ESLs) are appropriate for making site-screening decisions. ESLs are derived and implemented as follows:

- ESLs for radionuclides and nonradionuclides are calculated for a given receptor provided receptor-specific information (e.g., body weight, rates of consumption, and diet) and toxicity information are available. The target dose level used to calculate radionuclide ESLs is 0.1 rad/day. ESLs for nonradionuclides are derived from literature values for no observable adverse effect levels/concentrations or lowest observable adverse effect levels/concentrations. The methodology for calculating ESLs is detailed in Environmental Restoration Project (1999, 64783).

- Nonradiological ESLs are calculated based upon an HQ of 1 (i.e., a dose that has been determined acceptable for each screening receptor). An HQ greater than 1 indicates potential effects to biota. If a COPC has an HQ greater than 1, it is identified as a chemical of potential ecological concern (COPEC).
- If multiple chemicals are present, HIs are calculated as the sum of all HQs for a given receptor when there are common toxicity endpoints (i.e., radiological effects are summed separately from nonradiological effects). As per NMED guidance, nonradiological chemicals that contribute 0.3 or more to an HI that exceeds 1 are identified as COPECs.

(b) Risk Assessment

If a risk-screening assessment indicates potentially risk-significant quantities of COPCs or COPECs at a site, a risk assessment of human health and/or ecological impacts may be performed. The ER Project risk assessment approach builds upon existing Laboratory methodologies developed in conjunction with NMED and is consistent with EPA guidance.

Exposure estimates are based on the distribution of contamination throughout areas or volumes of contaminated media and over the time periods that are consistent with land-use assumptions and contaminant persistence. In general, the area or volume of contamination that a receptor might be exposed to over a given period should be consistent with the selected exposure scenario. For example, a residential exposure unit may be equivalent to a standard lot size (500 m^2), and an ecological exposure unit may be equivalent to the home range of an ecological receptor. The 95% UCL value of the mean is used for the exposure point concentration in the areas or volumes in which reasonable maximum exposure might take place. Appropriate alternative statistics also may be used to provide estimates of reasonable maximum exposure. For example, when a chemical has a low frequency of detection (i.e., a large number of undetected values) the 95% UCL value of the median, rather than the mean, may be used for the exposure-point concentration to represent the reasonable maximum exposure. In all cases, the administrative authority approves alternative statistical methods for calculating exposure-point concentrations before they are used in a risk assessment.

Human Health Risk Assessment

The tiered approach to human health risk assessment used by the ER Project is consistent with EPA guidance (EPA 1989, 08021; EPA 1998, 63140) and follows the NMED's risk-based decision framework (NMED 1998, 57761). Risk assessment methodology for human health follows the EPA's risk assessment guidance for Superfund (EPA 1989, 08021). For sites with a radionuclide component, DOE's RESRAD computer model is used to calculate dose estimates for receptors. For complex sites, other site-specific models may be used. In either case, the approach to risk assessment uses the Laboratory-specific human health scenarios presented in "Standard Human Health Risk Assessment Scenarios" (Mirenda and Soholt 1999, 64003). The parameters and assumptions for these scenarios are designed to be conservative and represent a point of departure (i.e., parameters can be modified to reflect site-specific conditions as appropriate), when the project conducts a risk assessment.

An exposure scenario serves as the basis for assessing a site for potential risk to human health and defines the pathways by which receptors are exposed. A human health exposure scenario is determined by the current and future land use of the site. Standard land-use scenarios used by the ER Project to determine exposure to human receptors include

- residential,
- industrial,

- recreational, and
- resource user.

Standard land-use scenarios are fully described in Mirenda and Soholt (1999, 64003). The Laboratory site development plan (LANL 1995, 57224) is used to determine which Laboratory lands fall into the industrial and recreational categories of land use, both currently and in the future. Industrial land use affects Laboratory workers and is prescribed by the 30-year planning horizon for the Laboratory's mission and the continued operation of present-day facilities. Buffer zone land use may affect recreational users and is based on present and future access to Laboratory property, as prescribed in the Laboratory's site development plan. Figure 2.1-4 shows future land-use expectations for the Laboratory.

The ER Project is also in the process of developing a set of pathways that would appropriately describe how members of neighboring pueblos use Laboratory lands and environs.

Baseline human health risk assessments may provide a basis for proposal of final corrective actions at sites where COPCs have been identified, as follows:

- If the total carcinogenic and noncarcinogenic risk thresholds for human receptors are not exceeded, risk to human health at the site is considered acceptable (10^{-4} to 10^{-6} excess cancers per lifetime and an HQ/HI of 1, respectively).
- If the total radiological dose to human receptors is expected to be less than 15 mrem/yr above background (for unrestricted release of residential sites), risk to human health at the site is considered acceptable. Guidelines in DOE Order 5400.5, "Radiation Protection of the Public and the Environment" (DOE Proposed Rule, 10 CFR 834), and EPA proposed regulations for cleanup levels at sites with radioactive contamination (EPA proposed 40 CFR 196; EPA 1997, 58693) establish the rationale for adopting these dose levels.

Ecological Risk Assessment

The tiered approach to ecological risk assessment used by the ER Project follows EPA guidance (EPA 1997, 59370; 1998, 59600). The process progresses from a relatively simple screening assessment to an increasingly more complex assessment of individual sites or large aggregates (watersheds). This process uses an array of tools to determine whether the potential exists for adverse ecological impacts to receptors at a site. Included in this array are problem formulation, data evaluation, sampling and analysis, screening assessments, field surveys, environmental data, toxicity testing, biotic sampling, and computer models. The use of each tool adds information about potential impacts to receptors and enhances understanding of the ecology of the site. As a result, the uncertainty associated with the risk assessment is reduced, thereby providing the risk manager with a range of information to support the decision-making process.

To facilitate the implementation of the process, the ER Project has defined general assessment endpoints (GAEs) for the Laboratory and has developed screening methods for assessing potential ecological risk. The GAE approach was devised in collaboration with other Laboratory, state, and federal organizations and serves as a framework for selecting a representative subset of potential ecological receptors and adverse effects for ecological risk assessment (Kelly et al. 1999, 63510). Ecological screening methods were developed in conjunction with NMED and are described in "Screening Level Ecological Risk Assessment Methods" (Environmental Restoration Project 1999, 64783).

Baseline ecological risk assessments may provide a basis for proposal of final actions at sites where COPECs have been identified. If the total risk thresholds for ecological receptors at a site are not exceeded and/or the weight of evidence indicates no potential for adverse effects, ecological risk at the site is considered acceptable. Ecological thresholds are established on a case-by-case basis and may be based on an HQ/HI greater than 1, the relationship of the stressor level to the magnitude of the response, and/or the evaluation of the variability in exposure/effects to receptor populations.

(c) Uncertainty Analysis

The ER Project risk assessment process includes an uncertainty analysis that qualitatively and/or quantitatively addresses potential impact assumptions and uncertainties in human health and ecological screening or risk assessment. As a result, the level of confidence in numerical risk estimates can be determined for a site. The quantitative estimates of potential human health and ecological risks are conditional estimates that include considerable uncertainty due to numerous assumptions about exposure and toxicity. To place risk estimates in proper perspective, it is important to specify the uncertainties inherent in a human health and ecological screening or risk assessment. Uncertainty analysis also is used to identify areas where a moderate amount of additional data might considerably improve the basis for the selection of a remedy.

Several sources of uncertainties are evaluated for their combined impact on potential human health and ecological risks. These include, but are not limited to the uncertainty

- associated with data quality,
- associated with the initial selection of chemicals used to estimate exposures and risk on the basis of sampling data and toxicity information,
- inherent in the toxicity values for each chemical used to estimate risk,
- associated with the bioavailability of contaminants,
- inherent in the exposure assessment for individual chemicals and individual exposures,
- associated with exposure to two or more chemicals,
- associated with multiple-pathway exposure,
- associated with receptor usage factors,
- inherent in individual and population variability, and
- associated with contaminant metabolism.

(d) Computer Models for Risk Evaluation

The ER Project uses computer models to assist in understanding complex systems and processes that are difficult to measure, such as unsaturated groundwater flow; contaminant transport in porous, fractured, inhomogeneous media; or surface water flow and contaminant transport in a complex terrain at a large (watershed) scale.

Computer models are also used to predict future nature and extent of contamination at ER Project sites that are necessary to support a risk assessment. Models allow the simulation of processes that, over time, may mobilize currently inaccessible contamination to accessible media. Models are also used as an adjunct of field data collection activities to assist in understanding contaminant fate and transport at a site by integrating the contamination from multiple, currently discrete sources. Generally, fate and transport modeling is used at complex sites, including aggregates and watersheds.

The ER Project is developing models to simulate contaminant fate and transport via surface water and groundwater. Standard framework models are being developed for processes such as

- groundwater flow and solute transport beneath mesas and canyon floors,
- surface-water sediment transport of adsorbed contaminants from mesas (including their slopes) into canyons,
- surface-water solute transport, and
- saturated flow and transport of contaminants from multiple sources in the regional aquifer (and perched zones if necessary).

A model for simulating atmospheric transport of gas-phase and suspended-particulate contamination also will be developed for large-scale assessment of multiple-contaminant sources. The atmospheric transport model will be based on standard EPA-approved computer programs, if they are shown to be applicable in complex terrain.

3.2.1.7 Preferred Action Identification

When the assessment of an ER Project corrective action site results in the determination that further action is needed to reduce or eliminate risk posed by the site, the need for both interim and final remedies is considered. Interim actions are implemented to reduce actual or potential risk associated with the site during the period that long-term final remedies are being evaluated. The EPA threshold and balancing criteria for evaluating final remedies are listed in Section 3.1.4.5.

(a) Interim Actions

Interim actions focus on near-term activities to control risks and to prevent or minimize the further spread of contamination. Sites may be considered for interim action if all of the following conditions are true:

- The nature and extent of contamination, and the physical, chemical, and biological characteristics of the site are well understood.
- Near-term opportunities exist for significant risk reduction, prevention of further contamination, and/or long-term cost savings.
- The proposed action will not impede or be inconsistent with the expected approach for final remedy.
- Appropriate stabilization technologies are available to deal with the known contaminants.
- The interim action selected does not adversely impact the ecosystem, natural resources, worker safety, or public health.
- If waste is generated, adequate waste-treatment, storage, or disposal capacity is available.

(b) Accelerated Corrective Action

ACAs are final remedies that can be identified and implemented without a full-scale CMS/CMI. ACAs may include voluntary cleanup to approved media cleanup levels, treatment of contaminants or contaminated media, presumptive remedies, or monitored natural attenuation. ACAs are identified and evaluated in the context of the EPA threshold and balancing criteria presented in Section 3.1.4.5 of this document. In addition to those evaluation criteria, the following conditions must also exist at sites considered for ACA:

- The nature and extent of contamination, and the physical, chemical, and biological characteristics of the site, are well understood.
- Corrective action is necessary to reduce or eliminate risks associated with a site.
- The optimal remedy to reduce or eliminate risk is obvious and can be readily applied.
- The remedy is final.
- Adequate treatment, storage, and disposal capacity is available for all expected waste types.
- The remedy selected does not adversely impact the ecosystem, natural resources, worker safety, or public health.

Media Cleanup Levels

Media cleanup levels must be protective of human health and the environment as well as comply with state and federal regulations. ER Project media cleanup levels are based on facility- and site-specific background concentrations and conditions, existing state and federal standards, and risk-based concentrations derived from approved risk assessment methodologies. The ER Project develops, in conjunction with NMED, point of compliance, monitoring and sampling locations, analytical parameters and methods, statistical analysis, and the period required for monitoring restored sites.

Human health risk-based determinations for media cleanup levels are consistent with the RCRA corrective action process described in proposed Subpart S (Proposed Rule, 40 CFR Parts 264, 265, 270, and 271, "Corrective Action for Solid Waste Management Units (SWMUs) at Hazardous Waste Management Facilities," *Federal Register*, Vol. 55, pp. 30798–30884). Human health risk-based determinations are based on EPA risk assessment guidance, which states that "cleanup standards for carcinogens shall be established at levels which represent an excess upper-bound lifetime individual risk between 1 x 10^{-4} and 1 x 10^{-6}" (EPA 1991, 58234; 40 CFR 300, "National Oil and Hazardous Substances Pollution Contingency Plan, Final Rule, *Federal Register*, Vol. 55, No. 46). Cleanup levels for noncarcinogenic chemicals allow daily exposure without appreciable risk of deleterious effects during the exposure period.

Subpart S does not address corrective action for radionuclides. ER Project media cleanup levels for radionuclides are based on a total effective dose equivalent of 15 mrem/yr above background for plausible scenarios. A dose limit of 15 mrem/yr is consistent with the EPA guidance provided in "Establishment of Cleanup Levels for CERCLA Sites with Radioactive Contamination" (EPA 1997, 58693). These dose limits in conjunction with reasonably conservative exposure parameters result in media cleanup levels that satisfy the as low as reasonably achievable (ALARA) principle. However, when lower annual doses are practically achievable, lower cleanup levels may be selected for a site. Conversely, practical considerations may lead to the selection of an annual dose limit greater than

15 mrem/yr while still complying with the 100 mrem/yr dose limit of DOE Order 5400.5, “Radiation Protection of the Public and the Environment” (DOE Proposed Rule, 10 CFR 834).

The ER Project has not yet developed risk-based media cleanup concentrations for ecological receptors. ER Project ecological risk-based determinations will be consistent with EPA’s risk assessment guidance (EPA 1997, 59370). Development of appropriate ecological cleanup values will involve investigations of primary literature, experimental resources, and other NMED-approved resources, including available EPA guidance. The process will involve participation of the administrative authority in the choice of parameters, receptors, and equations for calculating media cleanup levels that are protective of ecological resources. It may also be necessary to conduct further risk assessment investigations to develop cleanup levels. The implementation of remedial activities at a site may have ecological impacts that exceed the impacts of leaving residual contamination in place. To minimize remediation impacts it may be necessary to reduce the level of remediation and/or leave some contamination in place despite not meeting ecological cleanup levels. Such action requires the approval of the administrative authority.

Site-specific conditions may result in a determination that concentrations of some contaminants must be lowered below calculated cleanup levels to protect sensitive human and/or ecological receptors. Final cleanup levels that are higher than derived risk-based concentrations may be allowed by the administrative authority if the risk-based concentrations are below facility- or site-specific background concentrations or state and federal standards. For example, concentrations of contaminants in groundwater in excess of state standards may be allowed if a variance (or alternate concentration limit) has been granted under the New Mexico Water Quality Control Commission regulations (Title 209, New Mexico Administrative Code).

Cleanup of a site or aggregate is approached on a case-by-case basis. Sites with widespread, very low-level contamination may not warrant remediation when the associated risk would not be significantly reduced by the proposed action. In addition, at some sites it may be physically impractical to remove all contamination above media cleanup levels. In such cases, the ER Project is responsible for demonstrating to NMED that remediation would not significantly reduce risk to human and ecological receptors.

Treatment

The ER Project uses contaminant treatment as a component of corrective action when treatment results in reducing the toxicity, mobility, and/or volume of a contaminated material. Treatment may be applied in place without removing contaminants or contaminated media, or it may involve the removal of the contaminated media. Treatment is considered for a corrective action site when, in addition to the EPA threshold and balancing criteria (evaluation criteria) presented in Section 3.1.4.5, the following criteria are met:

- appropriate and applicable treatment technology is available,
- treatment technology is cost effective,
- treatment reduces risk (to workers) relative to exhumation, and
- environmental impacts of the treatment are acceptable.

Presumptive Remedies

Presumptive remedies are preferred remedies that use successful past corrective actions to streamline corrective actions for common categories of sites. Presumptive remedies ensure consistency in remedy selection and implementation and reduce the cost and time required to investigate and remediate similar types of sites. The concept of using similarities between sites to streamline corrective actions is embodied in EPA's presumptive remedy policy (EPA 1993, 65062) and serves as the basis for implementing generic approaches to site remediation. The DOE refers to the use of generic strategies as the "plug-in" approach and suggests presumptive/plug-in remedies for sites that have similar characteristics such as

- process history,
- contaminant type,
- media type, or
- waste unit type.

The ER Project proposes to follow the DOE/EPA presumptive/plug-in remedy approach to completing corrective actions for MDAs, as described in the forthcoming MDAs Focus Area implementation plan**.**

Monitored Natural Attenuation

EPA's RCRA Corrective Action Program recognizes, in certain circumstances, that natural attenuation can be an acceptable component of remedial actions, and concludes that natural attenuation remedies are not to be considered "no action" remedies. The EPA's Office of Solid Waste and Emergency Response defines natural attenuation as "naturally occurring attenuation processes in soil and groundwater environments that act without human intervention to reduce the mass, toxicity, mobility, volume, or concentration of contaminants" (EPA 1997, 64946). The naturally occurring processes that are known to be active (in varying degrees) in the subsurface beneath corrective action sites at the Laboratory include biodegradation, dispersion, dilution, adsorption, volatilization, and chemical or biological stabilization or destruction of contaminants. The ER Project considers monitored natural attenuation as a component of corrective action when

- there is clear proof that attenuation processes exist,
- risk-sensitive receptors are not affected,
- alternative remedies pose higher risk, and
- the behavior of the contaminant plume is understood.

Before using natural attenuation as a component of corrective action, the ER Project uses field and laboratory data to demonstrate that natural attenuation processes exist. This demonstration includes evidence of one or more of the following:

- reduction in concentration along the contaminant flow path,
- loss of contaminant mass by chemical and geochemical data and biological decay rate data, and
- microbiological laboratory data supporting degradation and decay rates.

The responsibility for monitoring to ensure the effectiveness of natural attenuation will be assumed by the ER Project or ongoing Laboratory programs, depending on the expected monitoring period.

(c) Conditional Remedies

Final remedies are not always possible, because of factors such as the location of a corrective action site within an operating facility. In such cases, conditional remedies may be proposed for those ER Project sites. Conditional remedies are not interim actions, which focus on controlling near-term circumstances that may increase risk. Nor are they final remedies because they do not necessarily meet all remedy standards, including the EPA threshold and balancing criteria, listed in Section 3.1.4.5 of this document. However, attainment of these goals is delayed only through conditional remedies. Conditional remedies may allow risk-significant contamination to remain within the facility boundary for a period of time, provided certain conditions are met. Conditional remedies may be appropriate for sites that contain both active and inactive waste management units where it is difficult or impossible to distinguish releases and risks associated with contamination from those units. The ER Project proposes a conditional remedy if the remedy

- includes institutional or other controls necessary for the prevention of significant exposure (including deed restrictions),
- includes continued monitoring to determine if further significant degradation occurs,
- includes financial assurances for the conditional remedy, and
- complies with standards for waste management.

3.2.1.8 NFA Criterion 5 Qualification

When the ER Project can demonstrate that no unacceptable human health or ecological risk is associated with a corrective action site, NFA is proposed for the site under NFA Criterion 5. Proposals under Criterion 5 are based on the demonstration that the risk at a site is below levels that are acceptable to the administrative authority. Demonstration of acceptable levels of risk can be achieved with or without remediation.

A site is proposed for NFA Criterion 5 with no remediation when

- risk screening and/or risk assessment indicate that contaminant concentrations are below risk-based threshold concentrations established by the ER Project in conjunction with the administrative authority; or
- a site-specific risk assessment demonstrates that the site poses only acceptable risk.

When a site-specific risk assessment demonstrates that the site poses unacceptable risks, additional risk assessments are performed to evaluate alternative corrective measures. Alternative corrective measures may include contaminant removal, contaminant stabilization, engineered barriers, site-access controls, monitored natural attenuation, long-term surveillance and monitoring, or combinations of these approaches.

Some ER Project sites may qualify for NFA under NFA Criterion 5 even though contamination is not removed. At sites where a significant amount of contamination is left in place because removal is not justified, administrative and monitoring procedures are necessary.

Some residual contamination inevitably will remain within individual watersheds, based on evaluation in the context of EPA's threshold and balancing criteria. Environmental monitoring and stewardship activities conducted by the institution are required to ensure acceptable risk associated with persistent residual contamination. Stewardship activities are expected to include both active and passive controls, such as maintenance, multimedia monitoring, land-use and site-access controls, and resource management. The

Laboratory programmatic strategy for stewardship is under development in conjunction with DOE and NMED and will be responsive to forthcoming guidance from the DOE Focus Area on Long-Term Stewardship. Successful implementation will require coordination between the Laboratory, the DOE, the NMED, and affected municipal and tribal governments.

3.2.2 Approach to Data Collection and Evaluation

Throughout the corrective action process, data collection is required to support remedial action decisions (indicated as ovals in Figure 3.2-1). Data collection is undertaken to furnish data for

- revising and/or refining the site conceptual model,
- defining the nature and extent of contamination,
- identifying the chemical and physical aspects of the environmental fate and transport of potential contaminants,
- estimating potential risks associated with contamination,
- refining the parameters used in any computer models for the site, and
- verifying that remedial objectives have been achieved.

When releases from multiple PRSs are known or suspected to overlap (now or in the future), integrated investigations are implemented. The physical, ecological, and release profiles supporting the integrated investigation design are developed using data from all media, across all affected focus areas. With the completion of integrated databases, qualification of historic data, and evaluation of data usability, all data from PRSs and canyons within an aggregate are available for combining at multiple spatial scales. The data are evaluated for usability in context of the corrective action decision to be made. Then, the DQO process is used to identify significant data gaps. Mathematical models are used to identify data gaps to the extent warranted by the complexity of the conceptual site model and the quality and quantity of available data.

As the first step in an integrated SAP development, available canyon characterization data are reviewed to identify COPCs and transport pathways at a site. Ecological scoping assessments identify potential ecological receptors and habitats. Data needs are identified and a plan for collecting the needed data is developed. Data collected through the implementation of integrated SAPs contribute to multiple analyses, including RFI reports for individual PRSs, integrated RFI reports, canyons surface investigations, and long-term monitoring plans.

To ensure that the data collected for each decision are appropriate and provide sufficient information for making the decision, the ER Project follows the DQO process defined by EPA (EPA 1994, 44324).

3.2.2.1 Data Quality Objectives Process

The DQO process defines a systematic planning approach for developing data-collection activities that are specifically keyed to the corrective action decisions required for a site. DQO development is closely tied to the development of the site conceptual model. DQOs, in conjunction with the conceptual model, enable decision-makers to determine

- the corrective action decisions required for a site,
- the data required to make each decision,

- how much uncertainty is acceptable in the data used to make a decision, and
- the consequences of errors in each decision.

This process provides a strong and defensible documentation of each data-collection activity undertaken and consists of the seven following steps. Each step in the process is discussed in the context of ER Project corrective action implementation.

(a) Problem Definition

All corrective action sites under the purview of the ER Project essentially have the identical environmental problem of determining

- whether contamination is present at the site,
- if present, whether contamination poses unacceptable risk to natural resources (including human receptors) at the site, and
- if risk is unacceptable, what corrective measures should be taken to reduce the risk to acceptable levels.

(b) Identification of Decisions

ER Project corrective action decisions are provided in Figure 3.2-1 and discussed throughout Section 3.2.1, Corrective Action Process Decisions, of this document. As the figure indicates, simple sites, such as those meeting the requirements of NFA Criterion 1 or 2, fall out early in the process and therefore require fewer decisions than complex sites such as MDAs. However, the decision process itself is identical for all ER Project sites.

(c) Inputs to Decisions

Using the conceptual model, a focused list of variables that may impact a decision is identified. Variables may include

- land-use aspects such as structures or archeological objects located on or near the site;
- ecological aspects such as vegetation or the presence of threatened and endangered species;
- physical aspects such as topography, hydrology, and geology; and
- information about the nature and extent of COPCs.

The land-use, physical, ecological, and release profiles (Section 3.2.1.3 of this document) compiled for the conceptual model provide the available information to support corrective action decisions. The conceptual model's site-specific interaction matrix helps to identify data that have not yet been obtained but are necessary to making the decision.

(d) Define Boundaries for the Decision

Before a corrective action decision can be made, it is important to define the spatial and temporal aspects that bound the decision. These boundaries must recognize the inventory, persistence, and mobility of the contaminants under consideration and the natural boundaries of the potentially impacted ecosystem.

Sites with a relatively large inventory of long-lived, mobile contaminants generally have larger spatial and temporal boundaries than sites with a relatively small amount of short-lived, immobile contaminants. At all sites, spatial and temporal boundaries are integrated and consistent with each other.

Decision boundaries are defined by considering the physical, ecological, and release profiles for a site. The physical profile generally describes the features of a site that will affect contaminant mobility, particularly via surface and groundwater. The ecological profile describes the potential biological receptors at a site. The release profile describes the contaminants that are present in specific media and their spatial distributions. Evaluated together, the physical and release profiles characterize the potential mobility of the contaminants and the fate and transport of contaminants as a function of time and location. The ecological and release profiles help identify potentially sensitive receptors and relevant pathways, using species-specific toxicity information. All this information is used to determine the length, width, and depth (and height for airborne contaminants) of the site for which a decision is being made and the time frame within which the decision applies.

Spatial boundaries define the geographical area and geological media within which decisions apply. Spatial boundaries reflect borders such as property ownership, which is important because releases can have very different potential and perceived risks and very different acceptable corrective measures alternatives, depending on whether they are on or off DOE-owned property. Spatial boundaries also reflect features such as floodplains, hydrologic discontinuities, and airsheds, because these features affect contaminant transport.

Temporal boundaries define the time frame within which the results of a decision apply. Temporal boundaries also determine when data should be collected. Temporal boundaries include constraints on data collection such as those imposed by the presence of a threatened and endangered species at the site or desired temporal relationships between data and site conditions (e.g., sampling immediately following a storm event to identify transport trends).

Appropriate limits on the populations of interest are also required. A population of interest may be ecological (e.g., deer mice who inhabit the site or piñon trees located on the site), or physical (e.g., surface water that runs onto the site or sediment in drainage channels). Information from the conceptual model's land-use, physical, and ecological profiles are used to bound populations of interest.

Temporal and spatial boundaries are closely related for sites that contain long-lived and mobile contaminants. Temporal boundaries for risk management decisions regarding these sites must account for the entire period of time that the contamination may remain at the site. Spatial boundaries for these sites are variable, changing as contamination moves. For long-lived, soluble contaminants that move through the groundwater, spatial boundaries account for downward movement from surface soil or water (where it is accessible), through the vadose zone (where it is generally inaccessible), into the regional aquifer (where it is accessible again). Decisions may be phased for such sites. For example, accessible surface contamination may be remediated to eliminate imminent risk and minimize potential future risk, while the risk associated with potential future groundwater contamination from the same site may be evaluated a later time.

(e) Decision Rules

Decision rules establish the criteria for choosing between various courses of action. For example, if average contaminant concentrations within site boundaries are detected at levels exceeding BVs, fallout concentrations, and/or detection limits, risk must be evaluated; otherwise, the site is recommended for NFA under NFA Criterion 3. This decision rule incorporates the "metric" used for the decision (average contaminant concentrations); the scale of the decision (site boundaries); the action-triggering threshold (BVs, fallout concentrations, and detection limits); and the alternative actions (recommend for NFA or evaluate risk). The metric, scale, action-triggering threshold, and alternative actions for making decisions about measured contaminant concentrations are relatively straightforward and objective.

Decision metrics, scales, action-triggering thresholds and alternative actions are not always straightforward and objective, as illustrated in the following example. For this example the decision rule is if risk to the ecosystem (including humans) posed by contamination within the site boundaries now or in the future is unacceptable, ways to reduce the risk to acceptable levels must be evaluated; otherwise, the site is recommended for NFA under Criterion 5. The metric (risk), the scale (site boundaries, now or in the future), the action threshold (unacceptable risk), and the alternative actions (NFA or evaluation of ways to reduce risk) are ambiguous and subjective. By following the DQO process to formally address potentially conflicting values, the subjectivity of risk-based decisions can be reduced, and ambiguous objectives can be clarified. Section 3.2.2.1(f), below, provides a less subjective and ambiguous version of this example.

A fundamental element of the decision rule is the action threshold, which is used to decide between two alternative actions. Examples of risk-based action thresholds used by the ER Project are 10^{-6} incremental cancer risk (the risk of one additional fatal cancer in a population of one million), and an HI of 1. Once the action threshold is identified, the metric (measurement) used to assess whether the action threshold is exceeded is defined. All metrics have associated uncertainties, especially metrics such as incremental cancer risk that are calculated using mathematical models that have many variables and parameters. The uncertainty in the metric must be recognized and accepted by the risk management team so that it can be incorporated effectively into the decision rule.

The recognition, acceptance, and management of uncertainty are critical to the development of a successful decision rule.

(f) Decision Errors

For decision-makers, regulators, and the public to feel confident that the decision being made is correct, quantitative uncertainty limits must be set for the probability of error in the outcome of the decision. Uncertainty is evaluated by considering the consequences of an incorrect conclusion (Figure 3.2-5). The horizontal axis on the figure represents the metric in a decision rule (e.g., calculated excess incremental cancer risk). The solid vertical line represents an action level (e.g., an excess incremental cancer risk of 10^{-6}). The dashed vertical lines represent the uncertainty in the metric. For calculations that fall well below and well above the action level, the uncertainty in the calculation does not change the decision. However, for calculations that fall near the action level, the uncertainty may change the decision. Potential uncertainty consequences include risk to human health and the ecology, and wasted resources, and social and political consequences.

Uncertainties generally are more important, and often more difficult, to manage when a metric is close to an action threshold. This is especially true when the decision alternatives are NFA and corrective measure implementation. In these cases, the metrics and action thresholds in decision rules the ER Project chooses ensure that a decision to implement a corrective measure is more likely than a decision to recommend a site for NFA.

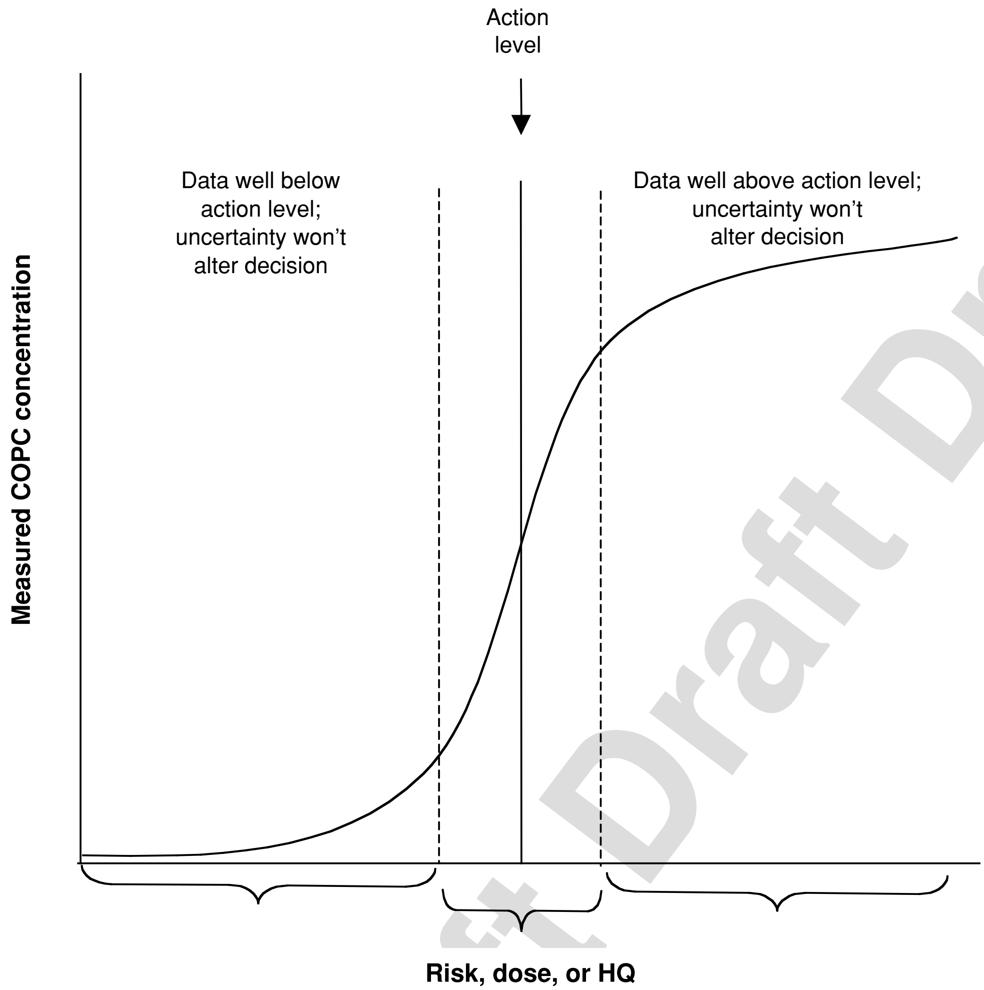

Figure 3.2-5. Effects of uncertainties on corrective action decisions

A less subjective and ambiguous version of the second example given in Section 3.2.2.1(e), above, is: If one or both of the following conditions is true, based on mean (plus two standard deviations) measured contaminant concentrations using standard EPA risk assessment methodologies, corrective measures must be evaluated for the site; otherwise, the site will be recommended for NFA under NFA Criterion 5:

- the incremental excess cancer risk to the maximally exposed off-site hypothetical adult receptor is greater than 10^{-6}, and/or
- the HI to the maximally exposed off-site hypothetical adult receptor is greater than 1.

This decision rule recognizes uncertainty within the metric (mean plus two standard deviations), and manages it by (1) stating acceptable assessment methodology and (2) using relatively conservative action thresholds to ensure against a decision to recommend NFA rather than evaluate corrective actions.

Decision rules for evaluating and/or optimizing corrective measures for a site incorporate the EPA's threshold and balancing criteria presented in Section 3.1.4.5 of this document. These criteria are ambiguous, and clear action thresholds and metrics must be determined to ensure that evaluations are meaningful and that decisions can be and are made.

(g) Development and Optimization of the Design for Obtaining Data

The ER Project uses the information from the site conceptual model in conjunction with the DQO process to select an appropriate sampling strategy for a site. Like the conceptual model, DQOs evolve as more information about a site becomes available. The data-collection activities identified in the DQO planning process are documented in work plans/SAPs (see Appendix E of this document). The SAP is site-specific and includes a clear statement of

- the decision being addressed by the data to be collected;
- the applicable decision inputs, bounds, and decision rules;
- the quantitative limits of acceptable decision errors (when appropriate);
- the consequences of incorrect decisions;
- the quality objectives for the data or the investigation objectives; and
- the required sensitivity, precision, and bias for each measurement in each matrix sampled.

3.2.2.2 Data Quality Assessment

Following data collection, ER Project data are evaluated against DQO specifications to determine if the data meet the expectations expressed in the specifications. This process, called data quality assessment, includes determining if

- newly collected data are appropriate to, and adequate for, making the decision and
- assumptions made for the conceptual model are valid and appropriate to the site.

If the newly collected data are not sufficient to make the decision, more data collection is required.

3.3 Field Sampling

To implement the RCRA corrective action process, the Laboratory ER Project undertakes many sampling activities, including data collection for

- investigations described in RFI work plans and any supplemental RFI sampling and analysis for which a need is identified;
- field observations to support field decisions;
- delineation of the extent of contamination at a site, or of an area requiring remediation before and during a corrective action;
- verification sampling to demonstrate that a corrective action is effective; and
- monitoring required as part of an interim action or a final remedy.

3.3.1 Objectives

In preparing SAPs, alternative sampling and analysis options are evaluated, and the most cost-effective design expected to meet the planning specifications is selected. Selecting a particular sampling design defines the type and number of samples required and the means of allocating samples. Specific sampling locations (and/or frequency of sample collection) are selected along with sample acquisition methods, measurement methods, and other procedures used to collect and analyze samples.

Potential data quality concerns are identified for each type of measurement to be made, based on the proposed use of the data and foreseeable consequences of errors resulting from incorrectly interpreting measurements. Data quality concerns include, but are not limited to

- collecting an adequate number of samples to support the decision;
- selecting sample locations that adequately define the nature and extent of contamination;
- selecting measurement techniques and methods that are selective, sensitive, and precise enough to distinguish target analyte concentrations from prespecified threshold levels;
- collecting samples representative of the media of interest; and
- maintaining the desired degree of data comparability to allow statistically valid evaluation or pooling of the data.

3.3.1.1 Data Collection

The ways in which the collected data are summarized and used in decision-making are also detailed in the SAP. When appropriate, quantitative limits of acceptable decision errors are specified. The consequences of making an incorrect decision are also considered. Based on this analysis of consequences, a statement of the quality objectives in quantitative terms (e.g., limits on decision errors) is made. If there is no basis for establishing quantitative criteria, the SAP specifies investigation objectives qualitatively.

The scientific and statistical assumptions that form the basis of a SAP include contaminant transport models, exposure models, and statistical models. Developing a statistical design requires making certain assumptions about the relative contribution of variability and error so as to maximize the probability that the data collected adequately support an associated decision. The SAP specifies the required sensitivity, precision, and bias (based on the historical performance of measurement systems) for each measurement in each matrix sampled. In addition, criteria for completeness are specified and incorporated into the SAP design.

During site characterization, filtered water samples may be collected (in addition to unfiltered samples) in order to evaluate contaminant fate and transport. Filtered groundwater samples are obtained for inorganic analysis to address one or more of the following circumstances that may exist at a PRS:

- Barium, chromium, or cobalt is a suspect COPC (New Mexico Water Quality Control Commission standards based on filtered samples for these chemicals are lower than EPA maximum concentration levels).
- Aquatic-life criteria (which are based on filtered-water samples) are needed to perform a risk assessment.

(a) Sample Location and Frequency

A SAP details the following sample location and frequency information:

- the number, or frequency of collection, for each type of sample (e.g., grab, integrated) to be collected;
- the sampling network design (e.g., rectangular or triangular grid, stratification) and the assumptions underlying the design;
- the approximate locations of sampling points;
- the techniques and/or guidelines to be followed in selecting sampling points using field measurement methods (as applicable), a description of or reference to the measurement technique/method to be used, and a description of how field screening results are to be used;
- the methods that will be used to locate sampling points in the field if sampling points are to be selected during field activities; and
- references to all administrative procedures and SOPs that will be used to carry out the work under the SAP.

(b) Sample Designation

All ER Project samples receive unique sample identification numbers (IDs), and all ER Project sample locations receive unique sample location IDs. Sample splits receiving different treatment (e.g., filtered and unfiltered splits of water samples) receive separate sample IDs. This numbering system ensures that all information required for identifying and tracking samples is readily accessible and unique to a particular sample. It also provides a tracking capability that facilitates data retrieval.

3.3.1.2 Field Measurements

Field measurements are used to bias the locations of samples, to determine the number of samples needed for site characterization, or to provide a preliminary assessment of nature and extent of contamination. If field measurements are used to guide fixed laboratory sampling locations and to support site decisions, correlations to laboratory measurements are verified statistically.

3.3.2 Field QA/QC Program

Only equipment that is maintained and calibrated in accordance with the manufacturer's recommendations or in accordance with equal or more stringent standards is used for data collection.

3.3.3 Sampling Equipment and Procedures

3.3.3.1 Sampling Procedures

Sample collection methods are selected to preserve sample integrity and to ensure that the samples adequately represent the environmental media from which they are taken. Considerations for selecting sampling methods include the

- environmental media to be sampled;
- portion of the environmental medium to be represented by the samples (e.g., 0- to 12-in. depth of entire site);

- description of how the material collected at each sampling point will be partitioned for analysis;
- types of samples needed in the sample collection design;
- types of analyses to be performed on the samples and any special sampling tool or method required by the analytical methods;
- volume of each sample necessary to satisfy all analysis requirements;
- size and type of sampling equipment appropriate for collecting the desired samples;
- decontamination activities that must be performed on nondisposable sampling equipment prior to and between uses;
- waste minimization (including the minimization of decontamination wastes) when it is cost-effective;
- classification of all measurements as critical (i.e., required to achieve SAP objectives) or noncritical (included for informational purposes only); and
- constraints on the sampling events that might significantly affect the projected time or costs (e.g., threats to endangered species).

Special consideration is given to the collection of samples for volatile organic compound (VOC) analysis in order to maintain sample integrity and minimize analyte loss through sampling, containerization, extraction, and analysis procedures. For site characterization, the ER Project follows the sampling and preservation methods recommended in EPA SW-846 Method 5035 (EPA 1998, 64779) as modified in “Technical Guidance on EPA SW-846 Method 5035 Sampling” (Environmental Restoration Project 2000, 65090).

The appropriate method of obtaining soil samples for site characterization is to collect discrete samples by depth intervals. Composite sampling is conducted following the guidance in Section III.B.1.a of NMED 1998 (57897).

Filtered and unfiltered inorganic groundwater samples are collected in accordance with Section III.B.2.b of NMED 1998 (57897).

3.3.3.2 Field Quality Control Sampling Guidance

In addition to the specification of type, frequency, and number of field samples and/or measurements to be made, the SAP documents the type and number of quality assurance (QA)/quality control (QC) samples to be collected in the field. QA/QC samples are used to provide information about variance (regardless of source) and/or bias during data assessment. Examples of field QA/QC samples include field blanks, field duplicates or collocated samples, and equipment rinsates.

3.3.3.3 Equipment Decontamination

Nondisposable sampling equipment is decontaminated following appropriate EPA guidance in SW-846 (EPA 1998, 64779).

3.3.4 Sample Handling and Analysis Procedures

To provide legal and technical defensibility of ER Project sample data, chain-of-custody requirements are implemented. Chain-of-custody records are initiated at the time of sample collection and remain active until final disposition of the sample.

All ER Project samples are shipped in accordance with International Air Transportation Association or US Department of Transportation regulations (49 CFR 171–173).

All analytical services are coordinated through the Sample Management Office (SMO). All samples submitted through the SMO are analyzed at ER Project-approved internal or external fixed laboratories. The analytical services statement of work (LANL 1995, 49738) specifies the required sample preparation, analytical methods, and associated QC requirements for the following routine analytical suites: metals and inorganic compounds, VOCs, semivolatile organic compounds, organochlorine pesticides, PCB compounds, high explosives, and radiochemical analytes.

Analytical method selection is based on the requirements of the decision to be made. These requirements reflect the following considerations:

- required analytical information (e.g., analyte list, including whether determinations are made for total, soluble, extractable, isotopic, volatile species, and how the data are used);
- sensitivity;
- selectivity;
- precision and bias;
- sample preparation;
- sample holding times;
- turnaround time;
- waste minimization;
- cost; and
- data comparability.

Whenever possible, analytical methods are selected to ensure that BV or SAL/ESL concentrations can be detected. SW-846 methods (EPA 1998, 64779) or the EPA Contract Laboratory Program statement of work is used for fixed laboratory analysis of organic and inorganic chemicals in soil samples unless other methods are justified. Surface water and groundwater samples are analyzed using either EPA SW-846 or the methods specified in 40 CFR 136, "Guidelines Establishing Test Procedures for the Analysis of Pollutants."

If a particular site investigation requires the measurement of analyte concentrations less than the lowest concentrations measured by routine analytical methods, the ER Project selects an appropriate analytical method that will provide lower detection limits, if practicable.

Although the toxicity characteristic leaching procedure (TCLP) is not used in risk assessments or for confirmation sampling, the ER Project does use TCLP analysis to characterize waste and determine disposal options. TCLP analysis is not used to determine the nature, rate, and extent of contamination or to determine SALs or a release.

Data Verification and Validation

Data verification and validation procedures are used to determine whether data packages received from an analytical laboratory were generated according to contract specifications and contain the information necessary to determine if the data are sufficient for decision-making. ER Project validation procedures are based on EPA national functional guidelines for organic (EPA 1994, 48640) and inorganic (EPA 1994, 48639) data review. Radionuclide validation procedures follow American National Standards Institute guidance (ANSI 1997, 64780).

Data qualifiers (letter codes attached to data results) are used in the data validation process to designate potential deficiencies associated with individual sample results. Each data qualifier is accompanied by a reason code that provides information about the deficiency that led to qualification of the data. The validation procedure used for routine analytical services provides information about the reason the qualifier was applied and its potential impact on the affected data, so that the data may be used appropriately.

This process results in validation reports used to direct focused data validations. Focused data validations are required to evaluate the data's usability and may be required as a follow-up to the routine validation process or to the data analysis review process. The purpose of a focused validation is to determine the technical adequacy of measurement data for a particular decision when

- the data are qualified as deficient or requiring professional judgment during the verification/baseline validation process. For example, when holding times are exceeded or interferences are present, a focused validation may be required to help determine data adequacy.
- the data quality assessment process requires additional information about the

    variability or uncertainty of the reported data, or

    data quality before making a data-use decision because of anomalies detected in a data set.

3.4 Site Management and Record Keeping

This section summarizes various measures required to implement ER Project field activities. Site access and security, temporary facilities, waste management, spill-and-discharge control measures, and contingency plans are some of the items that must be considered in order to develop project-specific plans. This section contains a general discussion of these considerations and broadly describes the elements associated with them. Each project-specific plan addresses these topics individually, providing greater detail as required by the activities conducted at the site.

3.4.1 Site Access and Security

The Laboratory maintains responsibility for all access and security measures required to gain access to a site. Site security at sites that are undergoing remedial activities is performed in accordance with the requirements presented in Section 5.4.2, Site Control, of this document.

3.4.2 Temporary Facilities

Temporary support facilities for remedial operations are identified in Laboratory reports submitted to the NMED monthly by the Hazardous and Solid Waste Group (ESH-19). Temporary facilities that fall under the auspices of the ER Project include satellite accumulation areas and less-than-90-day storage areas. Detailed descriptions of these types of temporary facilities are included in Section 6.3.2, Control Measures, of this document.

3.4.3 Waste Disposal

Waste disposal for ER Project activities to be implemented at the Laboratory are addressed in Section 6.3.1, Waste Types, of this document.

3.4.4 Contingency Planning

A contingency plan is an alternative action taken by the ER Project if a problem or interruption occurs during field activities. Before alternative actions are implemented, appropriate ER Project personnel are notified to approve implementation of alternate strategies. Certain reasonably anticipated alternative actions are addressed in site-specific health and safety plans. Other reasonably anticipated alternative actions are addressed in site-specific SAPs. In case of major deviation from planned activities, the NMED is contacted to discuss the alternative action. As a result of major deviation allowed by NMED, the ER Project will realign activities to be consistent with the new scope.

3.4.5 Record Keeping

ER Project-wide requirements for documentation and records are detailed in Chapter 4 of this document. All archival documentation (e.g., maps, engineering drawings, photographs, reports, memos, letters, and personnel interviews), logs, field data reports, instrument calibration records, check-sample analyses, and raw data must be submitted to the RPF. Once data and documentation are delivered to the RPF, they are available to data users. Data generated from internal or contract analytical laboratories are submitted to the SMO, following the requirements of the statements of work for the analytical laboratories. All final results and electronic data needed to support decision-making are submitted to the Facility for Information Management, Analysis, and Display.

REFERENCES FOR CHAPTER 3

The following list includes all references cited in this chapter. The parenthetical information following the reference provides the author, publication date, and ER Project identification (ER ID) number. This information is also included in the citation in the text and can be used to locate the document.

ER ID numbers are assigned by the Laboratory's ER Project to track all material associated with Los Alamos National Laboratory corrective action sites. These numbers can be used to locate copies of the documents at the ER Project Records Processing Facility and, where applicable, within the ER Project reference library. The references cited in this report can be found in the volumes of the reference library titled "Reference Set for Regulatory Compliance Focus Area."

Copies of the reference library are maintained at the New Mexico Environment Department Hazardous and Radioactive Materials Bureau, the Los Alamos Area Office of the US Department of Energy, the US Environmental Protection Agency, and the ER Project Office. This library is a living document that was developed to ensure that the administrative authority has all the necessary material to review the decisions and actions proposed in this report. However, documents previously submitted to the administrative authority are not included in the reference library.

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4.0 RECORDS MANAGEMENT PLAN

4.1 Organization

This plan constitutes the Records Management Program for the Environmental Restoration (ER) Project at Los Alamos National Laboratory (the Laboratory). It supports environmental cleanup work conducted by the US Department of Energy (DOE) and the University of California (UC) by establishing general guidelines for records management, including technical data. All work conducted under this plan is performed in accordance with internal administrative controls such as quality procedures (QPs), standard operating procedures (SOPs), and management guidance. The guidelines have been developed in cooperation with the ER Project quality assurance staff and the Laboratory Computing, Information, and Communication (CIC) Division staff.

The Records Management Plan interfaces with other chapters of this Installation Work Plan mandated by Module VIII of the Laboratory's Hazardous Waste Facility Permit (EPA 1994, 44146). This plan contains three major sections: Section 4.1, the introduction, presents the organization, regulatory mandate, purpose, objectives, and terminology of the plan. Section 4.2 describes records management procedures and their implementation. The ER Project Records Processing Facility (RPF) and Facility for Information Management, Analysis, and Display (FIMAD) are described in Section 4.3.

4.1.1 Regulatory Mandate

The development and implementation of this plan are mandated by Module VIII of the Laboratory's Hazardous Waste Facility Permit. General requirements for data management are presented in Task II, Section B, of Module VIII, but many other references to technical data are made throughout the document. The manner in which documentation of work performed under the permit is managed is of primary importance. Proper records management ensures the integrity of the data and documentation submitted to the New Mexico Environment Department (NMED) and the US Environmental Protection Agency (EPA). ER Project records also include the publicly accessible documentation that make up portions of the administrative record (AR).

4.1.2 Objectives

The Records Management Program Plan establishes the framework necessary to

- provide general guidelines to process, manage, retrieve, store, and protect records relevant to ER work conducted under Module VIII;
- provide an ongoing tool to support the technical efforts of DOE, UC, and its ER Project contractors;
- provide an opportunity for public involvement; and
- provide a support system for management decisions throughout the life of the project.

The plan addresses project needs for all forms of technical data, project records, photos, site reference literature, and other documentation. The records are collected, organized, electronically indexed, microfilmed, stored, and protected with the goal of providing efficient use and retrievability to a diverse group of users. This goal applies to both manual and automated methods of handling records. The plan enhances interactions with the local community and adjacent communities through the ER

Communications and Outreach Team, the NMED, EPA Region 6, DOE, Citizens Advisory Board, and other parties who may have an interest in the ER Project at the Laboratory.

The objective of this framework is the effective management of records generated and/or used by the ER Project at the Laboratory. It is important that the plan be consistently implemented to provide an auditable and legally defensible system for records management. Coordination with other aspects of the ER Project is important for achieving useful project-wide guidelines for managing records and obtaining technical data, which, in some cases, are not reproducible.

4.1.3 Terminology

Terminology must be consistent to ensure that information is correctly conveyed to the reader of this plan. Definitions for records, technical data, information, and other terms are varied and rigorously debated. To ensure consistent use of terms, the statutory definition for “records” (44 USC 3301) is used. “Records” are “...books, papers, maps, photographs, machine-readable materials, or other documentary materials, regardless of physical form or characteristics, …appropriate for preservation... because of the informational value of the data in them.” Thus, the term “records” may include technical data and is used in this document to reflect the broader scope of protecting all ER Project records.

4.2 Description

This plan delineates how ER Project records are handled to ensure the integrity and protection of information in order to maintain efficient, centralized, and cost-effective access for the legal and technical defensibility of records.

4.2.1 Work Flow, Procedures, and Control

The plan incorporates a threefold approach based on records control and commitment to quality program guidelines. This approach includes the following precepts:

- structured work flow for records—records control is maintained through a structured work flow and processing procedure for records.
- use of approved procedures—program requirements are met through the documented use of approved procedures by appropriately trained employees.
- referable information base—ER Project records are part of a compilation of an information base accessible to ER Project participants while providing records protection through a documented process of change control.

4.2.2 Implementation

Structured Work Flow for Records

ER Project participants must transmit their records to the RPF. ER Project records normally are used to make a decision, or they document the normal and routine course of conducting ER Project work. Documentation pertaining to decisions, including technical data, must be transmitted to the RPF for inclusion in the AR. This documentation may take the form of Resource Conservation and Recovery Act facility investigation reports or similar records documenting project decisions.

Participants are required to review their records to determine whether the information represents an ER Project record. This determination can be made in two ways:

- ER records are those specifically identified in QPs, SOPs, ER Project plans, and management guidance documents;
- ER records are those identified at the discretion of ER Project participants as essential to the project and required for the functioning and/or interests of the ER Project.

Upon receipt of the records, the RPF takes the following steps:

- reviews record for legibility, completeness, and sensitivity;
- completes electronic indexing for each record received;
- makes a microfilm copy of the record (any records that are not suitable for filming are stored at the Laboratory CIC Division long-term records storage facility);
- enters the microfilm roll number and box number globally in the ER Project record database; and
- forwards the original record and a microfilm copy to CIC Division for long-term protection; working copies of the records are made available at the RPF.

Use of Approved Procedures

Project records are processed under applicable procedures. Personnel involved in processing records are trained and documented in the use of these procedures.

Referable Information Base

Records sent to the RPF provide a base of information to which all project participants can refer. They include records that document ER Project activities at the Laboratory, as well as certain records originating outside the ER Project that have been transmitted in accordance with the records management procedure.

Administrative Record

An AR contains the documents that form the basis for the selection of a response action. The AR may contain privileged information. Privileged information is listed in the AR but is inaccessible to the public because it includes attorney work product, attorney-client privileged information, or other privileged information protected under the Privacy Act.

4.3 Description of Records Management Facilities

Records Processing Facility

The RPF receives, processes, and retrieves ER Project records. The RPF maintains working copies of records used in compiling site histories for corrective action sites. Original transmittals and a micrographic copy are sent to the Laboratory's CIC Division long-term records storage facility to ensure compliance with the ER Quality Management Plan requirements for retention and protection (Environmental Restoration Project 1998, 59575). The RPF is the central location of the AR and also functions as an interim information repository to assist project participants in conducting their work, particularly in locating site historical information, which may influence cleanup decisions. As part of this function, it provides the capability to retrieve records based on a variety of parameters such as subjects, originators, technical areas, dates, corrective action sites, and structures. ER Project participants may request records from the RPF.

The RPF staff works closely with the ER Project staff, Community Relations Office, Legal Counsel Office, Public Affairs Office, and Security and Safeguards Division to facilitate timely public awareness and access to ER Project documentation. Section 7.2.2 of this document provides detailed information regarding public repositories where ER documentation is located.

Facility for Information Management, Analysis, and Display

The ER Project Office established the FIMAD to provide the tools, systems, and expertise needed to support the large amount of spatial and tabular data collected as part of the ER Project. This information is readily available to project participants through a variety of media, including a network of workstations. The FIMAD taps the expertise of Geographical Information Systems (GIS) and database specialists to provide ER Project personnel with a relational database management system, database query results, spatial analyses, and data visualization.

The FIMAD's capabilities are

- geographic analysis, which uses the ARC/INFO GIS with ARC/View as the sophisticated graphical user interface;
- GIS capability, which focuses on data that are spatial in nature (location of buildings, roads, rivers, sample sites, boreholes, etc.);
- GIS specialists, who produce customized maps and perform complex spatial analysis (e.g., identify boreholes that penetrate the aquifer and are statistically within a certain distance of the action level);
- a database management team that uses the ORACLE relational database and focuses on specifying, constructing, and maintaining the complex database structures necessary to store a wide variety of data;
- expertise to understand the visualization and analysis needs of the ER Project and to meet these needs either by finding suitable commercial software or by developing in-house applications;
- provision of efficient and appropriate computer resources to access, maintain, and analyze data; and
- maintenance of an automated backup and copy to a disaster recovery facility.

Configuration management is implemented as a means of accounting for, controlling, and reporting the planned and actual design of components for FIMAD. Configuration management ensures that the latest version of the whole system is always approved and accessible. The end product of configuration management is formal documentation of the process of systems development to permit identification of relevant configuration at any given period in the life of the ER Project. The documentation follows accepted practices for designing and developing information systems. Configuration management during development of FIMAD allows flexibility in selecting system components.

Integrated Capabilities of RPF and FIMAD

The ER Project uses a hybrid approach to records management that incorporates the power and functionality of imaging technology and the reliability and wide acceptance of micrographics.

Optical Disk Storage. Optical storage systems efficiently store enormous volumes of information. Optical disk storage is used at the FIMAD to efficiently store and disseminate information via the FIMAD network. Legal issues related to optical disk storage are accommodated through the use of micrographics, as described below.

Microfilm. Industry standards for microfilming technology are reliable and widely accepted; therefore, this technology is used for capturing most ER Project records. Microfilm standards and legal defensibility are well established. Microfilm may also be used to transmit color graphics information or may be used as the source for digitizing project records in the future.

File Standards and Compatibility. The ER Project uses several different operating systems, including Microsoft Windows and NT, Apple, UNIX, and the Virtual Memory System, that are not directly compatible. The problem of file compatibility is neither unique to the ER Project nor is it simple. This plan specifies using systems that adhere to existing standards and protocols to exchange information.

Progress in Technology

Changes in hardware and software technology are frequent and substantial and demand that attention be given to industry standards. How a product fulfills regulatory requirements for records retention, data access, and legal defensibility influences which products are selected. Personnel assigned to operate and maintain the ER Project Network and the FIMAD keep abreast of industry trends and recommend conversions and/or modifications to the system, as necessary, to keep it a viable component of the ER Project.

Retention requirements for many records extend well beyond the typical life of systems currently used. Retention requirements are met by converting records, when practicable, to archive-quality micrographic media, subject to regulatory guidelines and approval. The ER Project currently uses an “indefinite” records retention period until the Laboratory’s Information Resource Management Program is fully implemented.

REFERENCES FOR CHAPTER 4

The following list includes all references cited in this chapter. The parenthetical information following the reference provides the author, publication date, and Environmental Restoration (ER) Project identification (ER ID) number. This information is also included in the citation in the text and can be used to locate the document.

ER ID numbers are assigned by the Laboratory's ER Project to track all material associated with Los Alamos National Laboratory corrective action sites. These numbers can be used to locate copies of the documents at the ER Project's Records Processing Facility and, where applicable, within the ER Project reference library. The references cited in this report can be found in the volumes of the reference library titled "Reference Set for Regulatory Compliance Focus Area."

Copies of the reference library are maintained at the New Mexico Environment Department Hazardous and Radioactive Materials Bureau, the Los Alamos Area Office of the US Department of Energy, and the ER Project Office. This library is a living document that was developed to ensure that the administrative authority has all the necessary material to review the decisions and actions proposed in this report. However, documents previously submitted to the administrative authority are not included in the reference library.

EPA (US Environmental Protection Agency), April 19, 1994. Module VIII of RCRA Permit No. NM0890010515, EPA Region VI, new requirements issued to Los Alamos National Laboratory, Los Alamos, New Mexico, effective May 19, 1994, EPA Region VI, Hazardous Waste Management Division, Dallas, Texas. (EPA 1994, 44146)

Environmental Restoration Project, June 10, 1998. "Quality Management Plan for the Los Alamos National Laboratory Environmental Restoration Project," Revision 0, Los Alamos National Laboratory document, Los Alamos, New Mexico. (Environmental Restoration Project 1998, 59575)

5.0 HEALTH AND SAFETY PLAN

5.1 Introduction

5.1.1 Purpose and Applicability

The Environmental Restoration (ER) Project at Los Alamos National Laboratory (the Laboratory) has developed a health and safety plan (HASP) (LANL 2000, 65050) to comply with applicable US Department of Energy (DOE) and federal and state occupational safety and health requirements. The HASP establishes generic health and safety (H&S) information and requirements applicable to ER field operations project-wide.

Chapter 5 of this Installation Work Plan (IWP) is based on the HASP. The differences between this chapter and the HASP are that (1) some of the detail in the body of the HASP does not appear in this chapter, and (2) the HASP contains several appendixes that are cited in this chapter and have not been included in the IWP. To meet new requirements and changing project needs, the HASP is frequently updated; the IWP will be updated at the same time to reflect those changes.

To supplement the generic guidance published in this chapter, a site-specific health and safety plan (SSHASP) is prepared for each field project as assigned by the focus area project leader (FAPL). As used in this chapter, “field projects” refers to investigation or cleanup of a corrective action site or group of corrective action sites. Each SSHASP supplements the HASP by providing additional H&S information and requirements indicated by the operations and conditions at individual project sites.

The Laboratory acknowledges that potential hazards are inherent in the performance of ER field operations. Accordingly, the Laboratory expects that work conducted under the ER Project will be performed in a safe and healthful manner that minimizes the threat and occurrence of hazards to health, property, and the environment to levels as low as reasonably achievable (ALARA). In the interest of protecting health and property (the Laboratory’s personnel and property, the local public and their interests, and the personnel and equipment involved in conducting ER work), programs, plans, and procedures associated with the performance of ER field projects are subject to approval by designated Laboratory representatives before implementation. However, such approval in no way relieves ER participants from complying with specific regulatory requirements pertaining to H&S programs, plans, procedures, and work practices, nor does such approval relieve ER participants from their personal responsibility for maintaining a safe and healthful work environment. The term “ER participants” refers to anyone performing work, including DOE and Laboratory personnel, federal and state oversight personnel, subcontractor personnel, and their lower-tier contractors, consultants, and agents (see Section 5.4.2.1 on Site Visitor Policy).

Furthermore, ER Project participants are responsible for conducting work in accordance with applicable federal, state, and local regulations. In some cases in this chapter and as indicated in the SSHASP, the Laboratory has chosen to invoke Occupational Safety and Health Administration (OSHA) and Laboratory requirements that ordinarily might not apply to ER field operations (e.g., OSHA's general industry standards in Title 29 of the Code of Federal Regulations [CFR] Part 1910 [29 CFR 1910]). These choices were made on a case-by-case basis to maintain consistency with the Laboratory's ALARA policy and to clarify the Laboratory's expectations with regard to interpretable requirements of the multiple agencies governing ER work.

When there is concern that implementation of work orders or H&S requirements would conflict with contract terms or could unreasonably compromise the safety or health of an individual or the environment, such concerns must be brought to the attention of the contract administrator and the

ER/H&S representative (Section 5.2.1.4) immediately. Failure to comply with the terms of H&S plans may constitute cause to stop activity or to issue a stop-work order as specified in Section 5.4.2.3 of this document without cost or penalty to the Laboratory.

The ER Project has provided to project participants the ER Project HASP consisting of the material in this chapter and the HASP appendixes containing forms and procedures. It has also provided a model SSHASP. Both the HASP and the completed SSHASP for each project are kept readily available for reference by individuals performing ER field operations to govern the conduct of work at the applicable site(s).

5.1.2 Review and Approval

Before any work is initiated, the project team submits a completed SSHASP, in draft form, to the H&S representative for the focus area, who will circulate it to appropriate Laboratory personnel for review and approval. Each SSHASP submitted must be signed by an authorized representative of each ER participant-employer whose employees are subject to the terms of the SSHASP. The employer's signature on the signature page serves as a certification that the employer has reviewed, concurs with, and will comply with the terms of the HASP and SSHASP. After signing the signature page, the FAPL returns the SSHASP to each employer.

Additionally, each individual who needs to enter a controlled area of a site where access has been limited in accordance with a SSHASP signs an acknowledgment form (Appendix B of the HASP) to acknowledge that he/she has read or has been briefed on and understands the contents of the HASP and applicable SSHASP and agrees to abide by the terms of these documents.

5.1.3 Integrated Safety Management

The ER Project embraces the implementation of the Laboratory's Integrated Safety Management (ISM) System (LANL 1999, 64707). All ER Project activities and documents are designed to be consistent with this over-arching environment, safety, and health policy. The ER Project accepts the responsibility for understanding and implementing the appropriate Laboratory Performance Requirements and Laboratory Implementation Requirements. ISM implementation is accomplished through worker involvement, communication, and feedback at all levels and is documented here, in the HASP, in each SSHASP, and in every task hazard analysis.

The five ISM core functions are summarized below along with how these functions are implemented in the ER Project.

1. Define the Scope of Work:

   All ER Project work is part of a well-defined work breakdown structure. Individual scopes of work are further defined into tasks, subtasks and activities. This structure has been in place since the Project's inception and is ingrained into the culture.

2. Analyze the Hazards and Environmental Aspects:

   Based on the defined scope of work and before any fieldwork is conducted, SSHASPs are prepared that address well-defined health and safety requirements. Field supervisors and site safety officers (SSOs) identify and analyze the potential hazards and document them in task hazard analyses (THAs). Each SSHASP contains as many THAs as necessary to address all potential safety and environmental hazards associated with the activity.

3. Develop and Implement the Controls:

   After identification and analysis of hazards, engineering, administrative, and personal protective equipment control measures are considered. The most suitable controls are incorporated into the THAs. The hazard controls are then integrated into the overall work plan.

4. Perform the Work:

   The scope of work is then executed. Each day the field team reviews the hazards and controls for the work they are about to perform. Every member of the field crew has the opportunity to question and provide feedback on the effectiveness of the controls during daily safety meetings. The field supervisor and SSO ensure that all work is conducted within the defined controls.

5. Ensure Performance:

   Changes to THAs are incorporated on a real-time basis based on feedback from the field team and as conditions change. Opportunities for performance improvement are often recognized based on the experience and ingenuity of the field teams. Such improvements are carried over to other fieldwork through the sharing of SSHASPs and THAs across focus areas and through the lessons learned process.

It is through these activities that the ER Project seeks to continuously improve safety performance and contribute to the Laboratory's commitment to ISM.

5.2 Personnel

5.2.1 Organization

The purpose of this section is to clarify the roles, responsibilities, and authority of individuals as they relate to H&S and to describe the organizational structure and lines of communications that are necessary to achieve the ER Project safety objectives. This section complies with the Laboratory's Integrated Safety Management (ISM) System, the Price Anderson Act Amendments, and OSHA Hazardous Waste Operations Emergency Response (HAZWOPER) requirements.

Defining H&S responsibilities, authority, and lines of communication for the ER Project is complicated by the matrix structure of the organization and the involvement of multiple subcontractor organizations. Over time, effective H&S structure and communications methods have evolved as described in this section. The following fundamental concepts help one understand the basis for the H&S structure and communications.

Line Organization and Management – A basic premise of ISM is that line management is responsible for safety. The ER Project endorses and abides by this concept. Because individuals from many different line organizations (Laboratory divisions) are matrixed to the ER Project, it is common practice for the ER Project to work out memorandums of understanding or similar agreements so that individuals from other line organizations always know and understand their safety chain of command.

Programmatic Organization and Management – Many H&S issues are inherent with environmental restoration and must be addressed at the program level. Decisions are made that protect all workers in the ER Project, regardless of employer. These decisions and policies are described in program H&S requirement documents such as the HASP. It is the responsibility of the line organizations to implement H&S and meet the programmatic requirements.

Facility Management Organization and Management – The ER Project performs work in many facility management units (FMUs) across the Laboratory. The ER Project must comply with the H&S requirements of those FMUs. To facilitate compliance, the ER Project and FMUs agree on formal “work packages.” The FMU H&S requirements, defined in the work package, are then incorporated into SSHASPs prepared for work specifically in that FMU.

Subcontractor Organization and Management – Several subcontractors perform work as part of the ER Project Team. As private employers, they are obliged (legally and contractually) to maintain their own H&S programs and line management structure. Subcontractors integrate the ER Project programmatic H&S requirements into their H&S programs as necessary while still maintaining a degree of H&S autonomy. Subcontractors prepare SSHASPs for each field project. In the SSHASPs, lines of communication are defined that link subcontractors to Laboratory’s ER Project line organizations. SSHASPs are reviewed and approved by Laboratory personnel. This mechanism, along with Laboratory field oversight, helps ensure that appropriate programmatic and line safety is integrated into work performed by subcontractors.

Most importantly, H&S roles, responsibilities, authority, and communications are established during the planning stages of every field project. The SSHASPs provide detailed information, ensuring that the ER Project integrates safety in the field, where there are the greatest potential hazards. Specific individuals fulfilling these roles are identified in each site-specific health and safety plan (SSHASP).

5.2.1.1 Project Team

(a) Programmatic Managers

Project Manager

The project manager is a University of California (UC) employee who is ultimately responsible for the safety of people working on the ER Project. His/her responsibilities include

- making H&S policy decisions;
- ensuring that adequate H&S resources are available to meet H&S objectives;
- resolving conflicts between H&S and production that cannot be resolved at a lower level;
- ensuring that FAPLs, team leaders, and subcontractor supervisors/subcontractor project managers comply with H&S programmatic requirements;
- performing safety walk-around surveys;
- supporting and promoting the Laboratory’s ALARA policies and principles;
- ensuring that ALARA program requirements are met; and
- exercising programmatic and line safety management authority as required.

Focus Area Project Leader

The FAPL is a UC employee who reports to the ER project manager. The FAPL may direct one or more team leaders and task leaders. His/her H&S responsibilities include

- exercising programmatic and line safety management authority as required;
- ensuring that the necessary SSHASPs for his/her project unit are developed and that the comments of appropriate reviewers have been incorporated;
- ensuring that the HASP and SSHASPs are implemented for field operations under his/her control;
- delegating H&S responsibility as necessary to maintain a clear chain of command for H&S issues;
- ensuring there is always a designated on-site supervisor;
- ensuring that appropriate communications with FMUs have occurred;
- ensuring that personnel performing work under his/her management meet H&S qualifications;
- communicating anticipated radiological control technician (RCT) support needs to the group leader for the Laboratory's Health Physics Operations Group (ESH-1) and the RCT Pool supervisor, based on current plans;
- resolving H&S issues concerning his/her project;
- prohibiting personnel who do not comply with H&S requirements from working on field projects under his/her control;
- conducting required inspections (Section 12.1 of the HASP); and
- ensuring the submittal of appropriate field project H&S records to the Laboratory's Records Processing Facility (Section 13 of the HASP).

Team Leader

The team leader (usually a UC employee for field projects) may manage one or more field projects. He/she has the flexibility to assume a direct role in management of the fieldwork or may delegate that responsibility to one or more task leaders or subcontractor supervisors/subcontractor project managers. His/her H&S responsibilities include

- exercising line management safety authority as required;
- delegating H&S responsibility as necessary to maintain a clear chain of command for H&S issues;
- ensuring there is always a designated on-site supervisor;
- ensuring that all known tasks, associated hazards, and control measures have been identified;
- ensuring that provisions of the SSHASP are implemented for his/her projects;

- ensuring that each concerned party has reviewed the SSHASP for accuracy and adequacy (Section 1.2 of the HASP); also ensuring that review comments are resolved and that the SSHASP is signed before any field activities are begun;
- ensuring that only qualified project team members and support personnel perform ER Project work;
- initiating work authorizations with ESH-1 for RCT support of field activities;
- communicating changes in fieldwork schedules with the RCT Pool supervisor so that adequate RCT support is available;
- ensuring that all field team members receive daily safety briefings;
- ensuring that all required permits have been obtained;
- ensuring that emergency response planning and training has been completed prior to beginning field operations;
- in the event of an incident or emergency, functions as site incident/emergency coordinator; as necessary, arranges for immediate notification of Laboratory emergency response personnel to take control of the scene and/or arranges for immediate notification of appropriate authorities (Section 9 of the HASP).
- conducting necessary inspections (Section 12.1 of the HASP);
- ensuring that necessary field logs and H&S records are produced and kept; and
- providing necessary H&S records to the FAPL at the close of the project (see Section 13 of the HASP).

Task Leader

Through delegation, a task leader may assume some or all of the H&S responsibilities and authority afforded the team leader. When this occurs, it must be authorized by the FAPL and clearly described in the SSHASP. The purpose of such delegation is to maintain a clear H&S chain of command in the field.

Subcontractor Supervisors/Subcontractor Project Managers

A subcontractor supervisor/subcontractor project manager is responsible for ensuring that employees under his/her supervision comply with the HASP and SSHASP. They are responsible for ensuring the full cooperation of their organization with the Laboratory and other subcontractors to achieve H&S objectives. In addition, the subcontractor supervisor/subcontractor project manager must exercise line management safety authority for personnel working for that company. When multiple subcontractors are on a site, each subcontractor must designate an on-site supervisor who has line management safety authority.

Through delegation, subcontractor supervisors/subcontractor project managers may assume some H&S responsibilities and authority afforded the team leader. When this occurs, it must be authorized by the FAPL and clearly described in the SSHASP. The purpose of such delegation is to maintain a clear H&S chain of command in the field.

Subcontractors to UC (second-tier subcontractors) that engage their own subcontractors (third-tier subcontractors) are responsible for ensuring that their subcontractors comply with all programmatic and site-specific H&S requirements. For projects where multiple second-tier subcontractors are working in the field together, ultimate on-site authority resides with the UC team leader or designee.

(b) Field Teams

Project Field Team Members

Project field team members may be part of the ER Project organization, other Laboratory divisions, Laboratory support organizations, or subcontractor organizations. Ultimately, field team members are responsible for conducting work in a safe manner and have the authority to stop work when unsafe conditions exist. They are responsible for abiding by requirements of the HASP, SSHASP, any supplements or modifications, and other applicable H&S regulations and procedures, and for fulfilling and maintaining their individual training and medical surveillance requirements. If there is concern that implementation of work orders or H&S requirements would unreasonably compromise the safety or health of an individual or the environment, such a concern must be brought to the attention of their line supervisor, the SSO, or team leader/task leader. When line managers in the field do not resolve an H&S concern adequately, the matter is brought to the attention of higher line managers or the ER/H&S representative, as necessary. If adequate resolution still has not been achieved, team members are encouraged to call the Laboratory's environment, safety, and health (ESH) hotline at 505-665-5010 or to contact the DOE Los Alamos Area Office at 505-667-5105 where they may file a complaint (Laboratory Implementation Requirement LIR 307-01-04.0, "Safety Concern Program"). The DOE has a policy that employees who report an H&S problem are protected from reprisal.

Facility Management Unit (FMU) Representative

FMU representatives include personnel of the FMU where ER Project activity will occur. The top representative is the facility manager. The facility manager may also be supported by an alternate, building managers and their alternates, and personnel responsible for facility-specific environment, safety, and health. With respect to ER Project activities occurring at facilities throughout the Laboratory, the facility manager, or his/her delegate, is responsible for

- establishing written facility manager-tenant agreements to communicate a mutual understanding of safety interface, requirements, roles, responsibilities, and authorities by facility manager and facility occupants;
- authorizing all facility-related work within the affected FMU boundary, including review and approval of or concurrence with ER Project SSHASPs and supplemental plans, permits, and procedures;
- determining required procedures for consistent application in the facility to stay within facility operating limits;
- periodically reviewing and monitoring operations occurring within the FMU boundary; and
- correcting or shutting down operations or activities that violate the facility-tenant agreement or that compromise safety.

5.2.1.2 H&S Personnel

Site Safety Officer

OSHA requires that a site safety and health supervisor (also known as SSO) be designated and that this person must have the responsibility and authority to develop and implement the site safety and health plan and verify compliance. The SSO may perform other duties on the project team, provided these duties do not compromise performance of his/her SSO duties. On a project-specific basis, the SSO must be qualified to recognize and evaluate hazards and to minimize and mitigate occupational H&S hazards.

The FAPL and/or team leader determines if a dedicated SSO is necessary for non-HAZWOPER projects. If a full-time SSO is not required, applicable duties of an SSO are to be assigned to other qualified personnel who will be on-site.

On projects with multiple subcontractors, there will be more than one person with site safety responsibilities. It is the team leader's responsibility to see that the safety chain of command is clearly defined and documented and that safety coverage is comprehensive.

The specific responsibilities of the SSO are to

- assist with and/or develop the SSHASP;
- verify that on-site personnel have current certification of the applicable training and medical surveillance requirements;
- help the team leader/task leader implement the HASP and SSHASP in compliance with applicable federal, state, and local H&S regulatory requirements;
- perform and document H&S inspections of site operations (Section 12.1 of the HASP);
- notify the team leader/task leader of any on-site personnel who are not abiding by applicable H&S requirements and of potential or actual hazardous situations needing to be rectified;
- notify the FAPL and the ER/H&S representative, when elements of the HASP and SSHASP are not being met and when H&S hazards are not being minimized or mitigated sufficiently;
- watch for changes in site operations and conditions that warrant hazard mitigation and/or modifications to project H&S plans, procedures, permits, etc.;
- ensure that copies of the HASP, SSHASP, supplements, and any modifications are current and that these documents are readily accessible on-site and as needed for ER Project work occurring elsewhere;
- assess the necessity and arrange for monitoring of employee exposures to H&S hazards and convey results and known implications to the team leader/task leader;
- inform the team leader/task leader, the ER/H&S representative, and affected subcontractor supervisors/subcontractor project managers of results of employee exposure monitoring (Section 13.3 of the HASP);

- monitor levels and effectiveness of personal protective equipment and verify proper use, storage and maintenance of equipment; and
- maintain H&S-related field project records, including a daily log of H&S-related matters concerning site operations, and provide these records to the team leader/task leader as necessary before closeout of the project.

Industrial Hygiene Technician

The industrial hygiene technician is a designated team member who is capable of monitoring employee exposures to hazardous substances, and, to the extent necessary for the site-specific work, is capable of evaluating exposure-monitoring results to determine actions necessary to protect individuals on-site. This person may be someone who is training to become an SSO, and, with approval of the team leader/task leader, someone to whom the SSO may delegate his/her responsibilities, as this person is trained and qualified to perform such duties.

Trenching/Excavation Competent Person

This individual is a designated team member or support person, in accordance with 29 CFR 1910.146, “Permit-Required Confined Spaces,” who is capable of identifying existing and predictable hazards in the surroundings, or unsanitary, hazardous, or dangerous working conditions for trenching or excavation. This individual has authorization to take prompt corrective measures to eliminate those hazards and must have had specific training in and be knowledgeable about soils analysis, the use of protective systems, and the requirements of 29 CFR 1926 Subpart P - Excavations (29 CFR 1926.650 *et seq.*).

Registered Professional Engineer

A registered professional engineer is a person who is registered as a professional engineer in the state where the excavation or trenching work is to be performed (29 CFR 1926.650 [b]).

Confined-Space-Entry Supervisor

The confined-space entry supervisor is a designated team member or support person who is responsible for determining whether acceptable entry conditions exist at a confined space where entry is planned, for authorizing and overseeing entry operations, and for terminating entry in accordance with regulatory and permit requirements (29 CFR 1910.146 [b]).

Other Competent or Qualified H&S Personnel

Throughout 29 CFR 1926, “Safety and Health Regulations for Construction,” and applicable standards of 29 CFR 1910, “Occupational Safety and Health Standards,” invoked by the UC, OSHA uses the terms “competent” and “qualified” to denote specially trained and knowledgeable individuals who are required to perform certain job functions. These specific standards are cited as applicable throughout the HASP and SSHASP. Wherever requirements exist in these standards for participation of a competent or qualified person, the person must be trained and knowledgeable of the particular regulated subject matter in accordance with 29 CFR 1926.32(f) or (m), the applicable regulatory standard, and Section 10 of the HASP.

5.2.1.3 Health Physics Personnel

Health physics personnel include radiological screening personnel (RSPs), health protection technicians (HPTs), and RCTs. ESH-1 provides HPTs and RCTs to the ER Project through the RCT Pool. These personnel are the only ones allowed to perform tasks required for compliance with 10 CFR 835, "Occupational Radiation Protection," (e.g., performing a survey for unconditional release of equipment from a field site). RCTs also perform oversight of work performed by RSPs. RSPs are contractor personnel who have a Radiological Surveillance Authorization Agreement (RSAA) with ESH-1. Typically, these agreements allow authorized individuals to perform limited radiological control tasks related to ER field projects.

All health physics personnel working on ER field projects, regardless of employer, are responsible for immediately reporting radiological issues and concerns to the team leader/task leader. If field supervision has been delegated to a subcontractor supervisor/subcontractor project manager, then radiological issues must also be reported to the subcontractor supervisor/subcontractor project manager and the team leader/task leader. It is essential that radiological concerns be reported up through the UC chain of command.

Radiological Screening Personnel (Non-ESH-1 Personnel)

RSPs are responsible for providing health physics monitoring support for the project team. Each RSP is responsible for performing health physics monitoring support in accordance with his/her RSAA. Specific responsibilities include

- maintaining a current and valid RSAA;
- performing radiological control work within the scope of their RSAA;
- performing and documenting housekeeping radiological surveys;
- performing conditional equipment surveys;
- performing daily instrument response checks;
- ensuring that all radiation-monitoring equipment is in good working order;
- ensuring that radiological postings are maintained;
- immediately notifying the team leader/task leader, SSO, and ESH-1 when any contamination occurs to skin or any personal clothing;
- reporting radiological concerns to the SSO, team leader/task leader, and ESH-1;
- providing the RCT Pool supervisor with a daily verbal summary of site radiological conditions and copies of all radiological survey documentation; and
- notifying the team leader/task leader and SSO when action levels defined in the SSHASP have been reached.

Health Protection Technician and Radiological Control Technician (ESH-1 Personnel)

In addition to the responsibilities of the RSP, the responsibilities of the HPT and the RCT include

- preparing, ensuring compliance with, and closing out radiological work permits);
- revising the site radiological work permits when the radiological controls required do not provide adequate worker protection or contamination control;
- providing guidance on radiological decontamination of equipment and personnel;
- performing "unconditional release" surveys for equipment (RCTs only);
- providing regulatory compliance guidance to the team leader/task leader when field conditions change and radiological issues emerge; and
- reporting radiological concerns to the team leader/task leader and to the RCT Pool supervisor.

5.2.1.4 Project Support Personnel

Subcontractor Representative

A subcontractor representative is a management or H&S professional representing an employer affected by terms of the SSHASP. This individual must have the authority to approve the terms of the SSHASP and any modifications and to ensure that employees of his/her employer abide by these terms. Additional responsibilities include

- interfacing with project line managers, other employers' supervisory personnel, and support professionals, as necessary, to coordinate implementation of HASP, SSHASP, and other applicable H&S requirements and
- assisting with resolving H&S issues involving his/her employees performing ER Project work, particularly those involving discrepancies between policies of multiple employers represented on-site and site-specific H&S requirements.

ER/H&S Representative

The ER/H&S representative may be either a UC or contract employee, or subcontractor who is assigned to the FAPL(s) as a technical advisor. This person provides H&S support to personnel performing ER Project work involving his/her assigned project unit(s). He/she serves as liaison between the project unit personnel, ESH Division personnel, and FMU H&S personnel. In addition to the responsibilities of the subcontractor representative, the ER/H&S representative has responsibilities that include

- overseeing health and safety for project units;
- ensuring that SSHASPs for his/her project unit(s) are reviewed by appropriate parties;
- verifying that known hazards, preventive measures, and mitigation controls associated with the project scope of work and tasks have been adequately incorporated in the SSHASP;
- providing or arranging for technical support concerning industrial hygiene, operational safety, and health physics matters;

- reviewing and approving SSHASPs, supplements, and modifications for ER Project work at his/her assigned project sites; and
- verifying that field operations associated with his/her project unit(s) are conducted in accordance with applicable H&S programs, plans, and regulatory requirements.

ESH-1 RCT Pool Supervisor

The ESH-1 RCT Pool supervisor is the point of contact for obtaining radiological control support and oversight (Section 12.2 of the HASP) for ER fieldwork. The Pool supervisor is provided with an anticipated field schedule based on current plans of the ER Project. The team leader/task leader or his/her delegate communicates anticipated radiological support needs, based on the baseline, to the Pool supervisor so he/she may schedule the resources. It is the responsibility of the team leader/task leader to communicate deviations from the baseline and changing support needs to the Pool supervisor at the earliest possible time. The responsibilities of the RCT Pool supervisor include

- scheduling RCTs to support ER fieldwork;
- updating scheduled support needs based on feedback from the team leader/task leader;
- entering into work authorizations with the ER Project for personnel assigned to support the ER Project;
- reviewing H&S documents as necessary;
- working with the team leader/task leader to resolve scheduling/resource conflicts;
- exercising line management safety authority, as required;
- providing regulatory compliance guidance to the team leader/task leader when field conditions change and radiological issues emerge;
- serving as a conduit for feedback from RCTs to ER Project management; and
- reporting radiological issues and concerns to ER Project management, not otherwise reported by RCTs.

5.2.2 Training Requirements

Described in this section are the DOE, OSHA, and Laboratory worker H&S training requirements applicable to ER field operations. In accordance with OSHA's training requirement in 29 CFR 1926.65(e)(1)(ii), "Hazardous Waste Operations and Emergency Response," field team personnel must have the necessary training to perform their assigned task(s) and associated responsibilities. Before the team leader tasks a project field team member with performing an ER field duty, the site safety officer verifies that the field team member has current certifications of required training.

Laboratory employees (including Laboratory contract employees) are eligible to take any courses offered by the Laboratory's ES&H Training Group (ESH-13) and the Property Management Group (BUS-6). ER Project contractors are responsible for implementing their own training programs. With the exception of the Laboratory-specific training described in Section 5.2.2.4, training offered by ESH-13 is available to ER contractors for a fee upon referral by an FAPL. Training offered by BUS-6 is also available to ER contractors for a fee.

5.2.2.1 HAZWOPER Requirements

General Requirements

All employees working on-site exposed to safety hazards, health hazards, or hazardous substances and their supervisors and managers responsible for the site must receive training that meets the requirements of Section 10 of the HASP before they are permitted to engage in HAZWOPER work. Employees are not permitted to participate in or supervise ER field activities until they have been trained at the level required by their job function and responsibility.

Employees and supervisors who have successfully completed the training and field experience requirements of Section 10.5 of the HASP are certified by their instructor, or the head instructor and trained supervisor, as having successfully completed the necessary training. OSHA requires that a written certificate be given to each person so certified.

Trainers must be qualified to instruct employees about the subject matter that they are presenting. Trainers must have the academic credentials and instructional experience necessary for teaching the subject(s) or must have completed a training program for teaching the subject(s). Instructors must demonstrate competent instructional skills and knowledge of the subject matter.

Employers who can show by documentation or certification that an employee's work experience and/or training has resulted in training equivalent to the training requirements of Section 10.5 of the HASP are not required to provide the initial training requirements of Sections 10.5.3 or 10.5.4 of the HASP. The employer must certify this equivalency and provide a copy of this certificate to the employee.

Anyone who has not been certified in accordance with Section 10.5 of the HASP is prohibited from engaging in ER field activities. The general HAZWOPER training requirements described in Section 10.5 of the HASP include

- worker training and supervised fieldwork for periods determined by expected exposure:
- initial 40 hours of training and 24 hours of supervised fieldwork (for areas in which contaminant concentrations may exceed exposure limits) or
- initial 24 hours of training and 8 hours of supervised fieldwork (for areas in which contaminant concentrations are not expected to exceed exposure limits),
- management and supervisor training,
- annual refresher training,
- site safety officer requirements,
- industrial hygiene technician requirements, and
- health physics personnel requirements.

Emergency Response Training

If a FAPL, team leader, or subcontractor supervisor/subcontractor project manager chooses to have on-site personnel take any action other than immediate evacuation of the site in the event of a release or substantial threat of release of a hazardous substance, on-site personnel must receive the training described in Section 10.1.3 of the HASP as applicable for the tasks to be performed. The training categories include first-responder awareness level training and first-responder operations level training. OSHA requires that personnel who have been trained in accordance with this section receive annual refresher training of sufficient content and duration to maintain their competencies or demonstrate their competency at least yearly.

Pre-Job-Start H&S Briefing

In accordance with 29 CFR 1926.65(b)(4)(iii), the site safety officer must conduct training on the contents of the SSHASP before fieldwork begins so that each field team member is informed of the site-specific information and requirements applicable to the scope of work. This H&S briefing covers the contents of the SSHASP and applicable portions of the HASP.

Daily Tailgate H&S Meetings

Before beginning fieldwork each day and before each new shift, the site safety officer and team leader, task leader, or subcontractor supervisor/subcontractor project manager must conduct a tailgate H&S meeting. Field team members should be encouraged to discuss any health- or safety-related concerns during this meeting without fear of reprisal. Topics covered and attendance must be documented. During these tailgate meetings, field team members are informed of at least the following:

- any newly identified hazards and associated monitoring and exposure control measures and results not discussed previously and
- problems or concerns (especially H&S) that have arisen since the previous tailgate meeting.

5.2.2.2 First-Aid Requirements

In accordance with 29 CFR 1926.50, "Medical Services and First Aid," in the absence of a hospital or clinic that is reasonably accessible in terms of time and distance to the work site (i.e., capable of rendering treatment within 4 min of occurrence of the injury or illness), a person who has a valid certificate in first-aid training from the American Red Cross, or equivalent, must be available at the work site to render first aid. Section 10.1.3 of the HASP contains more detailed information concerning first aid.

5.2.2.3 Other OSHA Requirements

OSHA has numerous other standards and associated training requirements applicable to ER work. Some of these requirements apply at a programmatic level and are addressed in Section 5.4.2.1. Other training requirements apply to specific individuals who are either a competent person or a qualified person in the subject matter pertaining to their job function, as defined by OSHA [29 CFR 1926.32(f) and (m)], respectively, and/or as defined by applicable operation- or substance-specific standards (29 CFR 1926 and/or 29 CFR 1910, which are cited throughout the HASP and the SSHASP. Examples of these types of training are those for confined-space entry, lockout/tagout of energized equipment, electrical safety, trenching and excavation, respiratory protection, bloodborne pathogen exposure control, etc.

Site-specific training requirements that meet the requirements of this section are dictated by the operations and conditions occurring on-site and must be specified in Section 10 of the SSHASP or in a modification form to the SSHASP, as the requirement arises.

5.2.2.4 Other Requirements

The Laboratory has certain training requirements that are applicable to personnel who perform work for the Laboratory, which are described in Section 10.2 of the HASP and include

- general employee training,
- health and safety read training,
- health physics checklist indoctrination,
- Radiological Worker II training, and
- waste generator and waste management training.

5.2.3 Medical Surveillance

Before the team leader authorizes access to areas of the site where site controls have been established (e.g., exclusion and contamination reduction zones and other regulated areas), it is the responsibility of the site safety officer to verify that personnel entering such areas have a current certification of medical fitness for duty (Appendix E of the HASP), in accordance with this section. The site-specific medical surveillance requirements that meet applicable OSHA regulations and DOE requirements must be specified in Section 11 of the SSHASP.

A written medical surveillance program that complies with the requirements of this section must be implemented by employers of personnel working for the ER Project. These requirements include

- identification of active participants in the employer's medical surveillance program;
- cost and frequency of examinations;
- content of examinations;
- information to be provided to the examining physician; and
- information to be obtained from the physician, including a form provided in Appendix E of the HASP.

5.3 Site History and Description

General background information descriptive of Los Alamos (i.e., location and prevailing weather conditions) is provided in the HASP (Section 2). Background information specific to the project is provided in the SSHASP (Section 2), including the project's scope of work and descriptions of the corrective action sites.

5.4 Hazard Assessment

Hazard assessment is the process of identifying and evaluating the hazards associated with operational activities and is a fundamental component of the ER Project's Integrated Safety Management System. Evaluation and identification of hazards must occur

- during pre-operational planning of ER fieldwork,
- immediately after initiation of and during performance of tasks with potential hazards,

- before changes in tasks and/or operations,
- as required by changing site conditions, and
- continually, as appropriate.

The Laboratory has provided a method for evaluating and rating hazards in the ER Project health and safety manual (Environmental Restoration Decommissioning Project 1995, 55423). A list of several assessment methods is provided by the DOE HASP guidelines (DOE 1994, 59929). The hazard assessment method and rationale(s) for the resulting assessment(s) are clearly indicated in each SSHASP.

5.4.1 Task Hazard Analysis

OSHA (29 CFR 1926.65[b][4][ii][A]) requires that a hazard analysis be prepared for each task to be performed during the ER field project. The task hazard analysis must identify the likely radiological, safety, chemical, physical, and biological hazards and the affected personnel so that determination can be made of the corresponding exposure-monitoring and response plans, administrative and engineering controls, site control measures, personal protective equipment, medical surveillance, training, and emergency/incident response requirements to be implemented to minimize or mitigate the anticipated site hazards.

Each SSHASP must include a task hazard analysis (Section 4 of the SSHASP) for each of the tasks described in the project scope of work. Field team participants and key H&S support personnel must be identified in the SSHASP by the role (job title) and task(s) they are expected to perform. Then each anticipated task-specific hazard is assessed, as described in greater detail in this section, to determine the associated qualitative probability of occurrence of the hazard and the severity of injury/illness expected to result.

Not all contaminants at a particular site or chemical products used during field operations pose an occupational health threat. The determination of which substances are expected to pose an occupational health threat is made by the process of hazard assessment. DOE suggests that the following criteria be used to identify the hazardous substances to be assessed:

- type, nature, form, quantity, and concentration of the hazardous substance(s);
- location of the substance(s);
- conditions under which exposure to the substance(s) may occur; and
- specific hazards associated with the substance(s).

5.4.1.1 Chemical

Details of the site-specific hazard assessment of each known site contaminant and chemical product to be used must be included in the SSHASP, unless there are none. Of the wide variety of chemicals of potential concern at each site, Table 4-2 of the SSHASP must include only the substances expected to pose an occupational health threat, together with the resulting hazard assessment rating. The signs and symptoms of chemical exposure, if any, must be provided in Appendix C of the SSHASP. Corresponding detection methods, protective measures, and response actions must be provided in Section 6 of the SSHASP.

5.4.1.2 Radiological

Assessment of site-specific hazards that could result from unpredictable detonation of high explosives, exposure to radiological and safety hazards, and to chemical hazards by class of chemical are included in Table 4-3 of the SSHASP. This table also must include the administrative and engineering controls to be implemented to prevent and/or mitigate occurrence of these hazards.

5.4.1.3 Physical

General physical hazards of concern include lightning strikes; slips, trips, and falls from less than 4-ft elevations; heat and cold stress; altitude sickness; animal attacks; and equipment hazards. These hazards have been assessed by the Laboratory’s Industrial Hygiene and Safety Group (ESH-5) with input from the Occupational Medicine Group (ESH-2), assuming variable exposure conditions on a project-wide basis. Results of this assessment, together with the symptoms of exposure, detection methods, protective measures, and response actions are provided in Appendix G of the HASP.

5.4.1.4 Biological

General biological hazards of concern include tick bites, rodent flea bites, poison ivy, poisonous snake bites, insect bites or stings, and transmission of blood-borne pathogens when first-aid or cardiopulmonary resuscitation (CPR) is rendered. Results of this assessment, together with the symptoms of exposure, detection methods, protective measures, and response actions are provided in Appendix G of the HASP.

5.4.1.5 Job Hazard Analyses

The Laboratory’s ER Project uses the terms “task hazard analyses, “activity hazard analyses,” and “job hazard analyses” interchangeably. Job (task) hazard analyses are discussed in Section 5.4.1 of this document.

5.4.2 Site Control

The primary site control measures include controlled zones (e.g., exclusion zone, contamination reduction zone, and support zone) and support facilities (e.g., equipment-staging area, support trailer(s), equipment decontamination pad, temporary drum storage area, mobile laboratory, and wash facility). The primary objectives of site control measures during field operations are

- to prevent and limit employee exposures during ER field operations;
- to ensure that only trained and fully informed persons are able to enter controlled areas of the work site, where operational hazards are of potential concern;
- to reduce the likelihood of spread of contamination by workers or equipment into uncontrolled areas of the site;
- to confine work activities to appropriate areas, thereby minimizing the likelihood of accidental exposures; and
- to facilitate the location and evacuation of personnel in case of an emergency.

The necessary site-specific control measures, some of which are required by applicable DOE and OSHA requirements, must be provided in Table 5 of the SSHASP. Site maps required by OSHA must be included in Appendix A of the SSHASP to show the intended locations of the specified controlled zones and support facilities. DOE states that, among other items, site maps should include

- site perimeter;
- direction of prevailing wind;
- site drainage points;
- natural and manmade features such as buildings, containers, impoundments, pits, ponds, and tanks; and
- locations of work zones.

Because some zone or facility locations may change as site work progresses, the site safety officer must explain current locations of zones and decontamination stations to field team members during daily H&S tailgate meetings and must document these locations in his/her daily logbook.

Section 5 of the SSHASP also must indicate whether each zone or facility is restricted as a radiological control area, a radioactive materials management area, or a regulated area and whether postings giving this information are required. Furthermore, whether the location of a facility is centralized on-site or localized at multiple work areas on-site, the means for demarcating each zone and other posting requirements (per 29 CFR 1926.200, “Accident Prevention Signs and Tags,” and 29 CFR 1910.145, “Specifications for Accident Prevention Signs and Tags”) must be specified.

5.4.2.1 Administrative Controls

The general work practices and administrative controls in Section 4.2.1 of the HASP are to be implemented as applicable during ER field operations. Requirements addressed in Section 4.2.1 of the HASP are

- drug and alcohol policy;
- housekeeping and sanitation;
- site control measures; and
- packaging, labeling, handling, transport, and disposal of hazardous substances.

Required Written Programs and Permit Systems

In addition to general administrative controls and the site-specific administrative controls indicated in the SSHASP, OSHA (29 CFR 1926) has requirements that employers develop, implement, and maintain certain written programs and permit systems as a means for preventing or mitigating exposure to H&S hazards in the work place. The programs and permits required by these regulations are listed below and are described in Appendix A of the HASP. When the program or permit system has been addressed sufficiently in the employer’s HAZWOPER program, it need not be repeated elsewhere. ER contractors are expected to maintain and implement these programs as they apply to the project work being performed:

- Assured Equipment-Grounding Conductor Program,
- Blood-borne Pathogens Exposure Control Program,

- Chemical Hazard Communication Program,
- Chemical-Specific Compliance Programs (OSHA-regulated substances in Subparts D and Z of 29 CFR 1926),
- Confined-Space-Entry Program (permit required),
- Hazardous Waste Operations Program,
- Hearing Conservation Program,
- Lockout/Tagout for Control of Hazardous Energy Sources for Personnel Safety (Red Lock Procedure) Program,
- Medical Surveillance Program,
- Personal Protective Equipment Program,
- Radiological Safety Program,
- Respiratory Protection Program,
- Spark- and Flame-Producing Operations (Hot Work/Burn Permit) Program, and
- Training Program.

Contractors are expected to submit their programs and permits to designated Laboratory representatives for review and approval before implementation. At least 30 days before the scheduled start date of an operation for which a written program is required, the program must be submitted to the ER/H&S representative so that it can be reviewed and approved by appropriate ESH personnel. Similarly, unless indicated otherwise below, at least 30 days before the anticipated date of permit implementation, contractors must initiate action to obtain the Laboratory's approval of their permits, which may include a requirement that the contractor submit project-specific standard operating procedures (SOPs).

As the host organization, the Laboratory will provide contractors with the hazard assessment information necessary for preparing permits. In addition, the Laboratory, as host organization, must be provided with a copy of the contractor's terminated permit. This copy should be given to the ER/H&S representative for distribution to the appropriate ESH group(s).

Site Visitor Policy

A visitor (e.g., regulatory personnel, private property owners, field auditors, or the public) is anyone who arrives at the work site who is not identified in the project-specific documents as a project team member or associated support personnel. When a visitor arrives, the team leader/task leader or designee must meet with the visitor to determine the purpose of the visit and to provide a safety briefing. This briefing must include, at a minimum, a description of known and anticipated hazards and the applicable controls, site emergency response procedures, and site escort requirements.

Visitors are not permitted to enter limited-access, controlled work zones unless absolutely necessary. In such cases, the visitor must be briefed per Section 10.1.1 of the HASP, must meet all applicable requirements of the HASP and SSHASP, and may need to be accompanied by an escort, at the discretion of the team leader/task leader. If a visitor does not comply with these requirements, the team leader/task leader, or designee, must request the visitor to leave the controlled zone immediately or must limit site operations to minimize threat of harm to the visitor (e.g., have the project team take a break, reset the zone boundaries if appropriate, or temporarily discontinue any threatening task). Alternatively, if a visitor needs to observe work being performed in a controlled zone which is not readily visible from outside the zone(s), the team leader/task leader should consider videotaping or photographing the work, if allowed by security.

5.4.2.2 Engineered Controls

As a first line of defense, OSHA requires that employers implement administrative and/or engineering controls to prevent and/or mitigate hazards and protect site personnel. Secondarily, employers may require employees to use personal protective equipment (Section 5.5 of this document). Site-specific administrative and engineering requirements must be included in the SSHASP.

5.4.2.3 Communication

H&S issues must be communicated quickly and effectively to protect affected ER Project team members and nearby personnel. To meet this requirement, several communications processes are implemented. These processes may be adjusted as necessary to best meet the needs of each field project and must be accurately described in each SSHASP.

Pre-Field Communication

H&S communications start before a person joins the ER Project. Managers and supervisors communicate the importance of H&S during the interview process. It is a requirement that all candidates comprehend the issues, understand the importance, and accept the responsibility to work according to the HASP and SSHASPs. H&S communications continue during the training of personnel for the ER Project. This includes general and Laboratory-specific H&S requirements and a pre-job-start H&S briefing. See Section 10 of the HASP for more details.

Field Communication

Routine communications processes are employed as long as field activities are progressing as planned and conditions are consistent with those anticipated and addressed in the SSHASP. Each morning, a tailgate safety meeting is held (see Section 10.1.2 of the HASP). Attendance is mandatory for all project team members on-site. The team leader/task leader and/or SSO or designee conducts the meetings. During these meetings, the work plan for the day is discussed and specific task hazard analyses reviewed. Feedback from team members is actively solicited and incorporated into hazard control measures. Periodically, special emphasis topics may be included in the meeting. These are 5- to 10-minute refresher sessions covering H&S topics that are relevant to the work being conducted. Additional tailgate safety meetings may be held at the discretion of the team leader/task leader or SSO.

When field conditions change, added communication is required. The team leader/task leader or designee is responsible for communicating the changes to all field team members, the responsible FAPL, the FMU representative, subcontractor management, ER Project support personnel (e.g., ESH-1) and other personnel, as appropriate. Changing conditions often require a temporary “stop activity” until all H&S hazards can be adequately identified and controlled (Section 5.4.2.3 of this document).

Stop-Activity and Stop-Work Orders

It is necessary to discontinue an activity on-site or an entire field project when the conditions of operation are unsafe and must be reassessed to determine the appropriate means and/or methods for continuing work safely. The FAPL and the ER/H&S representative are to be notified by the team leader/task leader of any stop-activity or stop-work and the actions already taken or proposed to rectify the hazardous situation.

Implementing stop activity and stop work may require an ad hoc safety planning meeting and immediate telephone calls or radio communications. If unanticipated tasks must be performed, a task hazard assessment must be performed (see Section 4.1 of the HASP) and the resulting information communicated to all affected personnel. If the changing condition involves more or different radiological contamination than planned, the team leader/task leader may need to communicate with the ESH-1 RCT Pool supervisor to arrange for adequate RCT support.

Any individual observing an operation that presents a clear and imminent danger to the environment or to the H&S of site personnel, visitors, or the public is obligated and has the authority to immediately notify the individuals involved and the team leader/task leader or SSO. In turn, the team leader/task leader or SSO must verbally notify supervisors and individuals on the site of the danger. Once it has been concluded that conditions or practices exist that pose a threat to personnel or environmental safety or health, the team leader/task leader must take action to diminish the immediate threat of harm. Operations must be altered or discontinued to eliminate the immediate threat of harm, and individuals must be directed to immediately leave an area of imminent danger. In situations involving radiological hazards, RCTs have the responsibility and authority to stop work or to mitigate the effect of an activity if they suspect that the initiation or continued performance of the activity will result in a violation of radiological control standards or result in imminent danger or unacceptable risk.

A stop-activity may involve a situation such as removing defective equipment that could result in an injury or illness or removing site personnel from a section of scaffolding that is defective. In these cases, the activity may be stopped without stopping the entire field operation. Authorization to begin an activity again is given by the team leader/task leader only when it has been determined that the hazard(s) has/have been sufficiently abated, there is no further threat of harm, the FAPL and ER/H&S representative have concurred, and affected personnel have been notified of the intent to restart.

In situations where the activity or work stoppage has contractual implications, the contract administrator must be involved in the assessment and decision to issue a stop-work order. A formal ("contractual") stop-work order may be issued only by a Laboratory contract administrator. Experts from ESH Division may provide recommendations regarding the need to issue a stop-work order by notifying the FAPL and team leader/task leader. The FAPL or the ER/H&S representative will contact the contract administrator to arrange for review of the matter and will proceed in accordance with applicable Laboratory procedures. Only a Laboratory contract administrator may authorize the restarting of work after a stop-work order.

Post-Field Communication

At the conclusion of field activities, the team leader/task leader and SSO analyze the effectiveness of the H&S program. If appropriate, feedback should be provided to ER Project management, the ESH-1 Group Leader, the ESH-1 RCT pool supervisor, the ESH-5 group leader, the ESH-5 representative, the FMU representative, the ER/H&S representative, and the ER Project lessons-learned coordinator. Suggested changes are incorporated for continuous improvement. This is particularly relevant when there have been H&S problems or when things have gone exceptionally well.

5.4.2.4 Exposure Monitoring and Responses

Guidance for monitoring and assessing occupational exposure to chemical, biological, physical, and radiological hazards has been provided by the DOE (DOE 1994, 59929; 1996, 59930). According to the DOE, the exposure-monitoring strategy is developed cooperatively by the following professionals:

- an industrial hygienist who is certified by the American Board of Industrial Hygiene or who is otherwise Board-eligible or who has a minimum of three years' experience developing such strategies; and
- a health physicist who is certified by the American Board of Health Physics or who is otherwise Board-eligible or who has a minimum of three years' experience developing such strategies.

Site-specific exposure-monitoring strategies, including action levels, that meet applicable DOE and OSHA requirements must be specified in Section 6 of the SSHASP for each project task having different requirements. Exposure-monitoring strategies, including establishment of action levels, are determined based on the hazards that can be monitored using analytical instrumentation and published exposure limits and physical, chemical, and toxicological properties of the chemical and/or radiological substances of concern. This information is included in Appendix C of the SSHASP for the chemical substances of occupational concern included in Table 4-2 of the SSHASP. Toxicological information for radiological substances is found in the Laboratory's "Radiological Control Manual" (LANL 1994, 59928) for radiological substances of concern. Guidance for setting action levels for exposure to chemical substances is provided by DOE in the Handbook for Occupational Health and Safety During Hazardous Waste Activities" (DOE 1996, 59930) and by the American Industrial Hygiene Association Hazardous Waste Committee. Action levels in Section 6 of the SSHASP for monitoring exposure to radiological hazards have been set by ESH-1, unless otherwise indicated and approved by ESH-1.

Exposure monitoring must include use of direct-reading instruments, personal dosimetry, personal breathing zone sampling, and area sampling, as necessary, to evaluate the hazardous conditions posed by chemical and radiological substances on-site. DOE and OSHA (29 CFR 1926.65[b][4][ii][E]) require that the following information be specified in the SSHASP for each type of monitoring instrument to be used for exposure monitoring:

- procedure for calibration, maintenance, and use;
- locations and frequencies of monitoring; and
- corresponding action level(s), response actions, and rationales.

To promote greater consistency among the various ER contractors and field teams, ESH-5 has developed exposure-monitoring methods for the chemical exposure-monitoring instruments most commonly used during ER field operations (Environmental Restoration Decommissioning Project 1995, 55423). These methods include procedures and forms for calibration, maintenance, and use of instruments for monitoring exposure to chemicals. When OSHA has mandated methods in the chemical-specific regulatory standards included in Subparts D and Z of 29 CFR 1926 and Appendix A of the HASP, such methods must be specified in Section 6 of the SSHASP. FAPLs who choose to use alternative methods must provide a copy of the methods with the SSHASP for review and approval per Section 5.1.2 of this document.

Site health physics personnel must monitor for alpha and/or beta/gamma radiation, as specified in the SSHASP and in accordance with their individual radiological surveillance authorization agreement and the Laboratory's "Radiological Control Manual" (LANL 1994, 59928). Health physics personnel must use radiological instrumentation calibrated and maintained by the Health Physics Measurement Group (ESH-4). Subcontractors must abide by this requirement unless the subcontractor's radiological safety program, which must include identification of instruments and corresponding procedures, has been submitted to the Laboratory for approval during the prebid qualification or contract negotiation period, as required, or according to the applicable requirements of Section 5.4.2.2. All equipment leaving the site must be monitored for release in accordance with the health physics representative's radiological surveillance authorization agreement.

Requirements for personal dosimetry of radiation exposure must be determined by ESH-1 and the Laboratory's Radiation Protection Services Group (ESH-12) personnel during the review of the draft SSHASP. Guidance for determining site-specific personal dosimetry requirements is provided in the ER Project health and safety manual (Environmental Restoration Decommissioning Project 1995, 55423).

The results of exposure monitoring must be documented, and affected personnel must be informed of these results in accordance with the requirements of Section 5.8. Forms for recording the results of monitoring chemical exposure are included with the respective monitoring instrument method in the ER Project health and safety manual (Environmental Restoration Decommissioning Project 1995, 55423). Forms for recording monitoring results for radiological exposure are provided in the Laboratory's "Radiological Control Manual" (LANL 1994, 59928).

Analytical laboratories analyzing samples are accredited by the Environmental Protection Agency (EPA) and/or the American Industrial Hygiene Association. (Accreditation by the latter organization is necessary for samples collected using OSHA or National Institute for Occupational Safety and Health methods.) Samples are analyzed as indicated in the contractor's radiological safety program, which has been approved by the Laboratory prior to sample shipment.

5.5 Personal Protective Equipment

The purpose of personal protective equipment is to shield, isolate, or secure individuals from hazards that may be encountered when administrative or engineering controls are not feasible or cannot provide adequate protection. Accordingly, before requiring field team personnel to use personal protective equipment, appropriate administrative and engineering controls must be implemented as the first means of defense for mitigating hazards and protecting site personnel.

In accordance with applicable OSHA regulations (Subpart E of 29 CFR 1926), personnel are not allowed to use personal protective equipment unless the hazards for which the personal protective equipment are intended to protect against have been assessed and the appropriate personal protective equipment has been specified by a qualified H&S professional.

Personal protective equipment requirements must be based on a hazard assessment (see Section 5.4.1) that includes a comparative evaluation of site conditions, task-specific operations, potential hazards relative to the performance characteristics of the personal protective equipment items, and anticipated duration of use. Only radiological protective clothing (ANTI-Cs) may be used at radioactively contaminated sites. Other disposable protective clothing (e.g., Tyvek's) may be used at sites contaminated by mixed (radiological and chemical) wastes. Task-specific personal protective equipment requirements that meet applicable OSHA requirements of Subpart E of 29 CFR 1926 must be identified in Section 7 of the SSHASP.

Furthermore, personnel who use personal protective equipment to perform a job must be trained to recognize the limitations of the equipment and to properly select, fit, use, inspect, maintain, and store the equipment. Such training must occur and be documented before the user enters an area requiring the use of the personal protective equipment. To promote greater consistency among the various ER contractors and field teams and to facilitate compliance with 29 CFR 1926.65(g)(5), ESH-5 has developed a procedure that addresses limitations, selection, fitting, use, inspection, and maintenance of personal protective equipment (ER Project "Health and Safety Activities Manual" [Environmental Restoration Decommissioning Project 1995, 55423]). When OSHA has mandated methods in the chemical-specific regulatory standards included in Subparts D and Z of 29 CFR 1926 (Appendix A of the HASP), such methods must be specified, as applicable, in Section 7 of the SSHASP. Personnel who use ANTI-Cs must have successfully completed Radiological Worker II training.

The level of protective clothing and accessories selected may be upgraded or downgraded based on new findings or change(s) in site conditions or operations. Whenever a significant change occurs, the personal protective equipment requirements must be reassessed by the site safety officer, and a SSHASP modification form must be issued, as necessary.

It is the responsibility of the user of personal protective equipment to inspect the equipment before and as necessary during each use. Furthermore, the user must not use personal protective equipment that shows signs of compromised integrity. The site safety officer must monitor individuals in areas where personal protective equipment is required to ensure that they are properly attired.

Respiratory Protective Equipment

Use of respiratory protection occurs only in accordance with the requirements of 29 CFR 1910.134, the HASP, and SSHASP. When respiratory protective equipment requirements are mandated by OSHA in the chemical-specific standards included in Subparts D and Z of 29 CFR 1926 (Appendix A of the HASP), such requirements must be specified, as applicable, in Section 7 of the SSHASP. Laboratory personnel required to use respirators must have a valid respirator user authorization card. Contractors whose employees use respiratory protective equipment to perform ER Project work must be enrolled in a respiratory protection program that complies with OSHA requirements.

A contractor's respiratory protection program must be submitted to the ER/ H&S representative for review and approval by appropriate ESH personnel at least 30 days before the scheduled start date of field operations involving use of the respiratory protective equipment. Whenever air-supplying (Level B) respiratory protection will be used, project-specific SOPs addressing the requirements and procedures for using the Level B equipment must be submitted similarly for review and approval by appropriate ESH personnel.

5.6 Decontamination

Decontamination involves physically removing contaminants from personnel and equipment. This section has been developed to meet applicable DOE and OSHA requirements [i.e., those included in 29 CFR 1926.65(k), Subparts D and Z of 29 CFR 1926 (Appendix A of the HASP), and/or the Laboratory's "Radiological Control Manual" (LANL 1994, 59928)]. According to the DOE, the contamination reduction zone should include separate designated areas for a personnel contamination reduction corridor and an equipment contamination reduction corridor. The contamination reduction corridor boundaries must be conspicuously marked and must have restricted entry and exit points. Personnel must decontaminate themselves and any equipment that is contaminated or suspected of being contaminated according to the procedures specified in Section 8.0 of the SSHASP.

The site safety officer and health physics personnel must monitor decontamination activities to determine their effectiveness. If procedures are found to be ineffective, these individuals must take steps to correct any deficiencies and document any deviations from the SSHASP, using a modification form in Appendix C of the HASP. The following general requirements apply to personnel and equipment decontamination processes for ER Project work:

- Personnel, equipment, and vehicles must be decontaminated before exiting the contamination reduction zone. Clothing and equipment that cannot be decontaminated sufficiently must be properly contained and labeled before being transferred beyond the controlled work zones of the site. For sites having only radiological contamination, it is appropriate to first screen for radiological contamination to determine whether decontamination is necessary.
- If any significant contamination is encountered, personal protective equipment should be disposed rather than decontaminated for reuse (Section 8.0 of the HASP).
- Loose contaminants (dusts and vapors) that cling to clothing or equipment must be removed according to the applicable decontamination procedures (e.g., using a water or water-based detergent rinse and scrub brush), except when radiation action levels are exceeded (Section 8.0 of the HASP).
- Care is taken to avoid generating mixed waste during decontamination operations.
- Rinse water and waste generated on-site must be contained and disposed according to Section 8.0 of the HASP.

5.7 Emergency and Contingency Plan

This section describes the generic aspects of the emergency and incident action plan, which apply to all field operations of the ER Project. Site-specific details of this plan and the necessary equipment and supplies to execute this plan must be included in Section 9 of the SSHASP. Any deviations or exceptions to this section must be described in Section 9 of the SSHASP.

This section has been developed to meet the requirements of 29 CFR 1926.24 and 29 CFR 1926.65(l), and, as applicable, 29 CFR 1926.65(q) or 29 CFR 1926.35(b). It addresses contingency planning, response actions, and associated personnel and equipment requirements in the event of occurrence of an incident or emergency as defined in this section. DOE and OSHA require that this plan be rehearsed regularly as part of the overall training program for site operations [29 CFR 1926.65(l)(3)(iv)].

Explanations and definitions for determining the category of an unplanned or uncontrolled event are provided in the ER Project health and safety manual (Environmental Restoration Decommissioning Project 1995, 55423). For purposes of this section, the term “emergency” is used to refer to unplanned or uncontrolled events, such as

- situations necessitating rescue and/or administration of first-aid and/or CPR by qualified on-site responders per this section;
- situations necessitating fire fighting by qualified on-site responders per this section;
- releases of hazardous substances that cannot be responded to and adequately dealt with by qualified on-site personnel and resources per this section; and
- incidents involving local or adjacent facility operations that may influence field operations.

For purposes of ER fieldwork, the term "incidental release" is used to refer to unplanned or uncontrolled releases of hazardous substances that can be responded to and adequately dealt with by qualified on-site personnel and resources per this section. By this definition, incidental releases are defined as a release of insufficient quantity to pose a significant H&S hazard to field personnel in the immediate vicinity, to field personnel responding defensively, or to the surrounding environment. The team leader or designee, assisted by the site safety officer, directs and coordinates responses to incidental releases. These responsibilities include appropriately responding to the situations listed above, safely evacuating on-site personnel, gathering on-site personnel at the designated muster area, notifying emergency contacts, documenting that on-site personnel are accounted for at the muster area, conducting a follow-up investigation, and reporting the incident.

Releases of hazardous substances in sufficient quantity to necessitate a response either by personnel from outside the immediate release area or by other designated responders, such as the fire department or the Laboratory's Hazardous Materials Response Team (HAZMAT) (ESH-10), are considered emergencies. In such circumstances, on-site personnel are allowed only to take defensive actions for which they have been trained and are equipped in accordance with this section.

The team leader or designee, assisted by the site safety officer, must direct and coordinate responses to emergencies in accordance with this section until off-site emergency responders arrive and implement the Incident Command System. On-site spills or releases of hazardous substances must be handled in accordance with applicable requirements of this section and according to an approved site-specific spill prevention control and countermeasures plan prepared in accordance with the Laboratory's Spill Prevention Control and Countermeasures Plan.

Posting Requirements

At the start of field operations, emergency contacts and phone numbers, reporting information, emergency equipment, and maps of the route(s) to the Los Alamos Medical Center and to the Laboratory Occupational Medicine Clinic (ESH-2) must be posted at a location on-site where personnel may readily access the information. This site-specific information must be included in Appendix D of the SSHASP.

Emergency Alerting and Site Evacuation Procedures

The team leader, or designee, and site safety officer determines site-specific emergency alerting procedures, evacuation procedures and routes, and locations of muster areas. This information must be included in Section 9 of the SSHASP and be communicated by the site safety officer or team leader, or designee, to on-site personnel during the pre-job-start H&S briefing and/or the daily tailgate H&S meetings. The Department of Transportation's (DOT's) "2000 Emergency Response Guidebook" (DOT 2000, 65088) provides information for determining the extent of and safe distances for evacuation, which must be referenced in Appendix C of the SSHASP for each chemical substance identified in Table 4-2 of the SSHASP. Evacuation routes and muster areas should be predominantly upwind, uphill, and upstream of work areas where fire or release of chemicals or radiological contaminants might occur.

An employee alarm system must be specified in Section 9 of the SSHASP and must be established at the work site in accordance with 29 CFR 1926.65(l)(3)(vi) and 1926.159. Section 9 of the SSHASP also must include means and methods for alerting contact personnel at adjacent facilities of on-site events that could pose a threat to off-site facilities. It also must include means and methods for designated personnel at adjacent off-site facilities to alert on-site personnel of events that could pose a threat to on-site personnel or operations. The phone numbers or radio stations of contact personnel at adjacent facilities must be given in the list of emergency contacts included in Appendix D of the SSHASP.

General procedures for site evacuation are included in Section 9.2 of the HASP, and procedures for on-site responders who are trained and equipped to respond to incidents in accordance with this section are also provided in Section 9.3 of the HASP, including procedures for

- emergency medical treatment and first aid/CPR,
- life-threatening cases,
- other cases,
- exposure to another's blood or body fluids, and
- emergency decontamination of personnel.

Reporting Emergencies and Incidents

The ER/ESH procedure for making notifications in follow-up to an emergency or incident is provided in the ER Project "Health and Safety Activities Manual" (Environmental Restoration Decommissioning Project 1995, 55423). Accidents, emergencies, incidents, injuries, and illnesses must be reported to the FAPL and/or the ER/H&S representative. In the event of an occurrence necessitating medical care, the team leader must arrange for notification of the key personnel listed in Appendix D of the SSHASP (i.e., other line managers, the ER/H&S representative, and the employee's manager) as soon as possible.

Response Critique and Follow-Up

Before normal site activities are resumed, the FAPL, or his/her delegate, must evaluate the incident or emergency to determine

- the cause;
- effectiveness of emergency/incident planning, preparedness, and response;
- how the emergency or incident could have been prevented; and
- considerations for improvements of the emergency/incident response plans.

Points to be considered include whether procedures are adequate and were implemented correctly and in a timely manner. Also, before resuming normal site activities, personnel must be fully trained and equipped to handle another emergency or incident, which requires restocking emergency equipment and supplies and inspecting, testing, and resetting emergency equipment and systems.

5.8 Record Keeping

Site Records

The site safety officer must keep a daily record of H&S-related events in a bound logbook and must verify employee training and medical surveillance records in accordance with Section 13.2 of the HASP. Health physics personnel must keep records of health-physics-related events in accordance with the requirements of their radiological surveillance authorization agreement (Section 5.2.1.3). Records of all training must be maintained and available for oversight review. Site records must be provided to the personnel in charge of the field team at the close of the project, who provides them to the FAPL for storage at the ER Project Records Processing Facility.

Employee Exposure and Medical Records

Employers must retain exposure-monitoring and medical records for their employees who work on the ER Project in accordance with OSHA's standard (29 CFR 1926.33, "Access to Employee Exposure and Medical Records" . Medical records do not include medical examination or test results but include the employee's name and social security number, the physician's written opinion (Section 11.4 of the HASP) and recommended limitations, any medical complaints related to exposure of hazardous substances, and a copy of the information provided to the examining physician by the employer (not including a copy of the OSHA standard).

Records must be retained in accordance with the following requirements, as well as any other applicable requirements:

- To the extent permitted by law, the employer must maintain and keep in confidence records for each employee.
- The employer must maintain medical records for each employee for the duration of employment plus 30 yr (except health insurance claims records maintained separately from the employer's medical surveillance program records, first-aid records of one-time treatments, and medical records of employees who have worked for the employer for less than 1 yr and who have seen the records before termination).
- The employer must maintain exposure records for each employee monitored per Table 6-2 of the SSHASP for 30 yr.
- The employer must ensure that each employee, upon his/her request, has access to his/her records.
- Upon an employee's written request, the employer must ensure that the employee's designee has access to the employee's record(s). A sample consent form is provided in Appendix A of 29 CFR 1926.33.
- Whenever an employee or his/her designated representative requests access to an employee record, the employer must ensure that access is provided in a reasonable time and manner. If the employer cannot provide access to the record(s) within 15 working days, before the 15th working day following the request for access, the employer must apprise the requester of the reason for the delay and the earliest date the record(s) can be made available.
- Whenever an employee, or his/her designated representative, requests a copy of a record, the employer must ensure that either

    a copy of the record is provided without cost to the requester,

    the necessary copying equipment is made available without cost to the requester for the purpose of copying the record, or

    the record is lent to the requester for a reasonable time to enable a copy to be made.

- Once a record has been provided without cost to the requester, the employer may charge a reasonable, nondiscriminatory administrative cost for subsequent copies of the record. However, an employer must not charge for an initial request for a copy of new information that has been added to a record which was previously provided.

For purposes of follow-up investigation of an accident or incident, the employee's consent for the investigator(s) to access his/her records must be obtained in accordance with 29 CFR 1926.33.

Employee Notification Procedure

In accordance with 29 CFR 1926.33, the site safety officer is required to report dosimetry data to each monitored employee, using the form provided in the ER Project "Health and Safety Activities Manual" (Environmental Restoration Decommissioning Project 1995, 55423). The form must be reviewed and acknowledged by each affected employee. The site safety officer must provide a copy of the notification form to the subject employee and to his/her supervisor. These records must be maintained in confidence in accordance with the requirements of Section 5.8. The original form must be retained with other original site records. When it is necessary to communicate the results of exposure monitoring to others, it must be done in a manner that does not identify the monitored employee.

This confidentiality also precludes discussing affected on-site personnel during daily tailgate meetings following receipt and evaluation of the results.

Emergency/Incident Records

Records of emergency or incident reports and follow-up investigations must be processed as specified in Section 9.4 of the HASP.

REFERENCES FOR CHAPTER 5

The following list includes all references cited in this chapter. The parenthetical information following the reference provides the author, publication date, and ER Project identification (ER ID) number. This information is also included in the citation in the text and can be used to locate the document.

ER ID numbers are assigned by the Laboratory's ER Project to track all material associated with Los Alamos National Laboratory corrective action sites. These numbers can be used to locate copies of the documents at the ER Project Records Processing Facility and, where applicable, within the ER Project reference library. The references cited in this report can be found in the volumes of the reference library titled "Reference Set for Regulatory Compliance Focus Area."

Copies of the reference library are maintained at the New Mexico Environment Department Hazardous and Radioactive Materials Bureau, the Los Alamos Area Office of the US Department of Energy, the US Environmental Protection Agency, and the ER Project Office. This library is a living document that was developed to ensure that the administrative authority has all the necessary material to review the decisions and actions proposed in this report. However, documents previously submitted to the administrative authority are not included in the reference library.

DOE (US Department of Energy), February 1994. "Health and Safety Plan (HASP) Guidelines," EM Limited Technical Standard: SAFT-0025, Office of Environmental Restoration (EM-40), Washington, DC. (DOE 1994, 59929)

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DOT (US Department of Transportation), 2000. "2000 Emergency Response Guidebook," Research and Special Programs Division, Office of Hazardous Materials Training and Initiatives (DHM-50), Washington, DC. Available at http://hazmat.dot.gov/gydebook.htm. (DOT 2000, 65088)

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LANL (Los Alamos National Laboratory), September 1999. "Integrated Safety Management," Los Alamos National Laboratory Report LA-UR-98-2837, Rev. 3, Los Alamos, New Mexico. (LANL 1999, 64707)

LANL (Los Alamos National Laboratory), January 2000. "Environmental Restoration Project Health and Safety Plan," Revision 2, Los Alamos National Laboratory report, Los Alamos, New Mexico. (LANL 2000, 65050)

6.0 WASTE MANAGEMENT PLAN

6.1 Introduction

The Environmental Restoration (ER) Project at Los Alamos National Laboratory generates waste during the corrective action process, which includes activities such as site investigations, interim actions, decommissioning projects, and remedial actions. The activities supporting the historical mission at the Laboratory involved numerous hazardous chemicals, radioactive isotopes, and other materials and equipment that, through decommissioning or removal during restoration, became regulated wastes. Removal of contaminants resulting from the above described activities led to the generation of various types of waste regulated by the Resource Conservation and Recovery Act (RCRA), Toxic Substances Control Act (TSCA), New Mexico Hazardous Waste Act, New Mexico Solid Waste Act, and the US Department of Energy (DOE) (low-level and transuranic radioactive wastes). All work conducted under this plan is performed in accordance with internal administrative controls such as quality procedures (QPs) and/or standard operating procedures (SOPs).

6.2 Regulatory Requirements

The ER Project generates wastes that are regulated by various federal and/or state requirements. The following wastes are subject to those requirements:

- DOE-regulated radioactive wastes,
- US Environmental Protection Agency (EPA)-regulated RCRA hazardous waste (including RCRA regulations not yet adopted by the New Mexico Environment Department [NMED]),
- EPA-regulated TSCA waste, and
- New Mexico state-regulated hazardous waste, special wastes, and solid wastes.

6.2.1 Waste Characterization/Classification

A waste characterization strategy form must be completed before any field activities begin for sites where the ER Project plans to generate waste. The completed form includes historical data used as process knowledge for the site as well as a site-specific waste sampling strategy to ensure that the use of acceptable knowledge (e.g., archival information, reports, interviews, process knowledge) and/or sampling methods will adequately characterize all wastes generated. Any additional waste streams generated because of changes in field conditions are characterized as specified in an addendum to the Waste Characterization Strategy Form. This addendum is submitted as soon as possible following the discovery of the new waste stream.

The data from sampling and/or acceptable knowledge are needed to complete a waste profile form, which is then submitted to the Laboratory's Solid Waste Operations Group (currently within the Facility and Waste Operations Division) for review and waste classification. In most cases, final waste classification will be based on analytical data as well as process knowledge supplied by the ER Project.

6.2.2 Hazardous Waste

The ER Project generates RCRA-regulated hazardous and mixed wastes that are managed in accordance with the requirements of Title 40 of the Code of Federal Regulations (CFR), Parts 260–268 (40 CFR 260–268), and Title 20 of the New Mexico Administrative Code (NMAC), Chapter 4, Part 1 (20

NMAC 4.1). The ER Project does not manage any RCRA treatment, storage, and disposal (TSD) facilities regulated by 40 CFR 264, "Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities," or 40 CFR 265, "Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities."

The ER Project generates both listed and characteristic hazardous and mixed wastes. These wastes are typically removed during characterization or remediation, placed in containers, and shipped to a TSD facility. These wastes may be shipped to the Laboratory's permitted or interim status hazardous and mixed waste facilities at Technical Area 54 for temporary storage before final off-site shipment to a commercial TSD facility.

Characteristic hazardous and mixed wastes are sometimes treated at the point of generation in compliance with "generator treatment" requirements in 40 CFR 268.7(a)(5) to render these wastes nonhazardous. A waste analysis plan is prepared and submitted to the administrative authority prior to conducting treatment. Resultant wastes that are no longer hazardous are managed as formerly treated hazardous waste and disposed of in an approved landfill, or managed in accordance with DOE regulations for radioactive wastes.

As part of the corrective action process, different treatment technologies such as bioremediation or in situ vitrification may be studied. In addition, small samples of hazardous and mixed wastes may be tested on-site or shipped to approved off-site laboratories for treatability studies to determine the optional conditions for proposed treatment processes.

6.2.3 Special Waste

New Mexico special waste is periodically generated from ER Project operations and is managed in accordance with the "Solid Waste Management Regulations" (20 NMAC 9.1). Typical sources of New Mexico special waste are petroleum-contaminated soils resulting from past discharges or spills from heavy equipment operations; soils containing asbestos fibers; and ash from the burning of high explosives obtained from areas undergoing corrective action. Special wastes are sampled, as appropriate, to adequately characterize the waste prior to on-site storage and off-site disposal.

Petroleum-contaminated soils and treated formerly characteristic hazardous waste require sampling before disposal per 20 NMAC 9.1.

6.2.4 Surface/Ground Water Discharges

Investigation-derived water that has been sampled and declared free of hazardous waste or hazardous constituents may be discharged in compliance with the "New Mexico Ground and Surface Water Quality Protection Regulations" (20 NMAC 6.2). A formal notice of intent to discharge these waters is submitted to the NMED for approval prior to any discharge.

6.3 Waste Management

The ER Project conducts waste management operations in accordance with the most stringent state or federal regulatory requirements. Current ER Project waste management operations include packaging, labeling, characterization, short-term storage, generator treatment, and shipment of wastes.

Sections 6.3 and 6.4 of this document discuss common waste management operations, definitions for commonly generated wastes, record keeping procedures, and waste minimization and pollution prevention procedures.

6.3.1 Waste Types

Wastes are generated from several primary ER Project mission-related activities, including site investigations and remedial actions. Waste classifications generated from these operations include TSCA-regulated wastes, RCRA-regulated hazardous wastes, radioactive wastes, RCRA-regulated mixed wastes, TSCA-regulated mixed wastes, TSCA-regulated radioactive wastes, New Mexico special wastes, and solid wastes. Any of these waste classifications could include either solid or liquid forms.

6.3.1.1 Investigation-Derived Wastes

Investigation-derived waste includes small amounts of samples, personal protective equipment, contaminated sampling supplies, plastic, drill cuttings, well development and purge waters, and decontamination fluids. The characterization/classification of this waste type is typically determined through the evaluation of the site characterization data or through direct waste characterization analysis.

(a) Well Development, Purge, and Decontamination Water

Investigations involving drilling or subsequent well sampling and equipment decontamination operations generate liquid that is placed in containers and characterized based on direct sampling results and/or acceptable knowledge to determine the appropriate management approach. Wastewaters that have been analyzed and do not contain hazardous waste or hazardous constituents may be managed under New Mexico surface and groundwater regulations and discharged through an approved notice of intent to discharge.

(b) Personal Protective Equipment

Personal protective equipment varies at each field site, dependant upon anticipated contaminants and planned operations. Launderable coveralls are often used for general site operations. The remaining personal protective equipment such as gloves and respirator cartridges are managed based on acceptable knowledge or analytical results obtained during the site investigation or remedial action. Uncontaminated personal protective equipment may be reused, as appropriate.

6.3.1.2 Remedial Action Waste Streams

ER Project remedial action wastes are generated through a wide variety of remedial action alternatives specified through an interim action, accelerated cleanup, or the corrective measures study/corrective measures implementation process. This waste consists primarily of contaminated soil and structural debris such as septic systems. Site operations also generate secondary wastes such as personal protective equipment, site control materials, and decontamination wastes. Remedial action wastes typically are characterized through direct waste sampling or sampling during excavation. All remediation waste is stored, as appropriate, to protect human health and the environment. Remediation waste is brokered through the Laboratory's Solid Waste Operations Group (currently in Facility and Waste Operations Division).

Remedial action wastes may be treated on-site or in situ under permitted operations, but the decision to do so will be made with regulator involvement.

6.3.1.3 Radioactive Wastes

Radioactive wastes are generated from investigation or from remedial action activities. A radioactive waste is defined as waste that has been determined to contain added (or concentrated) naturally occurring radioactive material, radioactive material, or activation products by either monitoring and analysis or acceptable knowledge (or both), or waste that does not meet radiological release criteria. Most radioactive wastes generated by the ER Project are low-level radioactive wastes, which are defined as waste that contains radioactivity and is not classified as high-level waste, transuranic waste, or spent nuclear fuel or II(e)2 byproducts material (e.g., uranium or thorium mill tailings) as defined in DOE Order 435.1, "Radioactive Waste Management"; test specimens of fissionable material irradiated for research and development only and not for the production of power or plutonium may be classified as low-level waste, provided that the concentration of transuranics is less than 100 nCi/g of waste. In isolated instances, small areas of elevated contamination require that the material be managed as transuranic waste, defined by DOE as waste that is contaminated with alpha-emitting radionuclides with half-lives greater than 20 yr and concentrations greater than 100 nCi/g at the time of assay and that have atomic numbers greater than 92.

Decisions regarding disposal of low-level radioactive wastes depend on the volume of waste generated and the available volume of the on-site disposal facility. Small volumes of low-level radioactive wastes are disposed of on-site at the Laboratory's low-level radioactive waste disposal facility, while large volumes may be shipped off-site to a commercial disposal facility. If transuranic radioactive waste is generated during remedial action activities, the waste will be characterized and shipped to TA-54 for storage and certification for transfer to the Waste Isolation Pilot Plant in Carlsbad, New Mexico.

6.3.1.4 Other Wastes

Other incidental wastes are generated by the ER Project through treatability studies at off-site laboratories and from maintenance and operations of several support facilities.

6.3.2 Control Measures

The ER Project implements several control measures for waste storage. Use of these control measures (RCRA less-than-90-day storage areas and satellite accumulation areas) result in documentation that the wastes were fully contained during storage and ensures that any deficiency is quickly remedied.

Less-Than-90-Day Storage Areas

The operation of less-than-90-day storage areas is regulated by RCRA and 20 NMAC 4.1, "Hazardous Waste Management." These areas are used for the temporary storage of hazardous or mixed wastes in quantities greater than 55 gal. of hazardous or mixed waste or 1 qt of acutely hazardous or mixed waste. The ER Project complies with Laboratory policy and all applicable regulatory requirements for the management and documentation of these areas. Generator treatment may also be conducted in these less-than-90-day storage areas.

Satellite Accumulation Areas

A satellite accumulation area, as defined by 40 CFR 262.34(c), "Accumulation Time," is an accumulation area for as much as 55 gal. of hazardous or mixed waste or 1 qt of acutely hazardous or mixed waste. This accumulation area is at or near the point of generation where waste (under the control of the operator of the process that generated the waste) initially accumulates. The ER Project uses these accumulation areas for storage of small quantities of hazardous or mixed waste.

6.3.3 Documentation

Waste management documentation is maintained by both the ER Project waste management coordinator and the ER Project Records Processing Facility.

6.3.3.1 Transportation

The following documentation for the transport of hazardous materials is maintained in accordance with the required duration in Titles 40 and 49 of the Code of Federal Regulations, “Protection of Environment” and “Transportation,” respectively.

(a) Manifests

Manifests and other shipping papers are completed for uniform hazardous, uniform radioactive, and New Mexico special wastes. These manifests accompany waste from the time it leaves the Laboratory until it arrives at its final destination. Manifests for hazardous waste and mixed waste are retained for a minimum of three years from the date of shipment. Retention time for manifests for other types of waste is at the discretion of the facility.

(b) Land Disposal Restriction Certification

RCRA land disposal restriction (LDR) certifications, when required, are generated either by the ER Project waste management coordinator or personnel from the Laboratory’s Solid Waste Operations Group at the time of waste classification. This notification accompanies the manifest upon transport and is retained with the hazardous and mixed waste records.

(c) Special Waste

Manifests, where applicable, and shipping papers for New Mexico special waste will be retained in accordance with 20 NMAC 9.1.

6.3.3.2 Record Keeping and Reporting Requirements

For each regulated waste stream generated by the ER Project, a written waste record is archived for each corrective action site. All material to be recycled or reused is documented in field logs.

An annual Waste Minimization Awareness Plan is submitted to NMED to describe the wastes that were generated and the waste minimization activities implemented for all ER Project activities.

The Laboratory’s Hazardous and Solid Waste Group (ESH-19) submits the RCRA annual report on hazardous waste generation, which includes ER Project wastes. That group also submits reports related to treatability studies in accordance with 40 CFR 261.4(f), “Samples Undergoing Treatability Studies at Laboratories and Testing Facilities.” If a treatability study is proposed by the ER Project, the Project will submit the notification to ESH-19 for each waste stream to be evaluated and will maintain copies of all documentation supporting these record keeping requirements.

(a) RCRA Waste

Complete waste management records for RCRA-regulated hazardous waste or New Mexico special waste contain the following documentation:

- waste characterization strategy forms,
- waste profile forms,
- waste disposal requests,
- manifests and shipping papers,
- land disposal restriction notifications (as applicable),
- references to waste analysis sample numbers,
- waste storage area inspection records (when applicable), and
- correspondence related to waste classification (when applicable).

(b) Radioactive Waste

Radioactive waste documentation includes several documents for each waste stream in addition to those for RCRA-regulated hazardous waste [listed in Section 6.3.3.2(a)]. These additional documents include the

- US Department of Transportation contamination screening release tag and
- radiation screening laboratory data.

6.4 Waste Minimization/Pollution Prevention

The ER Project implements waste minimization and pollution prevention techniques whenever economically feasible. Many common waste minimization techniques have been incorporated into standard operating procedures and implemented during field operations.

During site investigation operations, using reusable sampling supplies and launderable personal protective equipment and returning excess sample material to the point of generation (as appropriate) are common practice. These operations have significantly reduced the amount of investigation-derived waste generated.

Remediation operations include decontaminating radiologically contaminated debris and recycling materials, where appropriate. Specialized radiological segregation techniques and equipment have also been used to minimize concentrated radiologically contaminated media. For sites where potentially large volumes of waste may be generated, specific “opportunity assessments” are conducted to integrate waste minimization into planned operations.

7.0 PUBLIC INVOLVEMENT PLAN

7.1 Introduction

Role of Public Involvement in the Environmental Restoration Project

Under Module VIII of Los Alamos National Laboratory's (the Laboratory's) Hazardous Waste Facility Permit (EPA 1994, 44146), the Environmental Restoration (ER) Project must adopt a community relations plan. The first edition of the ER Project's Installation Work Plan (LANL 1990, 7517; 7518; 7519) included the original plan. That plan has evolved into the Public Involvement Plan presented in this chapter and addresses the requirements specified in Section Q, Task II, Section D, of Module VIII. This plan emphasizes early public participation in developing recommendations for ER Project activities. All work conducted under this plan is done in accordance with internal administrative controls; such as quality procedures and/or standard operating procedures.

The goal of public involvement is to provide the public with the opportunity to obtain information from, and provide input to, the ER Project on its investigation and cleanup activities. To create trust in the community, public involvement efforts must build long-term relationships based on accessibility and open communication. Key US Department of Energy (DOE) Orders and Executive Orders have made public involvement a cornerstone for the Laboratory's and DOE's activities.

The ER Project recognizes that early public involvement maximizes its opportunities for (1) making decisions that satisfy both the public and the organizations responsible for implementing those decisions, (2) avoiding delays resulting from public challenges to decisions made without adequate public involvement, and (3) achieving cost savings that result from making better initial decisions and avoiding delays. The current plan (Section 7.2) describes the new approach in detail.

The Environmental Restoration Project's Current Approach to Public Involvement

The ER Project has a Communications and Outreach Team, which is responsible for communicating in an understandable and consistent way with interested parties during the investigation and cleanup of ER Project sites. The team coordinates with the Laboratory's Community Relations Office; Public Affairs Office; Outreach Coordinating Council; and the Environment, Safety, and Health Division's Public Involvement Design Study Group regarding ER efforts.

The specific objectives of this Public Involvement Plan are to develop and implement the tools and processes within the ER Project that will

- make ER Project information readily available to the public;
- give the public the information it needs to understand the ER Project's investigation and cleanup issues and provide informed input;
- increase contacts with the public in ways that encourage interaction, such as establishing dialogues with members of local and tribal governments, community organizations, chambers of commerce, church groups, and the Northern New Mexico Citizens Advisory Board (CAB), as well as Laboratory employees outside the ER Project;
- involve the public in the cleanup process while decisions are being made, rather than after the fact;

- solicit assistance from community members on their communities' concerns (for example, assessing unique health risks to pueblo members, related to traditional cultural uses of lands bordering the Laboratory);
- coordinate public involvement activities for the ER Project with long-term stewardship, land transfer, and other land use-related activities;
- consider alternatives for determining cleanup levels and prioritizing sites and then incorporate approved changes into the "Integrated Technical Strategy" (LANL 1999, 63491), as appropriate; and
- evaluate the effectiveness and efficiency of public participation activities.

Use of the methods described in this plan for improving communication and trust during current activities will continue and expand with experience as the ER Project moves through the corrective action process. The plan will be revised as necessary.

7.2 Involvement Process

The regulatory process requires the ER Project to investigate a site, analyze the data, and then, based on the analysis, make and implement decisions. These decisions include cleanup actions and proposals for no further action (Chapter 3). Factors in cleanup decisions include the amounts and kinds of waste to be cleaned up, the types of technologies to be used, public concerns, and the desired degree of cleanup. Cleanup actions may themselves disturb the environment and produce wastes. The cost of cleanup must also be considered. The ER Project needs the public's help in weighing these factors before making cleanup decisions.

The ER Project will provide the public with a variety of opportunities to personally observe activities and discuss issues as cleanup progresses. During these activities, the ER Project technical staff will be available to discuss the history and background of the corrective action sites that are the subject of the activity, to describe the sampling and the data obtained on corrective action sites of interest, and to describe the risk assessment process and its relationship to various alternatives. The ER Project may also provide various opportunities for public involvement in specific projects, for example the development and revision of key ER Project documents; the design, selection, and implementation of interim actions; or ER Project activities related to land transfers. The types and scope of public involvement activities for such projects will be developed on a case-by-case basis, as appropriate. As required by regulation, meetings are held for the purpose of obtaining public comments and recommendations on certain proposed actions that involve modifying Module VIII of the Laboratory's Hazardous Waste Facility Permit. Comments obtained at such meetings are forwarded to the New Mexico Environment Department for consideration in deciding whether to accept the ER Project's proposals.

As recommendations for actions at corrective action sites are developed, ER Project personnel will discuss with the public the ramifications of cleanup to residential, recreational, and industrial standards. With the public's involvement, the ER Project will prioritize sites and discuss appropriate cleanup standards.

The sections that follow provide descriptions of the specific activities proposed for use in implementing this public involvement plan.

7.2.1 Information Preparation

ER Project personnel prepare a variety of materials for the northern New Mexico community regarding the ER Project activities. The materials may include progress reports, news releases, informal handouts for tours, information sheets, photographic and video tours, and citizen toolkits. These materials describe site history when appropriate and include site maps, information about potential contamination, and cleanup alternatives such as no further action and accelerated cleanups. Personnel strive to make information sheets sensitive to cultural issues and solicit comments from the public to make sure their concerns have been addressed. Some information sheets are translated into Spanish. If the pueblos indicate a desire for an oral translation, the ER Project will arrange for presentations in pueblo languages. The ER Project also maintains this information, as well as reports and other information it generates, on the World Wide Web at `http://erproject.lanl.gov`.

7.2.2 Information Dissemination

The major objective of all information dissemination is to familiarize the public with the ER Project so that the public may participate more knowledgeably in the decision-making process. The ER Project maintains communication with the public in several ways, including posting information on the World Wide Web site, preparing and distributing information sheets and summaries of major project actions, and organizing and conducting community meetings, tours, and workshops. The public is notified of these events through mailings from the Laboratory's facility mailing list; public service announcements on local radio stations; notices and advertisements in local newspapers, such as *Albuquerque Journal North, Santa Fe New Mexican, Rio Grande Sun, Taos News, and Los Alamos Monitor;* and information on the World Wide Web site. Information is also provided to the media via press releases to the aforementioned newspapers, as well as television stations throughout northern New Mexico; dialogue with members of the public is provided through meetings of the CAB, meetings with local governments and tribes, public meetings, and meetings with various civic organizations.

The Laboratory Public Reading Room in Los Alamos (phone: 505-665-4400 or 800-508-4400) is the repository for documents about the Laboratory's ER Project activities that are of interest to the public. In addition, the ER Project provides some technical reports and other key documents to the Mesa Public Library in Los Alamos, the public libraries in Española and Santa Fe, the Office of the Governor of the San Ildefonso Pueblo, the CAB office, and Laboratory outreach centers in Española and Santa Fe. Access to the catalog of documents housed in the Public Reading Room or accessible on-line is available on the Laboratory’s World Wide Web site at `http://www.lanl.gov/worldwideview`.

Other information provided to members of the public includes written notification to neighbors when new field campaigns are initiated and notification of newly discovered off-site releases that might impact members of surrounding communities (e.g., San Ildefonso Pueblo and Los Alamos). Should such a release be discovered, the ER Project will inform the affected parties as soon as possible.

7.2.2.1 Community Meetings

To improve its dialogue with the community, the ER Project hosts formal quarterly community meetings and conducts other activities such as round-table discussions, site tours, informal monthly meetings, and speaking directly with interested groups and citizens. The ER Project will continue to solicit invitations from community groups to attend their meetings for the purpose of sharing information, discussing the ER Project, and encouraging public participation in the ER Project, targeting such groups as traditional clubs, acequia associations, land associations, Laboratory employees, media associations, local and tribal governments, local schools and universities, and church groups. The primary goals of these meetings are personal engagement and informal group dialogue. The ER Project also participates in public meetings held by DOE's Headquarters and Albuquerque Operations Offices and by the New Mexico Environment Department.

7.2.2.2 Tours

Tours help acquaint the public with the ER Project and specific corrective action sites as these sites are addressed throughout the corrective action process, especially prior to initiation of investigation and cleanup activities. Written information supplements the discussions during the tours. These tours are open to all members of the public interested in ER Project activities. To guide future planning and to aid in evaluation, ER Project personnel record participants' concerns and suggestions and respond as appropriate.

7.2.2.3 Education Programs

Members of the ER Project staff visit schools and help teachers who request assistance in developing class projects that promote students' understanding of environmental restoration and their involvement in the ER Project. ER Project personnel work with the Laboratory's Science Education and Outreach Group to develop programs for students and to provide support for existing efforts that focus on ER Project-related activities.

7.2.2.4 Northern New Mexico Citizens Advisory Board

The CAB is a DOE-chartered site-specific advisory board whose purpose is to provide independent advice and recommendations to DOE regarding the Laboratory's ER Project and waste management activities and associated environmental issues. It is composed of citizens representing the communities and pueblos of northern New Mexico. The full CAB holds monthly public meetings and has chartered a number of committees, including an environmental restoration committee. The ER Project provides information, training, and tours to the CAB and provides staff support to both its public and committee meetings.

7.2.3 Public Input

Throughout the public involvement process, the ER Project invites people to participate more actively in developing recommendations for cleanup decisions and invites such people to working meetings for this purpose.

Public Involvement in the Planning Process

The ER Project provides planning information to the public annually through the "Accelerating Cleanup: Paths to Closure" document, which contains projections of proposed activities and budgets for the ER Project. The document is available at the Laboratory Public Reading Room in Los Alamos and the outreach centers in Española and Santa Fe. More information regarding DOE's process for public involvement in its budget is available on the World Wide Web at `http://www.em.doe.gov`. Various aspects of the planning process are also discussed at the formal quarterly community meetings.

Public Involvement in the Land Transfer Process

On November 26, 1997, Congress enacted Public Law 105-119, which required the DOE to identify parcels of land within the Laboratory that could be considered for transfer to either Los Alamos County or San Ildefonso Pueblo for the purposes of economic development or cultural preservation. The DOE has identified ten parcels that may be transferred, in whole or in part, by November 26, 2007. Before transferring the parcels, all environmental restoration work required within a parcel must be completed. In 1999, the ER Project initiated a public involvement program related to the land transfer initiative that will continue through November 2007. Meetings are held routinely with the two proposed recipients to discuss questions and concerns that they have related to environmental contamination on any of the parcels proposed for transfer. The CAB receives regularly scheduled and ad hoc updates on the land transfer process, as does the CAB's Environmental Restoration Committee. In addition, the ER Project schedules tours of the parcels and meetings regarding cleanup issues, as requested. Land transfer information is available to the general public on the ER Project's World Wide Web site and also in the form of a document entitled "Summary of Environmental Restoration Activities to Support Land Conveyance and Transfer at Los Alamos National Laboratory Under Public Law 105-119" (LANL 1999, 64153). Figure 7.1-1 identifies the land transfer parcels in relation to the watersheds and aggregates.

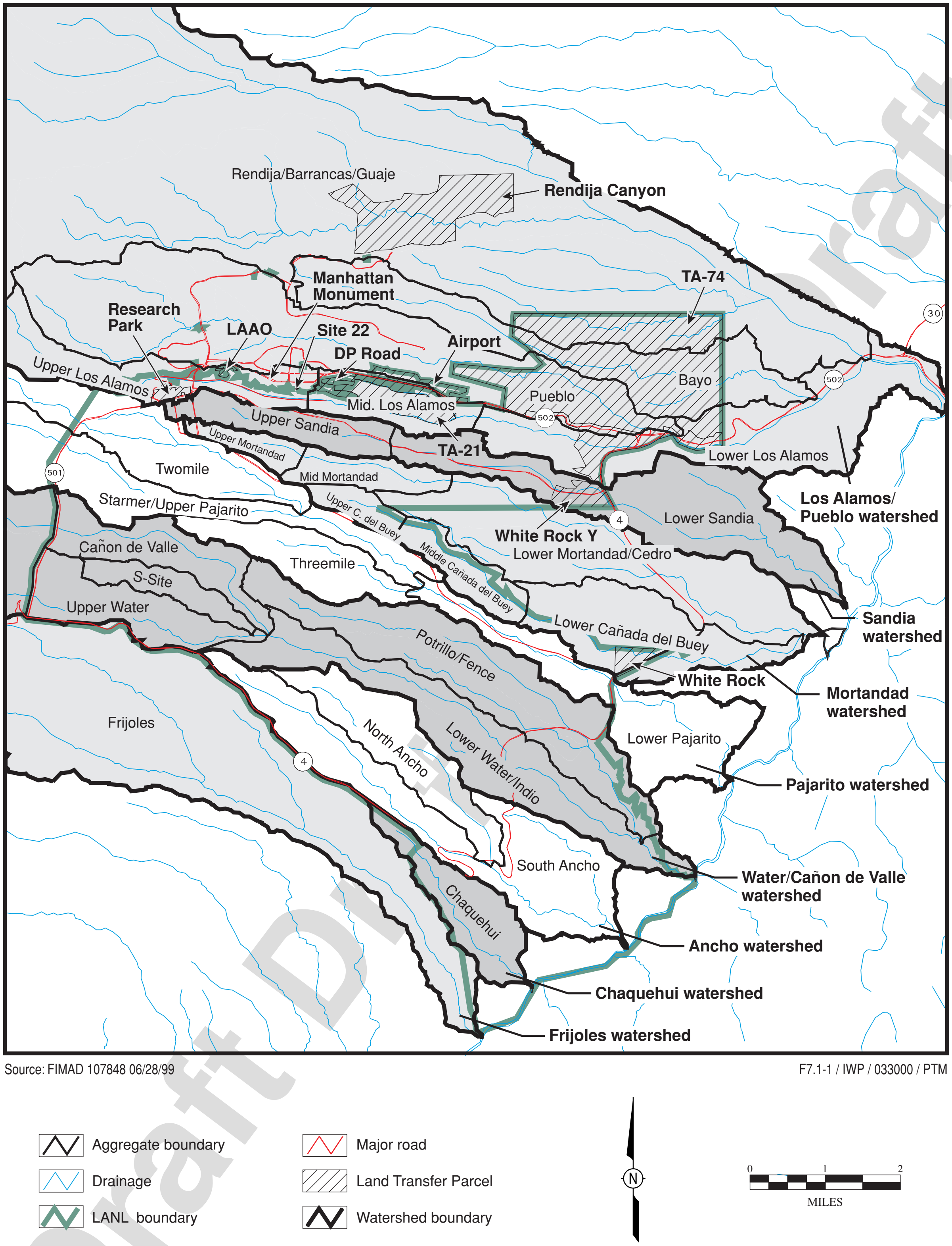

Figure 7.1-1. Land transfer parcels in relation to the watersheds and aggregates

REFERENCES FOR CHAPTER 7

The following list includes all references cited in this chapter. The parenthetical information following the reference provides the author, publication date, and ER Project identification (ER ID) number. This information is also included in the citation in the text and can be used to locate the document.

ER ID numbers are assigned by the Laboratory's ER Project to track all material associated with Los Alamos National Laboratory corrective action sites. These numbers can be used to locate copies of the documents at the ER Project's Records Processing Facility and, where applicable, within the ER Project reference library. The references cited in this report can be found in the volumes of the reference library titled "Reference Set for Regulatory Compliance Focus Area."

Copies of the reference library are maintained at the New Mexico Environment Department Hazardous and Radioactive Materials Bureau, the Los Alamos Area Office of the US Department of Energy, the US Environmental Protection Agency, and the ER Project Office. This library is a living document that was developed to ensure that the administrative authority has all the necessary material to review the decisions and actions proposed in this report. However, documents previously submitted to the administrative authority are not included in the reference library.

EPA (US Environmental Protection Agency), April 19, 1994. Module VIII of RCRA Permit No. NM0890010515, EPA Region VI, new requirements issued to Los Alamos National Laboratory, Los Alamos, New Mexico, effective May 19, 1994, EPA Region VI, Hazardous Waste Management Division, Dallas, Texas. (EPA 1994, 44146)

LANL (Los Alamos National Laboratory), November 1990. "Installation Work Plan for Environmental Restoration," Volume I, Los Alamos National Laboratory Report LA-UR-90-3825, Los Alamos, New Mexico. (LANL 1990, 7517)

LANL (Los Alamos National Laboratory), November 1990. "Installation Work Plan for Environmental Restoration," Volume II, Part 1, Los Alamos National Laboratory Report LA-UR-90-3825, Los Alamos, New Mexico. (LANL 1990, 7518)

LANL (Los Alamos National Laboratory), November 1990. "Installation Work Plan for Environmental Restoration," Volume II, Part 2, Los Alamos National Laboratory Report LA-UR-90-3825, Los Alamos, New Mexico. (LANL 1990, 7519)

LANL (Los Alamos National Laboratory), 1999. "Integrated Technical Strategy," Los Alamos National Laboratory Report LA-UR-99-3506, Los Alamos, New Mexico. (LANL 1999, 63491)

LANL (Los Alamos National Laboratory), August 1999. "Summary of Environmental Restoration Activities to Support Land Conveyance and Transfer Under Public Law 105-119," Los Alamos National Laboratory Report LA-UR-99-1018, Los Alamos, New Mexico. (LANL 1999, 64153)

Appendix A

Acronyms, Glossary, and Conversion Table

APPENDIX A ACRONYMS, GLOSSARY, AND CONVERSION TABLE

A-1.0 ACRONYMS AND ABBREVIATIONS

ABS	absorption factor
ACA	accelerated corrective action
AEC	US Atomic Energy Commission
AF	adherence factor
ALARA	as low as reasonably achievable
ANTI-C	radiological protective clothing
AOC	area of concern
AR	administrative record
BV	background value
CAB	Citizens Advisory Board
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CIC	Computing, Information, and Communication (Division)
CMI	corrective measures implementation
CMS	corrective measures study
COPC	chemicals of potential concern
COPEC	chemical contaminant of potential environmental concern
CPR	cardiopulmonary resuscitation
DOE	US Department of Energy
DOE-LAAO	US Department of Energy/Los Alamos Area Office
DOE/UC	US Department of Energy/University of California
DOT	US Department of Transportation
DP	Defense Programs (US Department of Energy)
DQO	data quality objective
EIS	environmental impact statement
EM	Office of Environmental Restoration and Waste Management
EM-30	Waste Operations (EM associate directorate)
EM-40	Environmental Restoration (EM associate directorate)
EM-50	Technology Development (EM associate directorate)
EO	executive order
EPA	US Environmental Protection Agency
ER	Environmental Restoration (Program)

ESG	Environmental Studies Group
ESH	Environment, Safety, and Health (Division)
ESL	ecological screening level
FAPL	focus area project leader
FIMAD	Facility for Information Management, Analysis, and Display
FMU	facility management unit
GAE	general assessment endpoint
GI	gastrointestinal
GIS	Geographical Information System
H&S	health and safety
HASP	Health and Safety Plan
HAZMAT	hazardous materials
HAZWOPER	Hazardous Waste Operations and Emergency Response
HEAST	Health Effects Assessment Summary Tables
HI	hazard index
HPT	health protection technician
HQ	hazard quotient
HSWA	Hazardous and Solid Waste Amendments
ICR	incremental cancer risk
IA	interim action
ID	identification number
IM	interim measure
IRIS	Integrated Risk Information System
ISM	Integrated Safety Management (System)
IWP	installation work plan
Laboratory	Los Alamos National Laboratory
LANL	Los Alamos National Laboratory
LDR	land disposal restriction
LTSM	long-term surveillance and maintenance
MCL	maximum contaminant level
MDA	materials disposal area
MSA	Major Systems Acquisition
NCEA	National Center for Environmental Assessment
NEPA	National Environmental Policy Act

NFA	no further action
NMAC	New Mexico Administrative Code
NMED	New Mexico Environment Department
NMEID	New Mexico Environmental Improvement Division
NMHWA	New Mexico Hazardous Waste Act of 1977
NMUSTB	New Mexico Underground Storage Tank Bureau
NOD	Notice of Deficiency
OSHA	Occupational Safety and Health Administration
OU	operable unit
PCB	polychlorinated biphenyl
PEF	particulate emission factor
PRS	potential release site
QA	quality assurance
QC	quality control
QP	quality procedure
RAGS	Risk Assessment Guidance for Superfund
RCRA	Resource Conservation and Recovery Act
RCT	radiological control technician
RFI	RCRA facility investigation
RPF	Records-Processing Facility
RSAA	Radiological Surveillance Authorization Agreement
RSI	Request for Supplemental Information
RSP	radiological screening personnel
SAL	screening action level
SAP	sampling and analysis plan
SMO	Sample Management Office
SOP	standard operating procedure
SSHASP	site-specific health and safety plan
SSO	site safety officer
SWMU	solid waste management unit
TA	technical area
TCLP	toxicity characteristic leaching procedure
THA	task hazard analysis
TSCA	Toxic Substances Control Act

TSD	treatment, storage, disposal
UC	University of California
UCL	upper confidence limit
UHTREX	ultra-high-temperature reactor experiment
USC	United States Code
USGS	US Geological Survey
UST	underground storage tank
VCA	voluntary corrective action
VCM	voluntary corrective measure
VF	volatilization factor
VOC	volatile organic compound

A-2.0 GLOSSARY

absorption. The penetration of substances into the bulk of a solid or liquid.

action level. Health- and environmental-based concentrations derived using chemical-specific toxicity information and standardized exposure assumptions. Action levels can be developed on a facility-specific basis or can be taken from standardized lists (61 Federal Register 19446). Contamination found in a particular medium below an appropriate action level would not generally be subject to remediation or further study.

administrative authority. The New Mexico Environment Department, US. Environmental Protection Agency, or the US Department of Energy, as appropriate.

adsorption. The surface retention of solid, liquid, or gas molecules, atoms, or ions by a solid or a liquid.

alluvial. Relating to geologic deposits or features formed by running water.

alluvium. Clay, silt, sand, and gravel transported by water and deposited on streambeds, flood plains, and alluvial fans.

analysis. Includes physical analysis, chemical analysis, and knowledge-of-process determinations. (Laboratory Hazardous Waste Facility Permit)

analyte. The element, nuclide, or ion a chemical analysis seeks to identify and/or quantify; the chemical constituent of interest.

analytical method. A body of procedures and techniques for systematically performing an activity.

anomaly. A deviation that is beyond normal variations.

aquifer. Body of permeable geologic material whose saturated portion is capable of readily yielding groundwater to wells.

area of concern (AOC). Areas at the Laboratory that might warrant further investigation for releases based on past facility waste management activities.

assessment. (1) The act of reviewing, inspecting, testing, checking, conducting surveillance, auditing, or otherwise determining and documenting whether items, processes, or services meet specified requirements. (2) An evaluation process used to measure the performance or effectiveness of a system and its elements. In this document, assessment is an all-inclusive term used to denote any of the following: audit, performance evaluation, management system review, peer review, inspection, and surveillance.

assessment endpoint. In a risk analysis, the quantitative or quantifiable expression of an environmental value considered to be at risk (e.g., a 25% reduction in fish biomass or local extinction of an avian species).

background level. Naturally occurring concentrations (levels) of an inorganic chemical and naturally occurring radionuclides in soil, sediment, and tuff.

background screening value (BSV). A threshold used to identify site sample results that may be greater than background levels.

barrier. Any material or structure that prevents or substantially delays movement of solid-, liquid-, or gaseous-phase chemicals in environmental media.

baseline risk assessment (also known as risk assessment)**.** A site-specific analysis of the potential adverse effects of hazardous constituents that are released from a site in the absence of any control or mitigation actions. A baseline risk assessment consists of four steps: data collection and analysis, exposure assessment, toxicity assessment, and risk characterization.

bias. Systematic deviation from the true value that remains constant over replicated measurements within the statistical precision of the measurement process.

blank sample. Sample expected to have negligible or unmeasurable amounts of analytes. Results of blank sample analyses indicate whether field samples might have been contaminated during the sample collection, transport, storage, preparation, and analysis process.

blind sample. See single blind sample and double blind sample.

borehole logging. The process of making remote measurements of physical, chemical, or other parameters at multiple depths in a borehole.

calibration. Process used to identify the relationship between the true (reference) analyte concentration or other variable and the response of a measurement instrument, chemical analysis method, or other measurement system.

certification. A signed statement attached to all reports required by permits and to other information requested by the administrative authority (AA), It ensures that a document and all its attachments were prepared under the direction or supervision of an authorized person in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted; it carries significant penalties for known violations [Permit Program, 27.11(b)(c)(d)].

chain of custody. Unbroken, documented trail of accountability designed to ensure the uncompromised physical integrity of samples, data, and records.

chemical. Any naturally occurring or man-made substance characterized by a definite molecular composition, including molecules that contain radionuclides.

chemical analysis. Process used to measure one or more attributes of a sample in a clearly defined, controlled, systematic manner. Often requires treating a sample chemically or physically before measurement.

chemical of potential concern (COPC). A chemical, detected at a site, that has the potential to adversely affect human receptors due to its concentration, distribution, and mechanism of toxicity. A COPC remains a concern until exposure pathways and receptors are evaluated in a site-specific human health risk assessment.

chemical of potential ecological concern (COPEC). A chemical, detected at a site, that has the potential to adversely affect ecological receptors due to its concentration, distribution, and mechanism of toxicity.

cleanup levels. Media-specific contaminant concentration levels that must be met by a selected corrective action. Cleanup levels are established by using criteria such as protection of human health and the environment; compliance with regulatory requirements; reduction of toxicity, mobility, or volume through treatment; long- and short-term effectiveness; implementability; cost; and public acceptance.

colluvium. Loose rock debris that accumulates at the base of a cliff or on a slope principally by the action of gravity.

confluence. Place where two or more streams meet; the point where a tributary meets the main stream.

contaminant. Any chemical (including radionuclides) present in environmental media or on structural debris.

contract analytical laboratory. An analytical laboratory under contract to the University of California to perform analysis of samples for work performed at the Laboratory.

controlled area. Laboratory area to which access is controlled to protect individuals from exposure to radiation and/or hazardous materials.

corrective action. Action to rectify conditions adverse to human health or the environment.

corrective measures implementation (CMI) plan. A detailed plan and specifications to implement the approved remedy at the facility. It is the third step of the corrective-action process. It includes design, construction, maintenance, and monitoring of the chosen remedy.

corrective measures study (CMS). A formal process to identify and evaluate remedy alternatives for releases at the facility (55 Federal Register 30798).

cumulative risk. The evaluation of simultaneous exposure to a receptor across multiple media, pathways, and contaminants to estimate the resulting health and environmental effects.

data quality assessment. Statistical and scientific evaluation of a data set that establishes whether it is adequate for its intended use.

data quality objective (DQO). Qualitative and quantitative goals developed before sampling begins. DQOs clarify investigation objectives and identify the type, quantity, and quality of data needed to support decisions.

data validation. Systematic process that applies a defined set of performance-based criteria to a body of data; may result in qualification of the data. The data validation process is performed independently of the analytical laboratory that generates the data set and occurs before conclusions are drawn from the data. The process may comprise a standardized data review (routine data validation) and/or a problem-specific data review (focused data validation).

data verification. Process of evaluating the completeness, correctness, consistency, and compliance of a laboratory data package against a specified standard or contract.

- Completeness means all required information is present—both hard copy and electronic.
- Correctness means the reported results are based on properly documented and correctly applied algorithms.
- Consistency means values are the same when they appear in different reports or are transcribed from one report to another.
- Compliance means the data pass numerical quality control (QC) tests based on parameters or limits specified in a contract or in an auxiliary document.

decommissioning. Permanent removal from service of facilities and their components, after the discontinued use of structures or buildings deemed no longer useful, in accordance with regulatory requirements and environmental policies.

decontamination. Removal of unwanted material from the surface of or from within another material.

deferred action. The postponement of the selection and implementation of a corrective measure; usually follows decommissioning of an active site.

detect. Sample result above the method detection level (MDL) reported by the laboratory. The laboratory reports the concentration of the analyte in the sample.

detection limit. Minimum concentration that can be determined by a single measurement by an instrument; implies a specified statistical confidence that the analytical concentration is greater than zero.

discharge. Accidental or intentional spilling, leaking, pumping, pouring, emitting, emptying, or dumping of hazardous waste into or on any land or water. (RCRA, 40 CFR 260.10)

disposal. The discharge, deposit, injection, dumping, spilling, leaking, or placing of any solid waste or hazardous waste into or on any land or water so that such solid waste or hazardous waste or any constituent thereof may enter the environment or be emitted into the air or discharged into any waters, including groundwaters. (40 CFR Part 260.10)

dose. Quantity of radiation that is absorbed, per unit of mass, by the body or by any portion of the body.

dose equivalent. Estimated amount of biological damage (in rems) done by the deposition in tissue of a given unit of absorbed-radiation dose.

ecological screening level (ESL). An organism's exposure-response threshold for a given chemical constituent. The concentration of a substance in a particular medium corresponds to a hazard quotient (HQ) of 1.0 for a given organism below which no risk is indicated.

effluent. Liquid discharged as a waste, such as contaminated water from a factory or the outflow from a sewage works; water discharged from a storm sewer or from land after irrigation.

environmental assessment (EA). A report that identifies potentially significant environmental impacts from any federally approved or federally funded project that may change the physical environment. If an EA shows significant impact, an environmental impact statement (EIS) is required.

environmental surveillance. Collection and analysis of samples of air, water, soil, foodstuffs, biota, and other media to determine the environmental quality of an industry or community. Environmental surveillance commonly is performed at sites that contain nuclear facilities.

ephemeral. Said of a stream or spring that flows only during and immediately after periods of rainfall or snowmelt.

ER data. Data derived as a result of samples that are collected and paid for by ER Project funding.

error. The quantifiable difference between an observed value and the true value of the parameter being measured.

estimated quantitation limit (EQL). The lowest concentration that can be reliably achieved within specified limits of precision and accuracy during routine analytical-laboratory operating conditions. The low point on a calibration curve should reflect this quantitation limit. The EQL is not used to establish detection status. Sample estimated quantitation limits are highly matrix-dependent, and the specified estimated quantitation limits might not always be achievable. See the statement of work (SOW) for analytical services (RFP No. 9-XS1-Q4257) for a more complete definition.

evapotranspiration. The combined discharge of water from the earth's surface to the atmosphere by evaporation from lakes, streams, and soil surfaces, and by transpiration from plants.

exposure pathway. Mode by which a receptor may be exposed to contaminants in environmental media (e.g., drinking water, ingesting food, or inhaling dust).

exposure unit. The bounded area or volume within which a person or other receptor may be exposed to contaminants that have been released to the environment.

fallout radionuclides. Radionuclides that are present at globally elevated levels in the environment as a result of the fallout from atomic weapons tests. The Laboratory background data sets consist of Environmental Surveillance samples taken from marginal and regional locations for the following radionuclides associated with fallout: tritium, cesium-137, americium-241, plutonium-238, plutonium-239/240, and strontium-90. Samples were collected from regional and marginal locations in the vicinity of the Laboratory that are (1) representative of geological media found within Laboratory boundaries and (2) were not impacted by Laboratory operations.

fault. A fracture, or zone of fractures, in rock along which there has been vertical or horizontal movement; adjacent rock layers or bodies are displaced.

Federal Register. The official daily publication for Rules, Proposed Rules, and Notices of federal agencies and organizations, as well as Executive Orders and other Presidential Documents.

focused data validation. A technically based analyte-, sample-, and potentially data-use-specific process that extends the qualification of data beyond method or contractual compliance and provides a level of confidence that an analyte is present or absent. If the analyte is present, the quality of the quantitation may be obtained through focused validation.

geohydrology. The science that applies hydrologic methods to the understanding of geologic phenomena.

grab sample. A specimen collected by a single application of a field sampling procedure to a target population (e.g., the surface soil from a single hole collected following the spade and scoop sampling procedure or a single air filter left in the field for three months).

ground cover. The covering of naturally occurring soils by either natural or man-made mechanisms (e.g., grasses, pine needles, asphalt, concrete, etc.).

groundwater. Water in a subsurface saturated zone; water beneath the regional water table.

gully erosion. The erosion process whereby water accumulates in narrow channels and, over short periods, removes the soil from this narrow area to considerable depths, which can range from 1 ft to as much as 50 ft.

half-life. The time required for one-half of the radioactive atoms initially present in a sample to decay. Each radionuclide has a characteristic half-life ranging from a fraction of a second to thousands of years.

hazard index (HI). The sum of hazard quotients for multiple contaminants to which a receptor (j) is determined to be exposed, i.e., $HI_j = \ _I HQ_{ij}$.

hazard quotient (HQ). The ratio of a calculated exposure (E) to or dose (D) from a given contaminant (I) to a given receptor (j) over a reference value (TRV) for contaminant (I) determined to be protective of receptor (j), i.e., $HQ_{ij} = E_{ij}$ [or D_{ij}]TRV_{ij}.

Hazardous and Solid Waste Amendments (HSWA). The Hazardous and Solid Waste Amendments of 1984 (Public Law No. 98-616, 98 Stat. 3221), which amended the Resource Conservation and Recovery Act of 1976, 42 U.S.C. § 6901 et seq.

hazardous constituent. Those constituents listed in Appendix VIII to 40 CFR Part 261.

hazardous waste. Any solid waste is generally a hazardous waste if it

- is not excluded from regulation as a hazardous waste,
- is listed in the regulations as a hazardous waste,
- exhibits any of the defined characteristics of hazardous waste (ignitability, corrosivity, reactivity, or toxicity), or
- is a mixture of solid waste and hazardous waste.

See 40 CFR 261.3 for a complete definition of hazardous waste.

holding time. The maximum elapse of time that one can expect to store a sample without unacceptable changes in analyte concentrations. Holding times apply under prescribed conditions and deviations from these conditions may affect the holding time. Extraction holding time refers to the time lapse from sample collection to sample preparation; Analytical holding time refers to the time lapse between sample preparation and analysis.

HSWA module. Module VIII of the Laboratory's Hazardous Waste Facility Permit. This permit allows the Laboratory to operate as a treatment, storage, and disposal facility.

hydraulic conductivity. The rate at which water moves through a medium in a unit of time under a unit hydraulic gradient through a unit area measured perpendicular to the direction of flow.

hydraulic gradient. The rate of change of hydraulic head per unit of distance in the direction of groundwater flow.

hydraulic head. Elevation of the water table or potentiometric surface as measured in a well.

Hydrogeologic Workplan. The document that describes activities planned by the Laboratory to characterize the hydrologic setting beneath the Laboratory and to enhance the Laboratory's groundwater monitoring program.

hydrogeology. The science that applies geologic methods to the understanding of hydrologic phenomena.

industrial-use scenario. Industrial use is the scenario in which current Laboratory operations continue. Any necessary remediation involves cleanup to standards designed to ensure a safe and healthy work environment for Laboratory workers.

infiltration. Entry of water into the ground.

institutional controls. Controls that prohibit or limit access to contaminated media: use restrictions, permitting requirements, standard operating procedures, Laboratory Implementation Requirements, Laboratory Implementation Guidance, Laboratory Performance Requirements, etc.

interim measure. Short-term actions taken to respond to immediate threats to human health or to prevent damage or contaminant migration to the environment.

interflow. A runoff process that involves lateral subsurface flow in the soil zone.

intermittent stream. A stream that flows only in certain reaches due to losing and gaining characteristics of the channel bed.

laboratory qualifier (or laboratory flag)**.** Codes applied to the data by the contract analytical laboratory to indicate, on a gross scale, a verifiable or potential data deficiency. These flags are applied using the Environmental protection Agency (EPA) contract laboratory program (CLP) guidelines.

LANL data validation qualifiers. The data qualifiers defined by the Laboratory (LANL) and used in the ER Project baseline-validation process. For a complete list of data qualifiers applicable to any particular analytical suite, consult the appropriate ER Project standard operating procedure (ER-SOPs 15.01–15.06).

leachate. Any liquid, including any suspended components in the liquid, that has percolated through or drained from hazardous waste (40 CFR 260.10).

leaching. The separation or dissolving out of soluble constituents of a solid material by the natural action of percolating water or by chemicals.

matrix (see also sample matrix)**.** Relatively fine material in which coarser fragments or crystals are embedded; also called "ground mass" in the case of igneous rocks.

maximum contaminant level (MCL). Under the Safe Drinking Water Act, the maximum permissible level of a contaminant in water that is delivered to any user of a public water system that serves 15 or more connections and 25 or more people. The standards set take into account the feasibility and cost of attaining the standard.

medium (environmental)**.** Any media capable of absorbing or transporting constituents. Examples of media include tuffs, soils and sediments derived from these tuffs, surface water, soil water, groundwater, air, structural surfaces, and debris.

medium (geological)**.** The solid part of the hydrogeological system; may be unsaturated or saturated.

method detection limit (MDL). The minimum concentration of a substance that can be measured and reported with a known statistical confidence that the analyte concentration is greater than zero. The MDL is determined from analysis of samples of a given matrix type that contain the analyte after subjecting the sample to the usual preparation and analyses. The MDL is used to establish detection status.

migration. The movement of inorganic and organic species through unsaturated or saturated materials.

migration pathway. A route (e.g., a stream or subsurface flow path) that controls the potential movement of contaminants to environmental receptors (plants, animals, humans).

mixed waste. Waste that contains both hazardous waste (as defined by RCRA) and radioactive waste (as defined by the Atomic Energy Act [AEA] and its amendments).

model. A mathematical approximation of a physical, biological, or social system.

monitoring well. A well or borehole drilled for the purpose of yielding groundwater samples for analysis.

no further action (NFA). A recommendation that not further investigation or remediation is warranted based on specific criteria.

nondetect. Sample result that is less than the MDL. The laboratory reports nondetects as undetected at the EQL.

non-ER data. Data derived as a result of samples collected and paid for by sources other than the ER Project.

notice of deficiency (NOD). A notice issued to DOE and the Laboratory by the administrative authority which states that some aspect(s) of a plan, report, or application does not meet their requirements or that requires clarification or correction.

operable unit (OU). At the Laboratory, one of 24 areas originally established for administering the ER Project. Set up as groups of potential release sites, the OUs were aggregated based on geographic proximity for the purpose of planning and conducting RCRA facility assessments and RCRA facility investigations. As the project matured, it became apparent that 24 were too many to allow efficient communication and to ensure consistency in approach. Therefore, in 1994, the 24 OUs were reduced to six administrative "field units."

perched groundwater. Groundwater that lies above the regional water table and is separated from it by one or more unsaturated zones.

percolation. Gravity flow of soil water through the pore spaces in soil or rock below the ground surface.

perennial stream. A stream or reach that flows continuously throughout the year.

permit modification. A request by either the permittee or the administrative authority to change to change a condition of the Laboratory's Hazardous Waste Facility Permit.

polychlorinated biphenyls (PCBs). Any chemical substance that is limited to the biphenyl molecule that has been chlorinated to varying degrees or any combination of substances which contains such substances. PCBs are colorless, odorless compounds that are chemically, electrically, and thermally stable and have proven to be toxic to both humans and animals.

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

porosity. The ratio of the volume of interstices in a soil or rock sample to its total volume expressed as a percentage or as a fraction.

potential release site (PRS). Refers to potentially contaminated sites at the Laboratory that are identified either as solid waste management units (SWMUs) or areas of concern (AOCs). PRS refers to SWMUs and AOCs collectively.

preliminary assessment. The process of collecting and reviewing available information about a potential release site.

preliminary risk assessment. A risk assessment conducted using conservative assumptions and scenarios and assuming no mitigating or corrective measures beyond those already in place.

quality assurance. All those planned and systematic actions necessary to provide adequate confidence that a facility, structure, system, or component will perform satisfactorily in service.

quality control (QC). (1) All those actions necessary to control and verify the features and characteristics of a material, process, product, or service to specified requirements. QC is the process through which actual quality performance is measured and compared with standards. (2) All methods and procedures used to obtain accurate and reliable results from environmental sampling and analysis. Includes rules for when, where, and how samples are taken; sample storage, preservation and transport; and the use of blanks, duplicates, and split samples during the analysis.

Quality Management Plan (QMP). A structured and documented management system describing the policies, objectives, principles, organizational authority, responsibilities accountability, and implementation plan of an organization for ensuring quality in its work processes, products (items), and services. The QMP provides the framework for planning, implementing, and assessing work performed by the organization and for carrying out required QA and QC.

quality procedure. A document that describes the process for performing activities governed by the ER Project's Quality Management Plan.

radioactive decay. (1) The process whereby radioactive materials undergo a change from one nuclide, element, or state to another, releasing radiation in the process. This action ultimately results in a decrease in the number of radioactive nuclei present in the sample. (2) The spontaneous transformation of one nuclide into a different nuclide or into a different isotope of the same nuclide accompanied by either the emission of particles from the nucleus, nuclear capture or ejection of orbital electrons, or fission.

radioactive material. Any material having a specific activity greater than 2 nanocuries per gram (nCi/g), is the activity per unit mass of the material and in which the radionuclide is evenly distributed. (This is a Department of Transportation definition.)

radioactive waste. Waste that has been determined to contain added (or concentrated naturally occurring radioactive material [NORM]) radioactive material or activation products by either monitoring or analysis, acceptable knowledge of both, or **does not** meet radiological release criteria.

radionuclide. A nuclide (species of atom) that exhibits radioactivity.

RCRA facility investigation (RFI). The investigation that determines if a release has occurred and the nature and extent of the contamination at a hazardous waste facility. The RFI is generally equivalent to the remedial investigation portion of the Comprehensive Environment Response, Compensation, and Liability Act (CERCLA) process.

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

recharge. The process by which water is added to the zone of saturation, either directly from the overlying unsaturated zone or indirectly by way of another material in the saturated zone.

recreational-use scenario. A land use condition under which individuals may be exposed for a limited amount of time as a result of outdoor activities such as hiking, camping, hunting, and fishing.

reference set. Compilation of reference items cited in ER Project documents within a specified focus area.

regional aquifer. Geologic material(s) or unit(s) of regional extent whose saturated portion yields significant quantities of water to wells, contains the regional zone of saturation, and is characterized by the regional water table or potentiometric surface.

regulatory standard. Media-specific contaminant concentration levels of potential concern that are mandated by federal or state legislation or regulation (e.g., the Safe Drinking Water Act, New Mexico Water Quality Control Commission regulations).

release. Any spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping, or disposing of hazardous waste or hazardous constituents into the environment (including the abandonment or discarding of barrels, containers, and other closed receptacles that contain any hazardous wastes or hazardous constituents).

remediation. The process of reducing the concentration of a contaminant (or contaminants) in air, water, or soil media to a level that poses an acceptable risk to human health and the environment; the act of restoring a contaminated area to a usable condition based on specified standards.

residential-use scenario. The standards for residential use are the most stringent of the three current- and future-use scenarios being considered by the ER Project and is the level of cleanup the EPA is currently specifying for SWMUs located off the Laboratory site and for those released for non-Laboratory use.

Resource Conservation and Recovery Act (RCRA). The Solid Waste Disposal Act as amended by the Resource Conservation and Recovery Act of 1976. (40 CFR 270.2)

retardation. The act or process that reduces the rate of movement of a chemical substance in water relative to the average velocity of the water. The movement of chemical substances in water can be retarded by adsorption and precipitation reactions, and by diffusion into the pore water of the rock matrix.

rill erosion. An erosion process in which numerous small channels only several inches deep are formed by concentrated runoff that flows during and immediately following rain storms.

risk. A measure of a negative or undesirable impact associated with an event.

risk analysis. A qualitative evaluation to determine the probability and the potential consequences associated with noncompliance of documents or work activities.

risk characterization. The summarization and integration of the results of toxicity and exposure assessments into quantitative and qualitative expressions of risk. The major assumptions, scientific judgments, and sources of uncertainty related to the assessment are also presented.

risk management. The integration of risk characterization with other nonscientific considerations specified in applicable statutes to make and justify regulatory decisions (RCRA/CERCLA Update, June 1992).

runoff. The portion of the precipitation on a drainage area that is discharged from the area either by sheet flow or adjacent stream channels.

run-on. Surface water flowing onto an area as a result of runoff occurring higher up the slope.

sample. A portion of a material (e.g., rock, soil, water, air), which, alone or in combination with other samples, is expected to be representative of the material or area from which it is taken. Samples are typically sent to a laboratory for analysis or inspection or are analyzed in the field. When referring to samples of environmental media, the term field sample may be used.

sample matrix. In chemical analysis, that portion of a sample which is exclusive of the analytes of interest. Together, the matrix and analytes of interest form the sample.

screening action level (SAL). Medium-specific concentration level for a chemical derived using conservative criteria below for which it is generally assumed that there is no potential for unacceptable risk to human health. The derivation of a SAL is based on conservative exposure and land-use assumptions. However, if an applicable regulatory standard exists that is less than the value derived by risk-based computations, it will be used for the SAL.

screening assessment. A process designed to determine whether contamination detected in a particular medium at a site may present a potentially unacceptable human-health and /or ecological risk. The assessment utilizes screening levels that are either human-health or ecologically based concentrations derived by using chemical-specific toxicity information and standardized exposure assumptions below which no additional actions are generally warranted.

sediment. (1) A mass of fragmented inorganic solid that comes from the weathering of rock and is carried or dropped by air, water, gravity, or ice; or a mass that is accumulated by any other natural agent and that forms in layers on the earth's surface such as sand, gravel, silt, mud, fill, or loess. (2) A solid material that is not in solution and either is distributed through the liquid or has settled out of the liquid.

significant condition. A condition which, if uncorrected, could have a serious effect on quality, project personnel, or the public's safety or could have a major impact on the project costs or schedules.

site characterization. Defining the pathways and methods of migration of the hazardous waste or constituents, including the media affected, the extent, direction and speed of the contaminants, complicating factors influencing movement, concentration profiles, etc. (U.S. Environmental Protection Agency, May 1994. "RCRA Corrective Action Plan, Final," Publication EPA-520/R-94/004, Office of Solid Waste and Emergency Response, Washington, DC)

site conceptual model. A qualitative or quantitative description of sources of contamination, environmental transport pathways for contamination, and biota that may be impacted by contamination (called receptors) and whose relationships describe qualitatively or quantitatively the release of contamination from the sources, the movement of contamination along the pathways to the exposure points, and the uptake of contaminant by the receptors.

Site-Specific Health and Safety Plan (SSHASP). A health and safety plan that is specific to a site or ER-related field activity that has been approved by an ER health and safety representative. This document contains information specific to the project including scope of work, relevant history, descriptions of hazards by activity associated with the project site(s), and techniques for exposure mitigation (e.g., personal protective equipment [PPE]) and hazard mitigation.

soil gas. Those gaseous elements and compounds that occur in the void spaces in unsaturated rock or soil. Such gases can move through or leave the rock or soil, depending on changes in pressure.

soil water. Water in the unsaturated zone, regardless of whether it occurs in soil or rock.

solid waste. Any garbage, refuse, or sludge from a waste treatment plant, water supply treatment plant, or air pollution control facility and other discarded material including solid, liquid, semisolid, or contained gaseous material resulting from industrial, commercial, mining, and agricultural operations and from community activities.

solid waste management unit (SWMU). Any discernible unit at which solid wastes have been placed at any time, irrespective of whether the unit was intended for the management of solid or hazardous waste. Such units include any area at a facility at which solid wastes have been routinely and systematically released. This definition includes regulated units (i.e., landfills, surface impoundments, waste piles, and land treatment units) but does not include passive leakage or one-time spills from production areas and units in which wastes have not been managed (e.g., product storage areas).

stakeholder. As used in this document, stakeholder refers to any party or agency, whether inside or outside the Laboratory, interested in or affected by Environmental Restoration Project issues and activities.

standard operating procedure (SOP). A document that details the method for an operation, analysis, or action with thoroughly prescribed techniques and steps, and is officially approved as the method for performing certain routine or repetitive tasks.

stop work. All activities that relate to specific functions are discontinued until an unacceptable condition is resolved.

stratification. Classification of the target population into two or more nonoverlapping and exhaustive categories (strata) on the basis of characteristics which are known a priori for the entire population.

stratigraphy. The science dealing with the succession, age, composition, and history of strata.

stop work. All activities that relate to specific functions are discontinued until an unacceptable condition is resolved.

target analyte. An element, chemical, or parameter, the concentration, mass, or magnitude of which is designed to be quantified by use of a particular test method.

technical area (TA). The Laboratory established technical areas as administrative units for all its operations. There are currently 49 active TAs spread over 43 square miles.

topography. The physical configuration of the land surface in an area.

toxic pollutants. The 126 individual priority toxic pollutants contained in 65 toxic compounds or classes of compounds (including organic pollutants and metals) adopted by the EPA pursuant to Section 307 (a) (1) of the Clean Water Act (DOE 1991).

tracer. A substance, usually a radioactive isotope, added to a sample to determine the efficiency (chemical or physical losses) of the chemical extraction, reaction, or analysis. The tracer is assumed to behave in the same manner as that of the target radionuclides. Recovery guidelines for tracer results are 30% to 110% under the current contract laboratory statement of work and will be 40% to 105% under the new statement of work. Correction of the analytical results for the tracer recovery is performed for each sample. The concentration of the tracer added needs to be sufficient to result in a maximum of 10% uncertainty at the 95% confidence level in the measured recovery.

treatment. Any method, technique, or process, including elementary neutralization, designed to change the physical, chemical, or biological character or composition of any hazardous waste so as to neutralize such waste; recover energy or material resources from the waste; or so as to render such waste nonhazardous or less hazardous; safer to transport, store, or dispose of; or amenable for recovery or storage; or reduced in volume.

trend analysis. An analytical or graphical representation used to identify changes in a variable when measured over a period of time.

tuff. A compacted deposit of volcanic ash and dust that contains rock and mineral fragments accumulated during an eruption.

unconfined. Said of water in a saturated zone that is open to the atmosphere (that is, not beneath a confining bed or under artesian pressure).

unsaturated hydraulic conductivity. A coefficient that describes the rate at which a fluid can potentially move through a permeable, unsaturated medium (EPA, 1986).

unsaturated zone. The zone between the land surface and the regional water table and between perched zones of saturation. Generally, fluid pressure in this zone is less than atmospheric pressure, and some of the voids may contain air or other gases at atmospheric pressure.

US Department of Energy (DOE). Federal agency that sponsors energy research and regulates nuclear materials for weapons production.

US Environmental Protection Agency (EPA). Federal agency responsible for enforcing environmental laws. While state regulatory agencies may be authorized to administer some of this responsibility, the EPA retains oversight authority to ensure protection of human health and the environment.

vadose zone. The unsaturated zone. Portion of the subsurface above the regional water table in which pores are not fully saturated.

water content. (Also gravimetric moisture content) The amount of water in an unsaturated medium, expressed as the ratio of the weight of water in a sample to the weight of the oven-dried sample; often expressed as a percent.

watershed. The region drained by, or contributing waters to, a stream, lake or other body of water and separated from adjacent drainage areas by a divides such as a ridge or summit of high ground.

water table. The top of the regional saturated zone; the piezometric surface associated with an unconfined aquifer.

welded tuff. A volcanic deposit hardened by the action of heat, pressures from overlying material, and hot gases.

A-3.0 METRIC TO ENGLISH CONVERSION TABLE

Metric to English Conversions

Multiply SI (Metric) Unit	by	To Obtain US Customary Unit
kilometers (km)	0.622	miles (mi)
kilometers (km)	3281	feet (ft)
meters (m)	3.281	feet (ft)
meters (m)	39.37	inches (in.)
centimeters (cm)	0.03281	feet (ft)
centimeters (cm)	0.394	inches (in.)
millimeters (mm)	0.0394	inches (in.)
micrometers or microns (µm)	0.0000394	inches (in.)
square kilometers (km^2)	0.3861	square miles (mi^2)
hectares (ha)	2.5	acres
square meters (m^2)	10.764	square feet (ft^2)
cubic meters (m^3)	35.31	cubic feet (ft^3)
kilograms (kg)	2.2046	pounds (lb)
grams (g)	0.0353	ounces (oz)
grams per cubic centimeter (g/cm^3)	62.422	pounds per cubic foot (lb/ft^3)
milligrams per kilogram (mg/kg)	1	parts per million (ppm)
micrograms per gram (µg/g)	1	parts per million (ppm)
liters (L)	0.26	gallons (gal.)
milligrams per liter (mg/L)	1	parts per million (ppm)
degrees Celsius (°C)	9/5 + 32	degrees Fahrenheit (°F)

Appendix B

Potential Release Sites at Los Alamos National Laboratory

Table B-1
Los Alamos Environmental Restoration Project Potential Release Sites Under Investigation
(sorted by PRS Number)

	Unit No.	Consolidated PRSs[a]	Unit Description	HSWA SWMU[b]	Focus Area	Former OU[c]
1	00-001		Sediment traps in Mortandad	Yes	Canyon	1049
2	00-003-99	00-003	Storage area	Yes	RCRA CA[d] - Townsite	1071
		00-012				
3	00-004		Container storage, 6th Street warehouses	No	RCRA CA - Townsite	1071
4	00-010(b)		Surface disposal site, 6th Street warehouses	No	RCRA CA - Townsite	1071
5	00-011(a)		Mortar impact area	Yes	RCRA CA - Townsite	1071
6	00-011(c)		Mortar impact area	Yes	RCRA CA - Townsite	1071
7	00-011(d)		Mortar impact area	Yes	RCRA CA - Townsite	1071
8	00-011(e)		Mortar impact area	Yes	RCRA CA - Townsite	1071
9	00-016		Firing range (inactive)	Yes	RCRA CA - Townsite	1071
10	00-017		Waste lines	Yes	RCRA CA - Townsite	1071
11	00-018(a)		Sludge bed, wastewater treatment plant, Pueblo (decommissioned)	Yes	RCRA CA - Townsite	1071
12	00-018(b)		Sludge bed, wastewater treatment plant, Bayo (active)	No	RCRA CA - Townsite	1071
13	00-019		Wastewater treatment plant, Central	Yes	RCRA CA - Townsite	1071
14	00-027		Storage area, DP Road	No	RCRA CA - Townsite	1071
15	00-028(a)		Effluent discharge, golf course (active)	Yes	RCRA CA - Townsite	1071
16	00-028(b)		Effluent discharge, ball fields (active)	Yes	RCRA CA - Townsite	1071
17	00-029(a)		Transformer	No	RCRA CA - Townsite	1071
18	00-029(b)		Transformer	No	RCRA CA - Townsite	1071
19	00-029(c)		Transformer	No	RCRA CA - Townsite	1071
20	00-030(a)		Septic system, DP Road	Yes	RCRA CA - Townsite	1071
21	00-030(b)		Septic system 6th Street (active)	Yes	RCRA CA - Townsite	1071
22	00-030(c)		Septic system	No	RCRA CA - Townsite	1071
23	00-030(d)		Septic system	No	RCRA CA - Townsite	1071
24	00-030(e)N		Septic system	No	RCRA CA - Townsite	1071
25	00-030(e)S		Septic system	No	RCRA CA - Townsite	1071
26	00-030(f)		Septic system	No	RCRA CA - Townsite	1071
27	00-030(g)		Septic system (near old Catholic Church parking lot)	Yes	RCRA CA - Townsite	1071
28	00-030(h)		Septic system (near new Catholic Church)	No	RCRA CA - Townsite	1071
29	00-030(i)		Septic system	No	RCRA CA - Townsite	1071
30	00-030(j)		Septic system	No	RCRA CA - Townsite	1071
31	00-030(k)		Septic system	No	RCRA CA - Townsite	
32	00-030(l)		Septic system, 6th Street warehouses (active)	Yes	RCRA CA - Townsite	1071
33	00-030(m)		Septic system, 6th Street warehouses (active)	Yes	RCRA CA - Townsite	1071
34	00-030(n)		Septic system	No	RCRA CA - Townsite	1071
35	00-030(o)		Septic system	No	RCRA CA - Townsite	1071

Table B-1 (continued)

	Unit No.	Consolidated PRSs[a]	Unit Description	HSWA SWMU[b]	Focus Area	Former OU[c]
36	00-030(p)		Septic system	No	RCRA CA - Townsite	1071
37	00-030(q)		Septic system	No	RCRA CA - Townsite	1071
38	00-031(a)		Soil contamination beneath former service station	No	RCRA CA - Townsite	1071
39	00-031(b)		Soil contamination beneath former motorpool - two USTs	No	RCRA CA - Townsite	1071
40	00-032		Soil contamination beneath former motorpool - UST for used motor oil	No	RCRA CA - Townsite	1071
41	00-033(a)		6th Street warehouses - UST removal	Yes	RCRA CA - Townsite	1071
42	00-033(b)		Outlet piping - 6th Street warehouse	No	RCRA CA - Townsite	1071
43	00-034(a)		Landfill, Eastern Area	No	RCRA CA - Townsite	1071
44	00-034(b)		Landfill, Western Area	No	RCRA CA - Townsite	1071
45	00-039		Underground tanks (new SWMU)	Yes	RCRA CA - Townsite	1071
46	C-00-001		Guaje Canyon	No	Canyon	1049
47	C-00-002		Rendija Canyon	No	Canyon	1049
48	C-00-003		Barrancas Canyon	No	Canyon	1049
49	C-00-004		Bayo Canyon	No	Canyon	1049
50	C-00-005		Pueblo Canyon	No	Canyon	1049
51	C-00-006		Los Alamos Canyon	No	Canyon	1049
52	C-00-007		Sandia Canyon	No	Canyon	1049
53	C-00-008		Mortandad Canyon	No	Canyon	1049
54	C-00-009		Cañada del Buey	No	Canyon	1049
55	C-00-010		Twomile Canyon	No	Canyon	1049
56	C-00-011		Pajarito Canyon	No	Canyon	1049
57	C-00-012		Threemile Canyon	No	Canyon	1049
58	C-00-013		Potrillo Canyon	No	Canyon	1049
59	C-00-014		Cañon de Valle	No	Canyon	1049
60	C-00-015		Fence Canyon	No	Canyon	1049
61	C-00-016		Water Canyon	No	Canyon	1049
62	C-00-017		Indio Canyon	No	Canyon	1049
63	C-00-018		Ancho Canyon	No	Canyon	1049
64	C-00-019		Chaquehui Canyon	No	Canyon	1049
65	C-00-020		Mortar impact area	No	RCRA CA - Townsite	1071
66	C-00-021		DP Canyon	No	Canyon	1049
67	C-00-036(a)		Borrow pit 1, Bandelier NM (new AOC)	No	RCRA CA - Townsite	1071
68	C-00-036(b)		Borrow pit 2, Bandelier NM (new AOC)	No	RCRA CA - Townsite	1071
69	C-00-036(c)		Borrow pit 3, Bandelier NM (new AOC)	No	RCRA CA - Townsite	1071
70	C-00-036(d)		Borrow pit 4, Bandelier NM (new AOC)	No	RCRA CA - Townsite	1071
71	C-00-037		Landfill, Bandelier NM (new AOC)	No	RCRA CA - Townsite	1071
72	C-00-038		Surface disposal, Bandelier NM (new AOC)	No	RCRA CA - Townsite	1071
73	C-00-041		Asphalt and tar remnant site	No	RCRA CA - Townsite	1071

Table B-1 (continued)

	Unit No.	Consolidated PRSs[a]	Unit Description	HSWA SWMU[b]	Focus Area	Former OU[c]
74	C-00-042		tank (formerly part of 0-032)	No	RCRA CA - Townsite	1071
75	C-00-043		Manhole (abandoned) (does not exist)	No	RCRA CA - Townsite	1071
76	01-001(a)-99	01-001(a)	Miscellaneous	Yes	RCRA CA - Townsite	1078
		01-001(b)				
		01-001(c)				
		01-001(d)				
		01-001(e)				
		01-001(f)				
		01-001(g)				
		01-001(m)				
		01-001(o)				
		01-001(s)				
		01-001(t)				
		01-001(u)				
		01-002				
		01-003(a)				
		01-003(b)				
		01-003(e)				
		01-004(a)				
		01-004(b)				
		01-005				
		01-006(a)				
		01-006(b)				
		01-006(c)				
		01-006(d)				
		01-006(e)				
		01-006(g)				
		01-006(h)				
		01-006(n)				
		01-006(o)				
		01-006(p)				
		01-007(a)				
		01-007(b)				
		01-007(c)				
		01-007(d)				
		01-007(e)				
		01-007(f)				
		01-007(h)				
		01-007(i)				

Table B-1 (continued)

	Unit No.	Consolidated PRSs[a]	Unit Description	HSWA SWMU[b]	Focus Area	Former OU[c]
		01-007(j)				
		01-007(l)				
		01-007(m)				
		01-007(o)				
77	01-003(c)		Surface disposal site	No	RCRA CA - Townsite	1078
78	01-003(d)		Surface disposal site - can dump	Yes	RCRA CA - Townsite	1078
79	01-007(k)		Soil contamination area	No	RCRA CA - Townsite	1078
80	01-007(n)		Soil contamination area	No	RCRA CA - Townsite	1078
81	02-003(a)		Reactor facility	No	Canyon	1098
82	02-003(b)		Reactor facility	No	Canyon	1098
83	02-003(c)		Reactor facility	No	Canyon	1098
84	02-003(d)		Reactor facility	No	Canyon	1098
85	02-003(e)		Holding tank (near reactor water boiler)	No	Canyon	1098
86	02-004(a)		Reactor facility	No	Canyon	1098
87	02-004(b)		Reactor facility effluent storage tank TA 2-54	No	Canyon	1098
88	02-004(c)		Reactor facility effluent storage tank TA 2-55	No	Canyon	1098
89	02-004(d)		Reactor facility effluent storage tank TA 2-56	No	Canyon	1098
90	02-004(e)		Reactor facility acid pit TA 2-53	No	Canyon	1098
91	02-004(f)		Reactor facility equipment building	No	Canyon	1098
92	02-004(g)		Aboveground tank	No	Canyon	1098
93	02-005		Systematic leak - cooling tower blowdown, Cr	Yes	Canyon	1098
94	02-006(a)		Ind. or san. wastewater treatment	Yes	Canyon	1098
95	02-006(b)		Ind. or san. wastewater treatment	Yes	Canyon	1098
96	02-006(c)		Waste line	No	Canyon	1098
97	02-006(d)		Waste line	No	Canyon	1098
98	02-006(e)		Waste line	No	Canyon	1098
99	02-007		Septic system	Yes	Canyon	1098
100	02-008(a)		Outfall	Yes	Canyon	1098
101	02-008(b)		Outfall from cooling tower	Yes	Canyon	1098
102	02-008(c)		Outfall	No	Canyon	1098
103	02-009(a)		Non-intentional release	Yes	Canyon	1098
104	02-009(b)		Non-intentional release	Yes	Canyon	1098
105	02-009(c)		Non-intentional release	Yes	Canyon	1098
106	02-009(d)		Non-intentional release	No	Canyon	1098
107	02-009(e)		Reactor facility	No	Canyon	1098
108	02-010		Building	No	Canyon	1098
109	02-011(a)		Storm drain and outfall	No	Canyon	1098
110	02-011(b)		Storm drain and outfall	No	Canyon	1098
111	02-011(c)		Storm drain and outfall	No	Canyon	1098

Table B-1 (continued)

	Unit No.	Consolidated PRSs[a]	Unit Description	HSWA SWMU[b]	Focus Area	Former OU[c]
112	02-011(d)		Storm drain and outfall	No	Canyon	1098
113	02-011(e)		Storm drain and outfall	No	Canyon	1098
114	02-012		Underground tanks	No	Canyon	1098
115	C-02-001		Metal nugget pile (new PRS)	No	Canyon	1098
116	03-001(d)		Satellite accumulation area	No	RCRA CA - Industrial	1114
117	03-001(e)		<90 day storage	No	RCRA CA - Industrial	1114
118	03-001(f)		<90 day storage	No	RCRA CA - Industrial	1114
119	03-001(g)		Satellite accumulation area	No	RCRA CA - Industrial	1114
120	03-001(h)		Satellite accumulation area	No	RCRA CA - Industrial	1114
121	03-001(i)		Satellite accumulation area	No	RCRA CA - Industrial	1114
122	03-001(j)		Satellite accumulation area	No	RCRA CA - Industrial	1114
123	03-001(k)		Storage pad	Yes	RCRA CA - Industrial	1114
124	03-001(l)		<90 day storage	No	RCRA CA - Industrial	1114
125	03-001(n)		Satellite accumulation area	No	RCRA CA - Industrial	1114
126	03-001(o)		Waste container	No	RCRA CA - Industrial	1114
127	03-001(q)		Satellite accumulation area	No	RCRA CA - Industrial	1114
128	03-001(s)		Satellite accumulation area	No	RCRA CA - Industrial	1114
129	03-001(t)		Satellite accumulation area	No	RCRA CA - Industrial	1114
130	03-001(u)		Satellite accumulation area	No	RCRA CA - Industrial	1114
131	03-001(v)		Satellite accumulation area	No	RCRA CA - Industrial	1114
132	03-001(w)		Satellite accumulation area	No	RCRA CA - Industrial	1114
133	03-001(x)		Satellite accumulation area	No	RCRA CA - Industrial	1114
134	03-001(y)		Satellite accumulation area	No	RCRA CA - Industrial	1114
135	03-002(a)		Container storage area	Yes	RCRA CA - Industrial	1114
136	03-002(c)		Storage area	Yes	RCRA CA - Industrial	1114
137	03-002(d)		Container storage area	Yes	RCRA CA - Industrial	1114
138	03-003(a)		Storage area	Yes	RCRA CA - Industrial	1114
139	03-003(b)		Storage area	Yes	RCRA CA - Industrial	1114
140	03-003(c)		Equipment storage area - PCB only site	Yes	RCRA CA - Industrial	1114
141	03-003(d)		Storage area - transformers	No	RCRA CA - Industrial	1114
142	03-003(e)		Storage area - transformers	No	RCRA CA - Industrial	1114
143	03-003(f)		Storage area - transformers	No	RCRA CA - Industrial	1114
144	03-003(g)		One-time spill - transformers	No	RCRA CA - Industrial	1114
145	03-003(h)		Storage area - transformers	No	RCRA CA - Industrial	1114
146	03-003(i)		Storage area - transformers	No	RCRA CA - Industrial	1114
147	03-003(j)		Storage area - transformers	No	RCRA CA - Industrial	1114
148	03-003(k)		Storage area - transformers	No	RCRA CA - Industrial	1114
149	03-003(l)		Storage area	No	RCRA CA - Industrial	1114
150	03-003(m)		Storage area - capacitor banks	No	RCRA CA - Industrial	1114

Table B-1 (continued)

	Unit No.	Consolidated PRSs[a]	Unit Description	HSWA SWMU[b]	Focus Area	Former OU[c]
151	03-003(n)		Storage area	No	RCRA CA - Industrial	1114
152	03-003(o)		Storage area - capacitor bank	No	RCRA CA - Industrial	1114
153	03-003(p)		Storage area	No	RCRA CA - Industrial	1114
154	03-004(a)		Container storage	No	RCRA CA - Industrial	1114
155	03-004(b)		Container storage	No	RCRA CA - Industrial	1114
156	03-004(c)		Storage area	No	RCRA CA - Industrial	1114
157	03-004(d)		Storage area	No	RCRA CA - Industrial	1114
158	03-004(e)		Storage area	No	RCRA CA - Industrial	1114
159	03-004(f)		Storage area	No	RCRA CA - Industrial	1114
160	03-006		Burn site (duplicate of 61-003)	No	RCRA CA - Industrial	1114
161	03-007		Firing site	No	RCRA CA - Industrial	1114
162	03-008(a)		Firing site	No	RCRA CA - Industrial	1114
163	03-008(b)		Firing site	No	RCRA CA - Industrial	1114
164	03-009(a)		Surface disposal - soil fill	Yes	RCRA CA - Industrial	1114
165	03-009(c)		Surface disposal	Yes	RCRA CA - Industrial	1114
166	03-009(d)		Surface disposal site	Yes	RCRA CA - Industrial	1114
167	03-009(g)		Surface disposal	Yes	RCRA CA - Industrial	1114
168	03-009(i)		Surface disposal site	Yes	RCRA CA - Industrial	1114
169	03-009(j)		Surface disposal site	Yes	RCRA CA - Industrial	1114
170	03-010(a)		Vacuum repair shop (former location) - systematic release site	Yes	RCRA CA - Industrial	1114
171	03-011		Systematic product release	Yes	RCRA CA - Industrial	1114
172	03-012(b)		Operational release and outfall	Yes	RCRA CA - Industrial	1114
173	03-013(a)		Operational release	Yes	RCRA CA - Industrial	1114
174	03-013(b)		Operational release	No	RCRA CA - Industrial	1114
175	03-014(a)-99	03-014(a)	Wastewater treatment plant	Yes	RCRA CA - Industrial	1114
		03-014(b)				
		03-014(b2)				
		03-014(c)				
		03-014(c2)				
		03-014(d)				
		03-014(e)				
		03-014(f)				
		03-014(g)				
		03-014(h)				
		03-014(i)				
		03-014(j)				
		03-014(k)				
		03-014(l)				

Table B-1 (continued)

	Unit No.	Consolidated PRSs[a]	Unit Description	HSWA SWMU[b]	Focus Area	Former OU[c]
		03-014(m)				
		03-014(n)				
		03-014(o)				
		03-014(p)				
		03-014(u)				
176	03-014(a2)		Wastewater treatment facility	No	RCRA CA - Industrial	1114
177	03-014(q)		Wastewater treatment facility	Yes	RCRA CA - Industrial	1114
178	03-014(r)		Wastewater treatment facility	Yes	RCRA CA - Industrial	1114
179	03-014(s)		Wastewater treatment facility	Yes	RCRA CA - Industrial	1114
180	03-014(t)		Wastewater treatment facility	Yes	RCRA CA - Industrial	1114
181	03-014(v)		Wastewater treatment facility	No	RCRA CA - Industrial	1114
182	03-014(w)		Wastewater treatment facility	No	RCRA CA - Industrial	1114
183	03-014(x)		Wastewater treatment facility	No	RCRA CA - Industrial	1114
184	03-014(y)		Wastewater treatment facility	No	RCRA CA - Industrial	1114
185	03-014(z)		Wastewater treatment facility	No	RCRA CA - Industrial	1114
186	03-015		Outfall	Yes	RCRA CA - Industrial	1114
187	03-016(a)		Septic system	No	RCRA CA - Industrial	1114
188	03-016(b)		Septic system	No	RCRA CA - Industrial	1114
189	03-016(c)		Septic system	No	RCRA CA - Industrial	1114
190	03-016(d)		Septic system	No	RCRA CA - Industrial	1114
191	03-016(e)		Septic system [duplicate of 3-014(s)]	No	RCRA CA - Industrial	1114
192	03-016(f)		Septic system [duplicate of 3-014(s)]	No	RCRA CA - Industrial	1114
193	03-019		Septic tank	Yes	RCRA CA - Industrial	1114
194	03-021		Surface disposal site	Yes	RCRA CA - Industrial	1114
195	03-022		Sump	No	RCRA CA - Industrial	1114
196	03-023		Sump	No	RCRA CA - Industrial	1114
197	03-025(a)		Tank and/or assoc. equipment	Yes	RCRA CA - Industrial	1114
198	03-025(b)		Tank and/or assoc. equipment	Yes	RCRA CA - Industrial	1114
199	03-025(c)		Tank and/or assoc. equipment	No	RCRA CA - Industrial	1114
200	03-026(a)		Sump	No	RCRA CA - Industrial	1114
201	03-026(b)		Sumps	Yes	RCRA CA - Industrial	1114
202	03-026(c)		Tank and/or assoc. equipment	Yes	RCRA CA - Industrial	1114
203	03-026(d)		Tank and/or assoc. equipment	Yes	RCRA CA - Industrial	1114
204	03-027		Separation site	No	RCRA CA - Industrial	1114
205	03-028		Surface impoundment	Yes	RCRA CA - Industrial	1114
206	03-029		Landfill	Yes	RCRA CA - Industrial	1114
207	03-030		Surface impoundment	No	RCRA CA - Industrial	1114
208	03-031		Tank and/or assoc. equipment	Yes	RCRA CA - Industrial	1114
209	03-032		Tank and/or assoc. equipment	Yes	RCRA CA - Industrial	1114

Table B-1 (continued)

	Unit No.	Consolidated PRSs[a]	Unit Description	HSWA SWMU[b]	Focus Area	Former OU[c]
210	03-033		Sump	Yes	RCRA CA - Industrial	1114
211	03-034(a)		Tank and/or assoc. equipment - radioactive liquid waste tanks	Yes	RCRA CA - Industrial	1114
212	03-034(b)		Tank and/or assoc. equipment	Yes	RCRA CA - Industrial	1114
213	03-036(a)		Aboveground tanks	Yes	RCRA CA - Industrial	1114
214	03-036(b)		Aboveground tanks	No	RCRA CA - Industrial	1114
215	03-036(c)		Aboveground tanks [duplicate of 3-043(f)]	Yes	RCRA CA - Industrial	1114
216	03-036(d)		Aboveground tanks [duplicate of 3-043(g)]	Yes	RCRA CA - Industrial	1114
217	03-036(e)		Aboveground tank	No	RCRA CA - Industrial	1114
218	03-036(f)		Aboveground tank	No	RCRA CA - Industrial	1114
219	03-036(g)		Aboveground tank	No	RCRA CA - Industrial	1114
220	03-036(h)		Aboveground tank	No	RCRA CA - Industrial	1114
221	03-036(i)		Aboveground tank	No	RCRA CA - Industrial	1114
222	03-036(j)		Aboveground tank	No	RCRA CA - Industrial	1114
223	03-037		Underground tank	Yes	RCRA CA - Industrial	1114
224	03-038(a)		Acid tank	Yes	RCRA CA - Industrial	1114
225	03-038(b)		Acid tank	Yes	RCRA CA - Industrial	1114
226	03-038(c)		Waste lines	No	RCRA CA - Industrial	1114
227	03-038(d)		Waste lines	No	RCRA CA - Industrial	1114
228	03-038(e)		Waste lines	No	RCRA CA - Industrial	1114
229	03-038(f)		Waste lines	No	RCRA CA - Industrial	1114
230	03-040(a)		Storage area	No	RCRA CA - Industrial	1114
231	03-040(b)		Storage area	No	RCRA CA - Industrial	1114
232	03-041		Underground tank	No	RCRA CA - Industrial	1114
233	03-042		Sump	No	RCRA CA - Industrial	1114
234	03-043(a)		Aboveground tank	No	RCRA CA - Industrial	1114
235	03-043(b)		Aboveground tank	No	RCRA CA - Industrial	1114
236	03-043(c)		Tank and/or assoc. equipment	Yes	RCRA CA - Industrial	1114
237	03-043(d)		Aboveground tank	No	RCRA CA - Industrial	1114
238	03-043(e)		Underground tank	Yes	RCRA CA - Industrial	1114
239	03-043(f)		Aboveground tank	No	RCRA CA - Industrial	1114
240	03-043(g)		Aboveground tank	No	RCRA CA - Industrial	1114
241	03-043(h)		Aboveground tank	No	RCRA CA - Industrial	1114
242	03-043(i)		Aboveground tank	No	RCRA CA - Industrial	1114
243	03-044(a)		Container storage	Yes	RCRA CA - Industrial	1114
244	03-045(a)		Outfall - ind. or san. wastewater treatment	Yes	RCRA CA - Industrial	1114
245	03-045(b)		Ind. or san. wastewater treatment	Yes	RCRA CA - Industrial	1114
246	03-045(c)		Outfall	Yes	RCRA CA - Industrial	1114
247	03-045(e)		Outfall - ind. or san. wastewater treatment	Yes	RCRA CA - Industrial	1114

Table B-1 (continued)

	Unit No.	Consolidated PRSs[a]	Unit Description	HSWA SWMU[b]	Focus Area	Former OU[c]
248	03-045(f)		Outfall from drain - ind. or san. wastewater treatment	Yes	RCRA CA - Industrial	1114
249	03-045(g)		Storm drain	Yes	RCRA CA - Industrial	1114
250	03-045(h)		Outfall - ind. or san. wastewater treatment	Yes	RCRA CA - Industrial	1114
251	03-045(i)		Outfall - ind. or san. wastewater treatment	Yes	RCRA CA - Industrial	1114
252	03-046		Aboveground storage tank	Yes	RCRA CA - Industrial	1114
253	03-047(a)		Storage area	No	RCRA CA - Industrial	1114
254	03-047(b)		Storage area	No	RCRA CA - Industrial	1114
255	03-047(c)		Drum storage	No	RCRA CA - Industrial	1114
256	03-047(d)		Storage area	No	RCRA CA - Industrial	1114
257	03-047(e)		Storage area	No	RCRA CA - Industrial	1114
258	03-047(f)		Storage area	No	RCRA CA - Industrial	1114
259	03-047(g)		Drum storage	No	RCRA CA - Industrial	1114
260	03-047(h)		Storage area	No	RCRA CA - Industrial	1114
261	03-047(i)		Satellite accumulation area	No	RCRA CA - Industrial	1114
262	03-047(j)		Drum storage	No	RCRA CA - Industrial	1114
263	03-047(k)		Drum storage	No	RCRA CA - Industrial	1114
264	03-048		Satellite accumulation area	No	RCRA CA - Industrial	1114
265	03-049(a)		Outfall	Yes	RCRA CA - Industrial	1114
266	03-049(b)		Operational release	Yes	RCRA CA - Industrial	1114
267	03-049(c)		Outfall	Yes	RCRA CA - Industrial	1114
268	03-049(d)		Outfall	Yes	RCRA CA - Industrial	1114
269	03-049(e)		Outfall	Yes	RCRA CA - Industrial	1114
270	03-050(a)		Exhaust emissions - off-gas scrubber of HEPA filter system	Yes	RCRA CA - Industrial	1114
271	03-050(b)		Exhaust emissions - off-gas scrubber of HEPA filter system	No	RCRA CA - Industrial	1114
272	03-050(c)		Exhaust emissions - off-gas scrubber of HEPA filter system	No	RCRA CA - Industrial	1114
273	03-050(d)		Exhaust emissions - off-gas scrubber of HEPA filter system	Yes	RCRA CA - Industrial	1114
274	03-050(e)		Exhaust emissions - off-gas scrubber of HEPA filter system	Yes	RCRA CA - Industrial	1114
275	03-050(f)		Exhaust emissions - off-gas scrubber of HEPA filter system	Yes	RCRA CA - Industrial	1114
276	03-050(g)		Exhaust emissions - off-gas scrubber of HEPA filter system	Yes	RCRA CA - Industrial	1114
277	03-051(a)		Soil contamination - oil from leaking compressor	No	RCRA CA - Industrial	1114
278	03-051(b)		Soil contamination - oil from leaking compressor	No	RCRA CA - Industrial	1114
279	03-051(c)		Soil contamination - vacuum pump leaking	No	RCRA CA - Industrial	1114
280	03-051(d)		Soil contamination - oil from leaking compressor	No	RCRA CA - Industrial	1114
281	03-052(a)		Storm drainage	Yes	RCRA CA - Industrial	1114
282	03-052(b)		Storm drainage	No	RCRA CA - Industrial	1114
283	03-052(c)		Storm drainage	Yes	RCRA CA - Industrial	1114
284	03-052(d)		Storm drainage - non-PCB transformers/ capacitors	No	RCRA CA - Industrial	1114
285	03-052(e)		Storm drainage	Yes	RCRA CA - Industrial	1114
286	03-052(f)		Storm drainage	Yes	RCRA CA - Industrial	1114

Table B-1 (continued)

	Unit No.	Consolidated PRSs[a]	Unit Description	HSWA SWMU[b]	Focus Area	Former OU[c]
287	03-053		Operational facility	No	RCRA CA - Industrial	1114
288	03-054(a)		Outfall	Yes	RCRA CA - Industrial	1114
289	03-054(b)		Outfall	Yes	RCRA CA - Industrial	1114
290	03-054(c)		Outfall	Yes	RCRA CA - Industrial	1114
291	03-054(d)		Outfall	Yes	RCRA CA - Industrial	1114
292	03-054(e)		Outfall	Yes	RCRA CA - Industrial	1114
293	03-055(a)		Outfall	Yes	RCRA CA - Industrial	1114
294	03-055(c)		Outfall	Yes	RCRA CA - Industrial	1114
295	03-055(d)		Outfall	Yes	RCRA CA - Industrial	1114
296	03-056(a)		Storage area	Yes	RCRA CA - Industrial	1114
297	03-056(b)		Container storage area	No	RCRA CA - Industrial	1114
298	03-056(c)		Transformer storage area - PCB only site	Yes	RCRA CA - Industrial	1114
299	03-056(d)		Drum storage	Yes	RCRA CA - Industrial	1114
300	03-056(e)		Satellite accumulation area	No	RCRA CA - Industrial	1114
301	03-056(f)		Drum storage	No	RCRA CA - Industrial	1114
302	03-056(g)		Satellite accumulation area	No	RCRA CA - Industrial	1114
303	03-056(h)		Transformer storage area	No	RCRA CA - Industrial	1114
304	03-056(i)		Drum storage	No	RCRA CA - Industrial	1114
305	03-056(j)		Storage area	No	RCRA CA - Industrial	1114
306	03-056(k)		Container storage area	No	RCRA CA - Industrial	1114
307	03-056(l)		Drum storage	Yes	RCRA CA - Industrial	1114
308	03-056(m)		Drum storage	Yes	RCRA CA - Industrial	1114
309	03-056(n)		Drum storage	Yes	RCRA CA - Industrial	1114
310	03-057		Sump/grease trap	No	RCRA CA - Industrial	1114
311	03-058		Container storage	No	RCRA CA - Industrial	1114
312	03-059		Storage area	Yes	RCRA CA - Industrial	1114
313	C-03-001		Gas trap	No	RCRA CA - Industrial	1114
314	C-03-002		One-time spill - leak from asphalt machine	No	RCRA CA - Industrial	1114
315	C-03-003		One-time spill - stained asphalt	No	RCRA CA - Industrial	1114
316	C-03-004		Miscellaneous debris	No	RCRA CA - Industrial	1114
317	C-03-005		Oil spill	No	RCRA CA - Industrial	1114
318	C-03-006		One-time spill	No	RCRA CA - Industrial	1114
319	C-03-007		Storage area	No	RCRA CA - Industrial	1114
320	C-03-008		Storage area/ rad contaminated	No	RCRA CA - Industrial	1114
321	C-03-009		Storage area	No	RCRA CA - Industrial	1114
322	C-03-010		Outfall	No	RCRA CA - Industrial	1114
323	C-03-011		Waste oil tank	No	RCRA CA - Industrial	1114
324	C-03-012		Satellite accumulation area	No	RCRA CA - Industrial	1114
325	C-03-014		Storage area	No	RCRA CA - Industrial	1114

Table B-1 (continued)

	Unit No.	Consolidated PRSs[a]	Unit Description	HSWA SWMU[b]	Focus Area	Former OU[c]
326	C-03-015		Underground storage tank	No	RCRA CA - Industrial	1114
327	C-03-016		Oil metal bin	No	RCRA CA - Industrial	1114
328	C-03-017		Underground storage tank	No	RCRA CA - Industrial	1114
329	C-03-018		Underground storage tank	No	RCRA CA - Industrial	1114
330	C-03-019		Underground storage tank	No	RCRA CA - Industrial	1114
331	C-03-020		Storage tank	No	RCRA CA - Industrial	1114
332	C-03-021		Underground storage tank	No	RCRA CA - Industrial	1114
333	C-03-022		Kerosene tanker trailer	No	RCRA CA - Industrial	1114
334	04-001-99	04-001	Firing site	Yes	RCRA CA - Industrial	1129
		04-002				
335	04-003(a)		Outfall	Yes	RCRA CA - Industrial	1129
336	04-003(b)		Outfall	Yes	RCRA CA - Industrial	1129
337	04-004		Soil contamination beneath bldgs.	No	RCRA CA - Industrial	1129
338	05-001(a)-99	05-001(a)	Firing site	Yes	RCRA CA - Industrial	1129
		05-001(b)				
		05-002				
339	05-001(c)		Former firing site	No	RCRA CA - Industrial	1129
340	05-003		Former calibration chamber	Yes	RCRA CA - Industrial	1129
341	05-004		Former septic system	Yes	RCRA CA - Industrial	1129
342	05-005(a)		Former French drain	Yes	RCRA CA - Industrial	1129
343	05-005(b)		Outfall	Yes	RCRA CA - Industrial	1129
344	05-006(b)		Soil contamination beneath former bldgs.	Yes	RCRA CA - Industrial	1129
345	05-006(c)		Soil contamination beneath former bldgs.	Yes	RCRA CA - Industrial	1129
346	05-006(e)		Soil contamination beneath former bldgs.	Yes	RCRA CA - Industrial	1129
347	05-006(h)		Soil contamination beneath former bldgs.	Yes	RCRA CA - Industrial	1129
348	06-001(a)		Septic system	Yes	RCRA CA - HE Production	1111
349	06-001(b)		Septic system	Yes	RCRA CA - HE Production	1111
350	06-002		Septic system (TA-6-41), receives wastewater from PRSs 06-003 & C-06-020.	Yes	RCRA CA - HE Production	1111
351	06-003(a)-99	06-003(a)	Firing site	Yes	RCRA CA - HE Production	1111
		06-008				
		C-06-019				
352	06-003(c)		Firing site (inactive), used for water recovery shots.	Yes	RCRA CA - HE Production	1111
353	06-003(d)		Firing site (inactive)	Yes	RCRA CA - HE Production	1111
354	06-003(e)		Firing site (inactive)	Yes	RCRA CA - HE Production	1111
355	06-003(f)		Firing site (inactive)	Yes	RCRA CA - HE Production	1111
356	06-003(g)		Firing site & building (inactive) TA-6-10	Yes	RCRA CA - HE Production	1111
357	06-003(h)		Firing site (inactive)	Yes	RCRA CA - HE Production	1111
358	06-006		Storage area	Yes	RCRA CA - HE Production	1111

Table B-1 (continued)

	Unit No.	Consolidated PRSs[a]	Unit Description	HSWA SWMU[b]	Focus Area	Former OU[c]
359	06-007(a)-99	06-005	MDA F	Yes	RCRA CA - HE Production	1111
		06-007(a)				
		06-007(b)				
		06-007(c)				
		06-007(d)				
		06-007(e)				
360	06-007(f)		Surface disposal	Yes	RCRA CA - HE Production	1111
361	06-007(g)		Building & surface disposal	Yes	RCRA CA - HE Production	1111
362	C-06-001		Building	No	RCRA CA - HE Production	1111
363	C-06-003		Building TA-6-11 - control building for explosive shots	No	RCRA CA - HE Production	1111
364	C-06-005		Building TA-6-13 - chemistry laboratory, assembly, and storage	No	RCRA CA - HE Production	1111
365	C-06-006		Building TA-6-14, used for explosives pressing and storage	No	RCRA CA - HE Production	1111
366	C-06-007		Building TA-6-15 - boiler for steam generation	No	RCRA CA - HE Production	1111
367	C-06-008		Building TA-6-16 - magazine for explosives	No	RCRA CA - HE Production	1111
368	C-06-009		Building TA-6-17 - magazine	No	RCRA CA - HE Production	1111
369	C-06-010		Building TA-6-21 - magazines for explosives storage	No	RCRA CA - HE Production	1111
370	C-06-011		Building TA-6-22 - magazine	No	RCRA CA - HE Production	1111
371	C-06-012		Building TA-6-23 - magazine	No	RCRA CA - HE Production	1111
372	C-06-013		Building TA-6-24 - magazine for explosives storage	No	RCRA CA - HE Production	1111
373	C-06-014		Building TA-6-25 - magazine for explosives storage	No	RCRA CA - HE Production	1111
374	C-06-015		Building TA-6-27 - magazine for explosives storage	No	RCRA CA - HE Production	1111
375	C-06-016		Building TA-6-28 - magazine used for explosives storage	No	RCRA CA - HE Production	1111
376	C-06-017		Building TA-6-29 - magazine for explosives storage	No	RCRA CA - HE Production	1111
377	C-06-018		Building TA-6-30 - magazine for explosives storage	No	RCRA CA - HE Production	1111
378	C-06-021		Building TA-6-26 - magazine used for explosives storage	No	RCRA CA - HE Production	1111
379	07-001(a)-99	07-001(a)	Firing site	Yes	RCRA CA - HE Production	1111
		07-001(b)				
		07-001(c)				
		07-001(d)				
380	08-001(a)		Buildings	No	RCRA CA - HE Production	1157
381	08-001(b)		Buildings	No	RCRA CA - HE Production	1157
382	08-002		Firing site (inactive)	Yes	RCRA CA - HE Production	1157
383	08-003(a)		Septic system	Yes	RCRA CA - HE Production	1157
384	08-004(a)		Floor drain	Yes	RCRA CA - HE Production	1157
385	08-004(b)		Drainline	Yes	RCRA CA - HE Production	1157
386	08-004(c)		Floor drain	Yes	RCRA CA - HE Production	1157
387	08-004(d)		Drain	Yes	RCRA CA - HE Production	1157
388	08-005		Container storage area	Yes	RCRA CA - HE Production	1157

Table B-1 (continued)

	Unit No.	Consolidated PRSs[a]	Unit Description	HSWA SWMU[b]	Focus Area	Former OU[c]
389	08-006(a)		Material disposal area (MDA Q) landfill	Yes	RCRA CA - HE Production	1157
390	08-009(a)		Ind. or san. wastewater treatment	Yes	RCRA CA - HE Production	1157
391	08-009(c)		Storm drain and outfall	No	RCRA CA - HE Production	1157
392	08-009(d)		Ind. or san. wastewater treatment	Yes	RCRA CA - HE Production	1157
393	08-009(e)		Ind. or san. wastewater treatment	Yes	RCRA CA - HE Production	1157
394	08-009(f)		Outfall	No	RCRA CA - HE Production	1157
395	C-08-010		Building	Yes	RCRA CA - HE Production	1157
396	C-08-014		Laboratory	No	RCRA CA - HE Production	1157
397	09-001(a)-99	09-001(a)	Firing sites	Yes	RCRA CA - HE Production	1157
		09-001(b)				
		C-09-005				
398	09-001(c)		Firing sites (inactive)	Yes	RCRA CA - HE Production	1157
399	09-001(d)		Firing sites (inactive)	Yes	RCRA CA - HE Production	1157
400	09-002		Burn pit	Yes	RCRA CA - HE Production	1157
401	09-003(a)-99	09-003(a)	Former structures	Yes	RCRA CA - HE Production	1157
		09-003(b)				
		09-003(e)				
402	09-003(d)		Settling tank	Yes	RCRA CA - HE Production	1157
403	09-003(g)		Settling tank	Yes	RCRA CA - HE Production	1157
404	09-003(h)		Settling tank	Yes	RCRA CA - HE Production	1157
405	09-003(i)		Settling tank	Yes	RCRA CA - HE Production	1157
406	09-004(a)-99	09-004(a)	Tanks/sumps/outfalls	Yes	RCRA CA - HE Production	1157
		09-004(b)				
		09-004(c)				
		09-004(d)				
		09-004(e)				
		09-004(f)				
		09-004(h)				
		09-004(i)				
		09-004(j)				
		09-004(k)				
		09-004(l)				
		09-004(m)				
		09-004(n)				
407	09-004(g)		Settling tank	Yes	RCRA CA - HE Production	1157
408	09-004(o)		Settling tank	Yes	RCRA CA - HE Production	1157
409	09-005(g)		Septic system	Yes	RCRA CA - HE Production	1157
410	09-006		Septic system	Yes	RCRA CA - HE Production	1157

Table B-1 (continued)

	Unit No.	Consolidated PRSs[a]	Unit Description	HSWA SWMU[b]	Focus Area	Former OU[c]
411	09-008(b)-99	09-005(a)	Tanks/sumps/outfalls	Yes	RCRA CA - HE Production	1157
		09-005(d)				
		09-008(b)				
412	09-009		Surface impoundment	Yes	RCRA CA - HE Production	1157
413	09-010(a)		Storage area	No	RCRA CA - HE Production	1157
414	09-010(b)		Storage area	No	RCRA CA - HE Production	1157
415	09-011(b)		Storage area	No	RCRA CA - HE Production	1157
416	09-011(c)		Storage area	No	RCRA CA - HE Production	1157
417	09-012		Disposal pit	No	RCRA CA - HE Production	1157
418	09-013		Material disposal area (MDA M)	Yes	RCRA CA - HE Production	1157
419	09-014		Firing site (inactive)	No	RCRA CA - HE Production	1157
420	C-09-001		Soil contamination	Yes	RCRA CA - HE Production	1157
421	10-001(a)-99	10-001(a)	Firing site	Yes	RCRA CA - Townsite	1079
		10-001(b)				
		10-001(c)				
		10-001(d)				
		10-005				
		10-008				
422	10-002(a)-99	10-002(a)	Wastewater treatment plant	Yes	RCRA CA - Townsite	1079
		10-002(b)				
		10-003(a)				
		10-003(b)				
		10-003(c)				
		10-003(d)				
		10-003(e)				
		10-003(f)				
		10-003(g)				
		10-003(h)				
		10-003(i)				
		10-003(j)				
		10-003(k)				
		10-003(l)				
		10-003(m)				
		10-003(n)				
		10-003(o)				
		10-004(b)				
		10-007				
423	10-004(a)		Septic system	Yes	RCRA CA - Townsite	1079
424	10-006		Burn site (does not exist)	Yes	RCRA CA - Townsite	1079

Table B-1 (continued)

	Unit No.	Consolidated PRSs[a]	Unit Description	HSWA SWMU[b]	Focus Area	Former OU[c]
425	10-009		Former Bayo landfill	No	RCRA CA - Townsite	1079
426	C-10-001		Surface soil - 2 10x10-ft plots, Bayo Canyon	No	RCRA CA - Townsite	1079
427	11-001(b)		Firing site (inactive)	Yes	RCRA CA - HE Production	1082
428	11-001(c)		Firing site (inactive)	Yes	RCRA CA - HE Production	1082
429	11-003(b)		Air gun	No	RCRA CA - HE Production	1082
430	11-004(a)-99	11-004(a)	Miscellaneous	Yes	RCRA CA - HE Production	1082
		11-004(b)				
		11-004(c)				
		11-004(d)				
		11-004(e)				
		11-004(f)				
431	11-005(a)		Septic system	Yes	RCRA CA - HE Production	1082
432	11-005(b)		Septic system	Yes	RCRA CA - HE Production	1082
433	11-005(c)		Ind. or san. wastewater treatment	Yes	RCRA CA - HE Production	1082
434	11-006(a)-99	11-001(a)	Tanks/sumps/outfalls	Yes	RCRA CA - HE Production	1082
		11-002				
		11-006(a)				
		11-006(b)				
		11-006(c)				
		11-006(d)				
		C-11-001				
435	11-009		Material disposal area (MDA S)	Yes	RCRA CA - HE Production	1082
436	11-011(a)		Ind. or san. wastewater treatment	Yes	RCRA CA - HE Production	1082
437	11-011(b)		Ind. or san. wastewater treatment	Yes	RCRA CA - HE Production	1082
438	11-011(c)		Steam vent line	Yes	RCRA CA - HE Production	1082
439	11-011(d)		Ind. or san. wastewater treatment	Yes	RCRA CA - HE Production	1082
440	11-012(a)		Building	No	RCRA CA - HE Production	1082
441	11-012(b)		Building	No	RCRA CA - HE Production	1082
442	11-012(c)		Building	No	RCRA CA - HE Production	1082
443	11-012(d)		Building	No	RCRA CA - HE Production	1082
444	C-11-002		Laboratory	No	RCRA CA - HE Production	1082
445	12-001(a)-99	12-001(a)	Firing Site	Yes	RCRA CA - Firing Sites	1085
		12-001(b)				
		12-002				
		C-12-005				
446	12-004(a)		Radiation test facility	No	RCRA CA - Firing Sites	1085
447	12-004(b)		Pipe	No	RCRA CA - Firing Sites	1085
448	C-12-001		Building	No	RCRA CA - Firing Sites	1085
449	C-12-002		Building	No	RCRA CA - Firing Sites	1085

Table B-1 (continued)

	Unit No.	Consolidated PRSs[a]	Unit Description	HSWA SWMU[b]	Focus Area	Former OU[c]
450	C-12-003		Building	No	RCRA CA - Firing Sites	1085
451	C-12-004		Building	No	RCRA CA - Firing Sites	1085
452	13-001-99	13-001	Firing Site	Yes	RCRA CA - HE Production	1082
		13-002				
		16-035				
		16-036				
453	13-003(a)-99	13-003(a)	Former structures	Yes	RCRA CA - HE Production	1082
		13-003(b)				
454	13-004		Disposal pit (does not exist)	Yes	RCRA CA - HE Production	1082
455	14-001(a)		Firing site (active)	No	RCRA CA - Firing Sites	1085
456	14-001(b)		Firing site (active)	No	RCRA CA - Firing Sites	1085
457	14-001(c)		Firing site (active)	No	RCRA CA - Firing Sites	1085
458	14-001(d)		Firing site (active)	No	RCRA CA - Firing Sites	1085
459	14-001(e)		Firing site (active)	No	RCRA CA - Firing Sites	1085
460	14-001(g)		Firing site (active) - open burn/open detonation	No	RCRA CA - Firing Sites	1085
461	14-002(a)-99	14-001(f)	Firing site - bullet test facility (active)	Yes	RCRA CA - Firing Sites	1085
		14-002(a)				
		14-002(b)				
		14-002(f)				
		14-009				
		14-010				
		C-14-008				
462	14-002(c)-99	14-002(c)	Firing site	Yes	RCRA CA - Firing Sites	1085
		14-002(d)				
		14-002(e)				
463	14-003		Open burning ground	Yes	RCRA CA - Firing Sites	1085
464	14-005		Incinerator (active)	Yes	RCRA CA - Firing Sites	1085
465	14-006		Tank and/or assoc. equipment	Yes	RCRA CA - Firing Sites	1085
466	14-007		Septic system	Yes	RCRA CA - Firing Sites	1085
467	C-14-001		Building	No	RCRA CA - Firing Sites	1085
468	C-14-002		Building	No	RCRA CA - Firing Sites	1085
469	C-14-003		Building	No	RCRA CA - Firing Sites	1085
470	C-14-004		Building	No	RCRA CA - Firing Sites	1085
471	C-14-005		Building	No	RCRA CA - Firing Sites	1085
472	C-14-006		Building	No	RCRA CA - Firing Sites	1085
473	C-14-007		Building	No	RCRA CA - Firing Sites	1085
474	C-14-009		Building	No	RCRA CA - Firing Sites	1085
475	15-001		Surface disposal	No	RCRA CA - Firing Sites	1086
476	15-002		Disposal pit and burn site	Yes	RCRA CA - Firing Sites	1086

Table B-1 (continued)

	Unit No.	Consolidated PRSs[a]	Unit Description	HSWA SWMU[b]	Focus Area	Former OU[c]
477	15-003		Firing site (active) - PHERMEX	Yes	RCRA CA - Firing Sites	1086
478	15-004(a)		Firing site C (inactive)	Yes	RCRA CA - Firing Sites	1086
479	15-004(b)-99	15-004(b)	Firing site	Yes	RCRA CA - Firing Sites	1086
		15-004(c)				
480	15-004(d)		Firing site C (inactive)	No	RCRA CA - Firing Sites	1086
481	15-004(f)-99	15-004(f)	Firing site	Yes	RCRA CA - Firing Sites	1086
		15-008(a)				
482	15-004(g)		Machine firing site (inactive)	Yes	RCRA CA - Firing Sites	1086
483	15-004(h)		Firing site (inactive)	No	RCRA CA - Firing Sites	1086
484	15-004(i)		Detonation ground (does not exist)	Yes	RCRA CA - Firing Sites	1086
485	15-005(b)		Storage area	No	RCRA CA - Firing Sites	1086
486	15-005(c)		Storage area (R-41)	No	RCRA CA - Firing Sites	1086
487	15-006(a)		Firing site - PHERMEX (active), open detonation	Yes	RCRA CA - Firing Sites	1086
488	15-006(b)		Firing site - Ector (active)	Yes	RCRA CA - Firing Sites	1086
489	15-006(c)-99	15-006(c)	Firing site	Yes	RCRA CA - Firing Sites	1086
		15-008(b)				
490	15-006(d)-99	15-006(d)	Firing site	Yes	RCRA CA - Firing Sites	1086
		15-008(g)				
491	15-006(e)		I-J site at TA-36 (not in TA-15), part of 36-004(e) [duplicate of C-36-006(e)]	No	RCRA CA - Firing Sites	1130
492	15-007(a)		Material disposal area (MDA N) landfill	Yes	RCRA CA - Firing Sites	1086
493	15-007(b)		Material disposal area (MDA Z) landfill	Yes	RCRA CA - Firing Sites	1086
494	15-007(c)		Shaft	Yes	RCRA CA - Firing Sites	1086
495	15-007(d)		Shaft	Yes	RCRA CA - Firing Sites	1086
496	15-008(c)		Surface disposal	Yes	RCRA CA - Firing Sites	1086
497	15-008(d)		Surface disposal (still active)	Yes	RCRA CA - Firing Sites	1086
498	15-009(a)		Septic system	Yes	RCRA CA - Firing Sites	1086
499	15-009(b)		Septic system	Yes	RCRA CA - Firing Sites	1086
500	15-009(c)		Septic tank	Yes	RCRA CA - Firing Sites	1086
501	15-009(e)		Septic system E/F site	Yes	RCRA CA - Firing Sites	1086
502	15-009(f)		Septic tank	Yes	RCRA CA - Firing Sites	1086
503	15-009(g)		Septic tank (still active)	Yes	RCRA CA - Firing Sites	1086
504	15-009(h)		Septic tank	Yes	RCRA CA - Firing Sites	1086
505	15-009(i)		Septic tank	Yes	RCRA CA - Firing Sites	1086
506	15-009(j)		Septic tank	Yes	RCRA CA - Firing Sites	1086
507	15-009(k)		Septic tank	Yes	RCRA CA - Firing Sites	1086
508	15-010(a)		Septic system	Yes	RCRA CA - Firing Sites	1086
509	15-010(b)		Septic system	Yes	RCRA CA - Firing Sites	1086
510	15-010(c)		Operational release (still active)	Yes	RCRA CA - Firing Sites	1086

Table B-1 (continued)

	Unit No.	Consolidated PRSs[a]	Unit Description	HSWA SWMU[b]	Focus Area	Former OU[c]
511	15-011(a)		Sump	Yes	RCRA CA - Firing Sites	1086
512	15-011(b)		Dry well	Yes	RCRA CA - Firing Sites	1086
513	15-011(c)		Sump	Yes	RCRA CA - Firing Sites	1086
514	15-012(a)		Surface disposal (not located) (does not exist)	Yes	RCRA CA - Firing Sites	1086
515	15-012(b)		Surface disposal site	Yes	RCRA CA - Firing Sites	1086
516	15-014(a)		Ind. or san. wastewater treatment	Yes	RCRA CA - Firing Sites	1086
517	15-014(b)		Ind. or san. wastewater treatment	Yes	RCRA CA - Firing Sites	1086
518	15-014(d)		Ind. or san. wastewater treatment	No	RCRA CA - Firing Sites	1086
519	15-014(e)		Ind. or san. wastewater treatment (active)	No	RCRA CA - Firing Sites	1086
520	15-014(g)		Ind. or san. wastewater treatment	No	RCRA CA - Firing Sites	1086
521	15-014(h)		Outfall	No	RCRA CA - Firing Sites	1086
522	15-014(i)		Outfall	Yes	RCRA CA - Firing Sites	1086
523	15-014(j)		Outfall	Yes	RCRA CA - Firing Sites	1086
524	15-014(k)		Outfall	Yes	RCRA CA - Firing Sites	1086
525	15-014(l)		Outfall (still active)	Yes	RCRA CA - Firing Sites	1086
526	C-15-001		Surface disposal	No	RCRA CA - Firing Sites	1086
527	C-15-004		Transformers	No	RCRA CA - Firing Sites	1086
528	C-15-005		Laboratory and building	No	RCRA CA - Firing Sites	1086
529	C-15-006		Building	No	RCRA CA - Firing Sites	1086
530	C-15-007		Non-intentional release	No	RCRA CA - Firing Sites	1086
531	C-15-010		Underground tank	No	RCRA CA - Firing Sites	1086
532	C-15-011		Underground tank	No	RCRA CA - Firing Sites	1086
533	16-001(a)-99	16-001(a)	Miscellaneous	Yes	RCRA CA - HE Production	1082
		16-001(b)				
		16-001(c)				
534	16-001(d)		Dry well	Yes	RCRA CA - HE Production	1082
535	16-003(a)		Sump	Yes	RCRA CA - HE Production	1082
536	16-003(b)		Sump	Yes	RCRA CA - HE Production	1082
537	16-003(c)-99	16-003(c)	Tanks/sumps/outfalls	Yes	RCRA CA - HE Production	1082
		16-026(v)				
538	16-003(d)-99	16-001(e)	Tanks/sumps/outfalls	Yes	RCRA CA - HE Production	1082
		16-003(d)				
		16-003(e)				
		16-003(f)				
		16-003(g)				
539	16-003(h)-99	16-003(h)	Tanks/sumps/outfalls	Yes	RCRA CA - HE Production	1082
		16-030(d)				
540	16-003(i)		Sump, TA-16-265	Yes	RCRA CA - HE Production	1082
541	16-003(j)		Sump, TA-16-267	Yes	RCRA CA - HE Production	1082

Table B-1 (continued)

	Unit No.	Consolidated PRSs[a]	Unit Description	HSWA SWMU[b]	Focus Area	Former OU[c]
542	16-003(l)-99	16-003(l)	Tanks/sumps/outfalls	Yes	RCRA CA - HE Production	1082
		16-030(h)				
543	16-003(m)-99	16-003(m)	Tanks/sumps/outfalls	Yes	RCRA CA - HE Production	1082
		16-006(d)				
		16-030(g)				
544	16-003(n)-99	16-003(n)	Tanks/sumps/outfalls	Yes	RCRA CA - HE Production	1082
		16-029(i)				
545	16-003(o)		Sump	Yes	RCRA CA - HE Production	1082
546	16-003(q)		Sump	No	RCRA CA - HE Production	1082
547	16-004(a)-99	16-004(a)	Wastewater treatment plant	Yes	RCRA CA - HE Production	1082
		16-004(b)				
		16-004(c)				
		16-004(d)				
		16-004(e)				
		16-004(f)				
548	16-005(a)		Septic tank	Yes	RCRA CA - HE Production	1082
549	16-005(b)		Decommissioned septic system	Yes	RCRA CA - HE Production	1082
550	16-005(c)		Septic tank	Yes	RCRA CA - HE Production	1082
551	16-005(h)		Septic tank	Yes	RCRA CA - HE Production	1082
552	16-005(k)		Septic tank	Yes	RCRA CA - HE Production	1082
553	16-005(l)		Grease trap	Yes	RCRA CA - HE Production	1082
554	16-005(n)		Septic system	Yes	RCRA CA - HE Production	1082
555	16-006(a)		Septic system	Yes	RCRA CA - HE Production	1082
556	16-006(c)		Septic system	Yes	RCRA CA - HE Production	1082
557	16-007(a)-99	16-007(a)	Former structures	Yes	RCRA CA - HE Production	1082
		16-024(d)				
		16-024(e)				
		16-025(e)				
		16-025(f)				
558	16-008(a)-99	16-008(a)	Former structures	Yes	RCRA CA - HE Production	1082
		16-017(a)-99				
		16-017(b)-99				
		16-017(c)-99				
		16-017(d)-99				
		16-017(e)-99				
		16-026(m)				
		16-026(n)				
		16-026(o)				
		16-026(p)				

Table B-1 (continued)

	Unit No.	Consolidated PRSs[a]	Unit Description	HSWA SWMU[b]	Focus Area	Former OU[c]
		16-029(k)				
		16-029(l)				
		16-029(s)				
		16-029(t)				
		16-029(u)				
		C-16-067				
559	16-009(a)		Burn site	Yes	RCRA CA - HE Production	1082
560	16-010(b)		Burn site - RCRA unit	Yes	RCRA CA - HE Production	1082
561	16-010(c)		Burn site - RCRA unit	Yes	RCRA CA - HE Production	1082
562	16-010(d)		Burn site - RCRA unit	Yes	RCRA CA - HE Production	1082
563	16-010(e)		Burn site - RCRA unit	Yes	RCRA CA - HE Production	1082
564	16-010(f)		Burn site - RCRA unit	Yes	RCRA CA - HE Production	1082
565	16-010(h)-99	16-005(g)	Miscellaneous	Yes	RCRA CA - HE Production	1082
		16-010(h)				
		16-010(i)				
		16-010(k)				
		16-010(l)				
		16-010(m)				
		16-010(n)				
566	16-010(j)		Burn site - RCRA unit	Yes	RCRA CA - HE Production	1082
567	16-013-99	16-006(h)	Former structures	Yes	RCRA CA - HE Production	1082
		16-013				
		16-017(q)-99				
		16-017(r)-99				
		16-017(s)-99				
		16-017(t)-99				
		16-017(u)-99				
		16-029(g2)				
		C-16-068				
		C-16-074				
568	16-015(a)		Operational facility, TA-16-16	Yes	RCRA CA - HE Production	1082
569	16-015(b)		Operational facility, TA-16-18	Yes	RCRA CA - HE Production	1082
570	16-016(a)		Landfill - buried metal site	Yes	RCRA CA - HE Production	1082
571	16-016(b)		Landfill	Yes	RCRA CA - HE Production	1082
572	16-016(c)-99	16-006(e)	Septic system	Yes	RCRA CA - HE Production	1082
		16-010(a)				
		16-016(c)				
573	16-016(d)		Surface disposal site	Yes	RCRA CA - HE Production	1082
574	16-016(e)		Surface disposal site	Yes	RCRA CA - HE Production	1082

Table B-1 (continued)

	Unit No.	Consolidated PRSs[a]	Unit Description	HSWA SWMU[b]	Focus Area	Former OU[c]
575	16-016(f)		Landfill	No	RCRA CA - HE Production	1082
576	16-016(g)		Surface disposal site	Yes	RCRA CA - HE Production	1082
577	16-017(g)-99		Former HE structure	Yes	RCRA CA - HE Production	1082
578	16-017(i)-99	16-017(i)-99	Former structures	Yes	RCRA CA - HE Production	1082
		C-16-025				
		C-16-026				
579	16-017(j)-99		Former structure - storage magazine	Yes	RCRA CA - HE Production	1082
580	16-017(k)-99		Former structure - storage magazine	Yes	RCRA CA - HE Production	1082
581	16-017(l)-99		Former structure - storage magazine	Yes	RCRA CA - HE Production	1082
582	16-017(m)-99		Former structure - storage magazine	Yes	RCRA CA - HE Production	1082
583	16-017(n)-99		Former structure - storage magazine	Yes	RCRA CA - HE Production	1082
584	16-017(o)-99		Former structure - storage magazine	Yes	RCRA CA - HE Production	1082
585	16-017(p)-99		Former structure - storage magazine	Yes	RCRA CA - HE Production	1082
586	16-017(w)-99		Former structure - storage magazine	Yes	RCRA CA - HE Production	1082
587	16-018		Material disposal area (MDA P), RCRA (closure)	Yes	RCRA CA - HE Production	1082
588	16-019		Material disposal area (MDA R)	Yes	RCRA CA - HE Production	1082
589	16-020		Silver recovery unit	Yes	RCRA CA - HE Production	1082
590	16-021(a)		Systematic release site	Yes	RCRA CA - HE Production	1082
591	16-021(b)		Systematic leak	No	RCRA CA - HE Production	1082
592	16-021(c)-99	16-003(k)	Tanks/sumps/outfalls	Yes	RCRA CA - HE Production	1082
		16-021(c)				
593	16-022(a)		Underground tank	No	RCRA CA - HE Production	1082
594	16-022(b)		Underground tank	No	RCRA CA - HE Production	1082
595	16-024(a)		Magazine	No	RCRA CA - HE Production	1082
596	16-024(b)		Magazine	No	RCRA CA - HE Production	1082
597	16-024(c)		Magazine	No	RCRA CA - HE Production	1082
598	16-024(f)		Magazine	No	RCRA CA - HE Production	1082
599	16-024(g)		Magazine	No	RCRA CA - HE Production	1082
600	16-024(h)		Magazine, TA-16-497	No	RCRA CA - HE Production	1082
601	16-024(i)		Magazine	No	RCRA CA - HE Production	1082
602	16-024(j)		Magazine	No	RCRA CA - HE Production	1082
603	16-024(k)		Magazine	No	RCRA CA - HE Production	1082
604	16-024(l)		Magazine	No	RCRA CA - HE Production	1082
605	16-024(m)		Magazine	No	RCRA CA - HE Production	1082
606	16-024(n)		Magazine	No	RCRA CA - HE Production	1082
607	16-024(o)		Magazine	No	RCRA CA - HE Production	1082
608	16-024(p)		Magazine	No	RCRA CA - HE Production	1082
609	16-024(q)		Magazine	No	RCRA CA - HE Production	1082
610	16-024(r)		Magazine	No	RCRA CA - HE Production	1082

Table B-1 (continued)

	Unit No.	Consolidated PRSs[a]	Unit Description	HSWA SWMU[b]	Focus Area	Former OU[c]
611	16-024(s)		Magazine	No	RCRA CA - HE Production	1082
612	16-024(t)		Operational facility - T-Site	No	RCRA CA - HE Production	1082
613	16-024(u)		Magazine, TA-16-481	No	RCRA CA - HE Production	1082
614	16-024(v)		Magazine	No	RCRA CA - HE Production	1082
615	16-025(a)		Abandoned building & appurtenances, TA-16-39	Yes	RCRA CA - HE Production	1082
616	16-025(b)		Abandoned building & appurtenances, TA-16-40	Yes	RCRA CA - HE Production	1082
617	16-025(c2)		Abandoned building & appurtenances, TA-16-56	Yes	RCRA CA - HE Production	1082
618	16-025(d2)		Abandoned building & appurtenances, TA-16-480	Yes	RCRA CA - HE Production	1082
619	16-025(e2)		Abandoned building & appurtenances	Yes	RCRA CA - HE Production	1082
620	16-025(f2)		Abandoned building & appurtenances	Yes	RCRA CA - HE Production	1082
621	16-025(h2)		Abandoned building & appurtenances	Yes	RCRA CA - HE Production	1082
622	16-025(m)		Abandoned building & appurtenances	Yes	RCRA CA - HE Production	1082
623	16-025(n)		Abandoned building & appurtenances	Yes	RCRA CA - HE Production	1082
624	16-025(o)		Abandoned building & appurtenances	Yes	RCRA CA - HE Production	1082
625	16-025(w)		Abandoned building & appurtenances, TA-16-81	Yes	RCRA CA - HE Production	1082
626	16-025(y)-99	16-025(y)	Former structures	Yes	RCRA CA - HE Production	1082
		16-029(a2)				
627	16-026(a)		Outfall	Yes	RCRA CA - HE Production	1082
628	16-026(a2)		Outfall	Yes	RCRA CA - HE Production	1082
629	16-026(b)-99	16-026(b)	Tanks/sumps/outfalls	Yes	RCRA CA - HE Production	1082
		16-026(c)				
		16-026(d)				
		16-026(e)				
		16-029(a)				
		16-029(b)				
		16-029(c)				
		16-029(d)				
630	16-026(b2)		Outfall, TA-16-202	Yes	RCRA CA - HE Production	1082
631	16-026(c2)		Outfall, TA-16-462	Yes	RCRA CA - HE Production	1082
632	16-026(d2)		Outfall	Yes	RCRA CA - HE Production	1082
633	16-026(e2)		Outfall	Yes	RCRA CA - HE Production	1082
634	16-026(f)		Outfall	Yes	RCRA CA - HE Production	1082
635	16-026(f2)		Outfall	Yes	RCRA CA - HE Production	1082
636	16-026(g)		Outfall	Yes	RCRA CA - HE Production	1082
637	16-026(g2)		Outfall	Yes	RCRA CA - HE Production	1082
638	16-026(h)		Outfall	Yes	RCRA CA - HE Production	1082
639	16-026(i)		Outfall, TA-16-224	Yes	RCRA CA - HE Production	1082
640	16-026(j)		Outfall, TA-16-226	Yes	RCRA CA - HE Production	1082
641	16-026(j2)		Outfall	Yes	RCRA CA - HE Production	1082

Table B-1 (continued)

	Unit No.	Consolidated PRSs[a]	Unit Description	HSWA SWMU[b]	Focus Area	Former OU[c]
642	16-026(k)		Outfall	Yes	RCRA CA - HE Production	1082
643	16-026(l)		Outfall	Yes	RCRA CA - HE Production	1082
644	16-026(q)-99	16-005(d)	Former structures	Yes	RCRA CA - HE Production	1082
		16-017(h)-99				
		16-017(x)-99				
		16-025(k)				
		16-025(l)				
		16-026(q)				
		16-029(f2)				
		16-029(r)				
		16-031(d)				
		16-032(c)				
		16-034(a)				
		C-16-006				
		C-16-065				
645	16-026(r)		Outfall, TA-16-180	Yes	RCRA CA - HE Production	1082
646	16-026(s)		Outfall, TA-16-5	Yes	RCRA CA - HE Production	1082
647	16-026(t)		Outfall	Yes	RCRA CA - HE Production	1082
648	16-026(u)		Outfall, TA-16-195	Yes	RCRA CA - HE Production	1082
649	16-026(x)		Outfall	Yes	RCRA CA - HE Production	1082
650	16-026(y)		Outfall	Yes	RCRA CA - HE Production	1082
651	16-026(z)		Outfall	Yes	RCRA CA - HE Production	1082
652	16-027(a)		Transformer	No	RCRA CA - HE Production	1082
653	16-027(b)		Transformer	No	RCRA CA - HE Production	1082
654	16-027(c)		Transformer	No	RCRA CA - HE Production	1082
655	16-027(d)		Transformer	No	RCRA CA - HE Production	1082
656	16-028(a)		South drainage	Yes	RCRA CA - HE Production	1082
657	16-028(b)		Ind. or san. wastewater treatment, TA-16-370	Yes	RCRA CA - HE Production	1082
658	16-028(c)		Ind. or san. wastewater treatment, TA-16-220	Yes	RCRA CA - HE Production	1082
659	16-028(d)		Ind. or san. wastewater treatment, TA-16-202	Yes	RCRA CA - HE Production	1082
660	16-029(b2)-99	16-029(b2)	Former structures	Yes	RCRA CA - HE Production	1082
		C-16-005				
661	16-029(c2)-99	16-005(e)	Former structures	Yes	RCRA CA - HE Production	1082
		16-015(c)				
		16-025(z)				
		16-029(c2)				
662	16-029(e)-99	16-026(h2)	Tanks/sumps/outfalls	Yes	RCRA CA - HE Production	1082
		16-029(e)				
663	16-029(f)		Sump from Building 16-345	Yes	RCRA CA - HE Production	1082

Table B-1 (continued)

	Unit No.	Consolidated PRSs[a]	Unit Description	HSWA SWMU[b]	Focus Area	Former OU[c]
664	16-029(g)-99	16-028(e)	Tanks/sumps/outfalls	Yes	RCRA CA - HE Production	1082
		16-029(g)				
665	16-029(h)-99	16-003(p)	Tanks/sumps/outfalls	Yes	RCRA CA - HE Production	1082
		16-029(h)				
666	16-029(h2)-99	16-025(d)	Former structures	Yes	RCRA CA - HE Production	1082
		16-025(g)				
		16-025(h)				
		16-025(i)				
		16-025(j)				
		16-029(h2)				
		16-029(m)				
		16-029(n)				
		16-029(o)				
		16-029(p)				
667	16-029(j)-99	16-026(k2)	Tanks/sumps/outfalls	Yes	RCRA CA - HE Production	1082
		16-029(j)				
668	16-029(q)-99	16-017(f)-99	Former HE processing building, TA-16-99	Yes	RCRA CA - HE Production	1082
		16-029(q)				
		C-16-064				
669	16-029(v)-99	16-015(d)	Former structures	Yes	RCRA CA - HE Production	1082
		16-025(a2)				
		16-025(b2)				
		16-029(d2)				
		16-029(e2)				
		16-029(v)				
		16-034(o)				
670	16-029(x)-99	16-006(g)	Former structures	Yes	RCRA CA - HE Production	1082
		16-017(v)-99				
		16-025(x)				
		16-029(w)				
		16-029(x)				
		16-031(c)				
671	16-029(y)-99	16-025(t)	Former structures	Yes	RCRA CA - HE Production	1082
		16-029(y)				
672	16-029(z)-99	16-011	Former structures	Yes	RCRA CA - HE Production	1082
		16-023(b)				
		16-025(p)				
		16-025(q)				
		16-025(r)				

Table B-1 (continued)

	Unit No.	Consolidated PRSs[a]	Unit Description	HSWA SWMU[b]	Focus Area	Former OU[c]
		16-025(s)				
		16-025(u)				
		16-025(v)				
		16-026(w)				
		16-029(z)				
		16-032(a)				
		16-034(l)				
		16-034(p)				
673	16-030(a)		Ind. or san. wastewater treatment	Yes	RCRA CA - HE Production	1082
674	16-030(b)		Ind. or san. wastewater treatment	Yes	RCRA CA - HE Production	1082
675	16-030(c)		Ind. or san. wastewater treatment	Yes	RCRA CA - HE Production	1082
676	16-030(e)		Ind. or san. wastewater treatment	Yes	RCRA CA - HE Production	1082
677	16-030(f)		Ind. or san. wastewater treatment	Yes	RCRA CA - HE Production	1082
678	16-031(a)		Ind. or san. wastewater treatment, TA-16-372	Yes	RCRA CA - HE Production	1082
679	16-031(b)		Ind. or san. wastewater treatment, TA-16-262	Yes	RCRA CA - HE Production	1082
680	16-031(e)		Ind. or san. wastewater treatment	Yes	RCRA CA - HE Production	1082
681	16-031(f)		Ind. or san. wastewater treatment	Yes	RCRA CA - HE Production	1082
682	16-031(h)		Ind. or san. wastewater treatment at P-Site	Yes	RCRA CA - HE Production	1082
683	16-033(a)		Underground tank	No	RCRA CA - HE Production	1082
684	16-033(b)		Underground tank	No	RCRA CA - HE Production	1082
685	16-033(c)		Underground tank	No	RCRA CA - HE Production	1082
686	16-033(d)		Tank and/or assoc. equipment	No	RCRA CA - HE Production	1082
687	16-033(e)		Underground tank	No	RCRA CA - HE Production	1082
688	16-033(f)		Underground tank	No	RCRA CA - HE Production	1082
689	16-033(g)		Underground tank	No	RCRA CA - HE Production	1082
690	16-033(h)		Underground tank	No	RCRA CA - HE Production	1082
691	16-033(i)		Underground tank	No	RCRA CA - HE Production	1082
692	16-033(j)		Underground tank	No	RCRA CA - HE Production	1082
693	16-033(k)		Underground storage tank <100 gallons	No	RCRA CA - HE Production	1082
694	16-034(b)-99	16-005(j)	Former structures	Yes	RCRA CA - HE Production	1082
		16-005(m)				
		16-034(b)				
		16-034(c)				
		16-034(d)				
		16-034(e)				
		16-034(f)				
695	16-034(h)		Soil contamination area, TA-16-137	Yes	RCRA CA - HE Production	1082
696	16-034(i)		Soil contamination area	Yes	RCRA CA - HE Production	1082
697	16-034(j)		Soil contamination area, TA-16-139	Yes	RCRA CA - HE Production	1082

Table B-1 (continued)

	Unit No.	Consolidated PRSs[a]	Unit Description	HSWA SWMU[b]	Focus Area	Former OU[c]
698	16-034(k)		Soil contamination area	Yes	RCRA CA - HE Production	1082
699	16-034(m)		Soil contamination area	Yes	RCRA CA - HE Production	1082
700	16-034(n)		Soil contamination area	Yes	RCRA CA - HE Production	1082
701	16-037		Aboveground tank (does not exist)	No	RCRA CA - HE Production	1082
702	C-16-001		Building	No	RCRA CA - HE Production	1082
703	C-16-002		Building TA-16-262	No	RCRA CA - HE Production	1082
704	C-16-008		Building	No	RCRA CA - HE Production	1082
705	C-16-009		Building	No	RCRA CA - HE Production	1082
706	C-16-010		Building	No	RCRA CA - HE Production	1082
707	C-16-011		Building TA-16-132	No	RCRA CA - HE Production	1082
708	C-16-012		Building	No	RCRA CA - HE Production	1082
709	C-16-013		Storage area	No	RCRA CA - HE Production	1082
710	C-16-014		Building	No	RCRA CA - HE Production	1082
711	C-16-015		Building	No	RCRA CA - HE Production	1082
712	C-16-016		Building	No	RCRA CA - HE Production	1082
713	C-16-017		Building	No	RCRA CA - HE Production	1082
714	C-16-018		Aboveground tank	No	RCRA CA - HE Production	1082
715	C-16-019		Building	No	RCRA CA - HE Production	1082
716	C-16-020		Building	No	RCRA CA - HE Production	1082
717	C-16-028		Building	No	RCRA CA - HE Production	1082
718	C-16-030		Building	No	RCRA CA - HE Production	1082
719	C-16-031		Building	No	RCRA CA - HE Production	1082
720	C-16-034		Aboveground tank	No	RCRA CA - HE Production	1082
721	C-16-035		Aboveground tank	No	RCRA CA - HE Production	1082
722	C-16-036		Septic system	No	RCRA CA - HE Production	1082
723	C-16-041		Building	No	RCRA CA - HE Production	1082
724	C-16-044		Manhole	No	RCRA CA - HE Production	1082
725	C-16-046		Manhole	No	RCRA CA - HE Production	1082
726	C-16-047		Transport area	No	RCRA CA - HE Production	1082
727	C-16-049		Building	No	RCRA CA - HE Production	1082
728	C-16-050		Building	No	RCRA CA - HE Production	1082
729	C-16-051		Transport area	No	RCRA CA - HE Production	1082
730	C-16-058		Transport area	No	RCRA CA - HE Production	1082
731	C-16-060		Building	No	RCRA CA - HE Production	1082
732	C-16-061		Building	No	RCRA CA - HE Production	1082
733	C-16-062		Generation area	No	RCRA CA - HE Production	1082
734	C-16-063		Generation area	No	RCRA CA - HE Production	1082
735	C-16-069		Building	No	RCRA CA - HE Production	1082
736	C-16-070		Underground tank	No	RCRA CA - HE Production	1082

Table B-1 (continued)

	Unit No.	Consolidated PRSs[a]	Unit Description	HSWA SWMU[b]	Focus Area	Former OU[c]
737	C-16-071		One-time spill	No	RCRA CA - HE Production	1082
738	C-16-072		Tank (does not exist)	No	RCRA CA - HE Production	1082
739	C-16-073		Underground tank	No	RCRA CA - HE Production	1082
740	C-16-075		Spill location near Bldg. 16-340 (newly identified area of concern)	No	RCRA CA - HE Production	1082
741	18-001(a)		Lagoon	Yes	Canyon	1093
742	18-001(b)		Sewer lines	Yes	Canyon	1093
743	18-001(c)		Sump	Yes	Canyon	1093
744	18-002(a)		Firing site (abandoned)	Yes	Canyon	1093
745	18-002(b)		Firing site (abandoned)	Yes	Canyon	1093
746	18-002(c)		Drop tower	No	Canyon	1093
747	18-003(a)		Settling pit	Yes	Canyon	1093
748	18-003(b)		Septic system	Yes	Canyon	1093
749	18-003(c)		Septic system	Yes	Canyon	1093
750	18-003(d)		Septic system	Yes	Canyon	1093
751	18-003(e)		Septic system	Yes	Canyon	1093
752	18-003(f)		Septic system	Yes	Canyon	1093
753	18-003(g)		Septic system	Yes	Canyon	1093
754	18-003(h)		Septic system	Yes	Canyon	1093
755	18-004(a)		Waste lines containment	Yes	Canyon	1093
756	18-004(b)		Pit	Yes	Canyon	1093
757	18-005(a)		Storage area	Yes	Canyon	1093
758	18-006		Storage pipe	No	Canyon	1093
759	18-007		Buried armored vehicle (does not exist)	Yes	Canyon	1093
760	18-008		Underground tank, TA 18-26	No	Canyon	1093
761	18-009(b)		Transformer	No	Canyon	1093
762	18-010(b)		Outfall	No	Canyon	1093
763	18-010(c)		Outfall	No	Canyon	1093
764	18-010(d)		Outfall	No	Canyon	1093
765	18-010(e)		Outfall	No	Canyon	1093
766	18-010(f)		Outfall	No	Canyon	1093
767	18-011		Soil containment	No	Canyon	1093
768	18-012(a)		Outfall	Yes	Canyon	1093
769	18-012(b)		Outfall	Yes	Canyon	1093
770	18-012(c)		Sump and drainlines	No	Canyon	1093
771	18-013		Waste tank	No	Canyon	1093
772	19-001-99	19-001	Former structures	Yes	RCRA CA - Townsite	1071
		19-002				

Table B-1 (continued)

	Unit No.	Consolidated PRSs[a]	Unit Description	HSWA SWMU[b]	Focus Area	Former OU[c]
		19-003				
		C-19-001				
773	20-001(a)		Landfill	Yes	RCRA CA - Industrial	1100
774	20-001(b)		Landfill	Yes	RCRA CA - Industrial	1100
775	20-001(c)		Landfill	Yes	RCRA CA - Industrial	1100
776	20-002(a)		Firing site	Yes	RCRA CA - Industrial	1100
777	20-002(b)		Firing site	Yes	RCRA CA - Industrial	1100
778	20-002(c)		Firing site	Yes	RCRA CA - Industrial	1100
779	20-002(d)		Firing site	Yes	RCRA CA - Industrial	1100
780	20-003(a)		Control Building at a firing site	Yes	RCRA CA - Industrial	1100
781	20-003(b)		Firing site	No	RCRA CA - Industrial	1100
782	20-003(c)		Firing site	No	RCRA CA - Industrial	1100
783	20-004		Septic system	No	RCRA CA - Industrial	1100
784	20-005		Septic tank	Yes	RCRA CA - Industrial	1100
785	C-20-002		Storage building	No	RCRA CA - Industrial	1100
786	C-20-003		Building	No	RCRA CA - Industrial	1100
787	21-002(a)		Container storage areas located throughout TA-21	Yes	MDA[e]	1106
788	21-002(b)		Container storage	No	MDA	1106
789	21-003-99	21-003	Miscellaneous	Yes	MDA	1106
		21-013(f)				
790	21-004(b)-99	21-004(b)	Tanks/sumps/outfalls	Yes	MDA	1106
		21-004(c)				
		21-004(d)				
791	21-005		Disposal pit	Yes	MDA	1106
792	21-006(a)		Disposal pit Bldg. 21-2	Yes	MDA	1106
793	21-006(b)		Disposal pit	Yes	MDA	1106
794	21-006(c)-99	21-006(c)	Miscellaneous	Yes	MDA	1106
		21-006(d)				
795	21-006(e)-99	21-006(e)	Miscellaneous	Yes	MDA	1106
795		21-006(f)				
796	21-007		Incinerators	Yes	MDA	1106
797	21-009		Waste treatment lab	No	MDA	1106
798	21-011(b)		Sump	Yes	MDA	1106
799	21-011(k)		Outfall	Yes	MDA	1106
800	21-012(b)		Dry well	Yes	MDA	1106
801	21-013(c)		Surface disposal site	Yes	MDA	1106
802	21-013(d)-99	21-013(d)	Miscellaneous	Yes	MDA	1106
		21-013(e)				
803	21-014		Material disposal area (MDA A)	Yes	MDA	1106

Table B-1 (continued)

	Unit No.	Consolidated PRSs[a]	Unit Description	HSWA SWMU[b]	Focus Area	Former OU[c]
804	21-015		Material disposal area (MDA B)	Yes	MDA	1106
805	21-016(a)-99	21-001	Wastewater treatment plant	Yes	MDA	1106
		21-010(a)				
		21-010(b)				
		21-010(c)				
		21-010(d)				
		21-010(e)				
		21-010(f)				
		21-010(g)				
		21-010(h)				
		21-011(a)				
		21-011(c)				
		21-011(d)				
		21-011(e)				
		21-011(f)				
		21-011(g)				
		21-011(h)				
		21-011(i)				
		21-011(j)				
		21-016(a)				
		21-016(b)				
		21-016(c)				
		21-028(a)				
		C-21-009				
		C-21-012				
806	21-017(a)-99	21-017(a)	MDA U	Yes	MDA	1106
		21-017(b)				
		21-017(c)				
		21-022(f)				
807	21-018(a)-99	21-013(b)	MDA V	Yes	MDA	1106
		21-013(g)				
		21-018(a)				
		21-018(b)				
808	21-021-99	21-019(a)	Miscellaneous	Yes	MDA	1106
		21-019(b)				
		21-019(c)				
		21-019(d)				
		21-019(e)				
		21-019(f)				

Table B-1 (continued)

	Unit No.	Consolidated PRSs[a]	Unit Description	HSWA SWMU[b]	Focus Area	Former OU[c]
		21-019(g)				
		21-019(h)				
		21-019(i)				
		21-019(j)				
		21-019(k)				
		21-019(l)				
		21-019(m)				
		21-020(a)				
		21-020(b)				
		21-021				
809	21-022(a)		Waste lines	Yes	MDA	1106
810	21-022(b)-99	21-022(b)	Former structures	Yes	MDA	1106
		21-022(c)				
		21-022(d)				
		21-022(e)				
		21-022(g)				
811	21-022(h)-99	21-022(h)	Former structures	Yes	MDA	1106
		21-022(i)				
		21-022(j)				
812	21-023(a)-99	21-023(a)	Former structures	Yes	MDA	1106
		21-023(b)				
		21-023(d)				
813	21-023(c)		Septic system	Yes	MDA	1106
814	21-024(a)		Septic system	Yes	MDA	1106
815	21-024(b)		Septic system	Yes	MDA	1106
816	21-024(c)		Septic system	Yes	MDA	1106
817	21-024(d)		Septic system VCA for rad	Yes	MDA	1106
818	21-024(e)		Septic system	Yes	MDA	1106
819	21-024(f)		Septic system	Yes	MDA	1106
820	21-024(g)		Septic system	Yes	MDA	1106
821	21-024(h)		Septic system	Yes	MDA	1106
822	21-024(i)		Septic system	Yes	MDA	1106
823	21-024(j)		Septic system	Yes	MDA	1106
824	21-024(k)		Septic system	Yes	MDA	1106
825	21-024(l)-99	21-004(a)	Tanks/sumps/outfalls	Yes	MDA	1106
		21-024(l)				
826	21-024(n)		Drainline	Yes	MDA	1106
827	21-024(o)		Drainline	Yes	MDA	1106

Table B-1 (continued)

	Unit No.	Consolidated PRSs[a]	Unit Description	HSWA SWMU[b]	Focus Area	Former OU[c]
828	21-026(a)-99	21-013(a)	Wastewater treatment plant	Yes	MDA	1106
		21-026(a)				
		21-026(b)				
		21-026(c)				
		21-026(d)				
829	21-027(a)		Ind. or san. wastewater treatment	Yes	MDA	1106
830	21-027(c)		Ind. or san. wastewater treatment	Yes	MDA	1106
831	21-027(d)-99	21-027(d)	Former structures	Yes	MDA	1106
		C-21-028				
832	21-028(c)		Container storage, Bldg. 21-3	No	MDA	1106
833	21-028(d)		Container storage	No	MDA	1106
834	21-029		Soil contamination area	Yes	MDA	1106
835	21-030		Sump identified as new PRS in August 1996	No	MDA	1106
836	C-21-001		One-time spill, Bldg. 21-5	No	MDA	1106
837	C-21-005		One-time spill	No	MDA	1106
838	C-21-006		Non-intentional release area, Bldg. 21-2	No	MDA	1106
839	C-21-007		Non-intentional release area	No	MDA	1106
840	C-21-027		Machinery	No	MDA	1106
841	C-21-031		Tank	No	MDA	1106
842	C-21-032		Machinery and tanks	No	MDA	1106
843	C-21-033		One-time spill	No	MDA	1106
844	C-21-034		Tank	No	MDA	1106
845	C-21-035		Aboveground tank	No	MDA	1106
846	C-21-036		Aboveground tank	No	MDA	1106
847	C-21-037		Aboveground tank	No	MDA	1106
848	22-010(a)		Septic system	Yes	RCRA CA - HE Production	1111
849	22-011		Disposal pit	Yes	RCRA CA - HE Production	1111
850	22-014(a)		Ind. or san. wastewater treatment	Yes	RCRA CA - HE Production	1111
851	22-014(b)		Sump	Yes	RCRA CA - HE Production	1111
852	22-015(a)		Drainlines and dry wells	Yes	RCRA CA - HE Production	1111
853	22-015(b)		Sump and outfall	Yes	RCRA CA - HE Production	1111
854	22-015(c)		Outfall	Yes	RCRA CA - HE Production	1111
855	22-015(d)-99	22-010(b)	Tanks/sumps/outfalls	Yes	RCRA CA - HE Production	1111
		22-012				
		22-015(d)				
		22-015(e)				
		22-016				
856	26-001		Surface disposal site	Yes	RCRA CA - Townsite	1071
857	26-002(a)		Tank and/or assoc. equipment	Yes	RCRA CA - Townsite	1071

Table B-1 (continued)

	Unit No.	Consolidated PRSs[a]	Unit Description	HSWA SWMU[b]	Focus Area	Former OU[c]
858	26-002(b)		Ind. or san. wastewater treatment	Yes	RCRA CA - Townsite	1071
859	26-003		Septic tank	Yes	RCRA CA - Townsite	1071
860	27-001		Buried naval guns	Yes	Canyon	1093
861	27-002		Firing sites (abandoned)	Yes	Canyon	1093
862	27-003		Bazooka impact area	Yes	Canyon	1093
863	31-001		Outfall from sanitary septic system	Yes	RCRA CA - Townsite	1079
864	32-001		Incinerator (former location)	Yes	RCRA CA - Townsite	1079
865	32-002(a)		Septic tank (former location); drainlines	Yes	RCRA CA - Townsite	1079
866	32-002(b)		Septic system	Yes	RCRA CA - Townsite	1079
867	32-003		Transformer site (former location) (new AOC)	No	RCRA CA - Townsite	1079
868	32-004		Drainline and outfall (new AOC)	No	RCRA CA - Townsite	1079
869	33-001(a)-99	33-001(a)	MDA E	Yes	RCRA CA - Firing Sites	1122
		33-001(b)				
		33-001(c)				
		33-001(d)				
		33-001(e)				
870	33-002(a)-99	33-002(a)	MDA K	Yes	RCRA CA - Firing Sites	1122
		33-002(b)				
		33-002(c)				
		33-002(d)				
		33-002(e)				
871	33-003(a)-99	33-003(a)	MDA D	Yes	RCRA CA - Firing Sites	1122
		33-003(b)				
872	33-004(a)		Septic system	Yes	RCRA CA - Firing Sites	1122
873	33-004(b)		Septic system	Yes	RCRA CA - Firing Sites	1122
874	33-004(c)		Septic system	Yes	RCRA CA - Firing Sites	1122
875	33-004(d)		Septic system	Yes	RCRA CA - Firing Sites	1122
876	33-004(g)		Outfall	Yes	RCRA CA - Firing Sites	1122
877	33-004(h)		Outfall	Yes	RCRA CA - Firing Sites	1122
878	33-004(i)		Outfall	Yes	RCRA CA - Firing Sites	1122
879	33-004(j)		Outfall	Yes	RCRA CA - Firing Sites	1122
880	33-004(k)		Outfall	Yes	RCRA CA - Firing Sites	1122
881	33-004(m)		Septic system	Yes	RCRA CA - Firing Sites	1122
882	33-005(a)		Septic system	Yes	RCRA CA - Firing Sites	1122
883	33-005(b)		Septic system	Yes	RCRA CA - Firing Sites	1122
884	33-005(c)		Septic system	Yes	RCRA CA - Firing Sites	1122
885	33-006(a)		Firing site (inactive)	Yes	RCRA CA - Firing Sites	1122
886	33-006(b)		Firing range (inactive)	Yes	RCRA CA - Firing Sites	1122
887	33-007(a)		Firing range (inactive)	Yes	RCRA CA - Firing Sites	1122

Table B-1 (continued)

	Unit No.	Consolidated PRSs[a]	Unit Description	HSWA SWMU[b]	Focus Area	Former OU[c]
888	33-007(b)		Firing range (inactive)	Yes	RCRA CA - Firing Sites	1122
889	33-007(c)		Firing range (inactive)	Yes	RCRA CA - Firing Sites	1122
890	33-008(a)		Landfill	Yes	RCRA CA - Firing Sites	1122
891	33-008(b)		Landfill	Yes	RCRA CA - Firing Sites	1122
892	33-008(c)		Landfill	No	RCRA CA - Firing Sites	1122
893	33-009		Surface disposal - PCB only site	Yes	RCRA CA - Firing Sites	1122
894	33-010(a)		Surface disposal	Yes	RCRA CA - Firing Sites	1122
895	33-010(b)		Surface disposal	Yes	RCRA CA - Firing Sites	1122
896	33-010(c)		Surface disposal	Yes	RCRA CA - Firing Sites	1122
897	33-010(d)		Surface disposal	Yes	RCRA CA - Firing Sites	1122
898	33-010(f)		Surface disposal	Yes	RCRA CA - Firing Sites	1122
899	33-010(g)		Surface disposal	Yes	RCRA CA - Firing Sites	1122
900	33-010(h)		Surface disposal	Yes	RCRA CA - Firing Sites	1122
901	33-011(a)		Storage area	Yes	RCRA CA - Firing Sites	1122
902	33-011(b)		Storage area	No	RCRA CA - Firing Sites	1122
903	33-011(c)		Storage area	Yes	RCRA CA - Firing Sites	1122
904	33-011(d)		Storage area	Yes	RCRA CA - Firing Sites	1122
905	33-011(e)		Drum storage	Yes	RCRA CA - Firing Sites	1122
906	33-012(a)		Drum storage - PCB only site	Yes	RCRA CA - Firing Sites	1122
907	33-013		Storage area	Yes	RCRA CA - Firing Sites	1122
908	33-014		Burn site	Yes	RCRA CA - Firing Sites	1122
909	33-015		Incinerator	Yes	RCRA CA - Firing Sites	1122
910	33-016		Sump	Yes	RCRA CA - Firing Sites	1122
911	33-017		Operational release	Yes	RCRA CA - Firing Sites	1122
912	C-33-001		Transformer	No	RCRA CA - Firing Sites	1122
913	C-33-002		Transformer	No	RCRA CA - Firing Sites	1122
914	C-33-003		Soil contamination area	No	RCRA CA - Firing Sites	1122
915	35-002		Material disposal area (MDA X)	Yes	RCRA CA - Industrial	1129
916	35-003(a)-99	35-003(a)	Wastewater treatment plant	Yes	RCRA CA - Industrial	1129
		35-003(b)				
		35-003(c)				
		35-003(d)				
		35-003(e)				
		35-003(f)				
		35-003(g)				
		35-003(h)				
		35-003(l)				
		35-003(m)				
		35-003(misc)				

Table B-1 (continued)

	Unit No.	Consolidated PRSs[a]	Unit Description	HSWA SWMU[b]	Focus Area	Former OU[c]
		35-003(n)				
		35-003(o)				
		35-003(q)				
		35-003(r)				
917	35-003(j)-99	35-003(j)	Former structures	Yes	RCRA CA - Industrial	1129
		35-003(k)				
		35-014(d)				
		35-015(b)				
918	35-003(p)		Wastewater treatment facility	Yes	RCRA CA - Industrial	1129
919	35-004(a)		Storage areas	Yes	RCRA CA - Industrial	1129
920	35-004(b)		Storage areas	Yes	RCRA CA - Industrial	1129
921	35-004(e)		Container storage area SAA	Yes	RCRA CA - Industrial	1129
922	35-004(g)		Container storage area	Yes	RCRA CA - Industrial	1129
923	35-004(h)		Container storage area	Yes	RCRA CA - Industrial	1129
924	35-004(m)		Container storage area	No	RCRA CA - Industrial	1129
925	35-006		Surface impoundment (closure), Bldg. 85 [duplicate of 35-005(a)]	Yes	RCRA CA - Industrial	1129
926	35-008		Surface disposal and landfill	Yes	RCRA CA - Industrial	1129
927	35-009(a)		Septic system	Yes	RCRA CA - Industrial	1129
928	35-009(b)		Septic system	Yes	RCRA CA - Industrial	1129
929	35-009(c)		Septic system	Yes	RCRA CA - Industrial	1129
930	35-009(d)		Septic system	Yes	RCRA CA - Industrial	1129
931	35-009(e)		Septic system	Yes	RCRA CA - Industrial	1129
932	35-010(a)-99	35-010(a)	Surface impoundments	Yes	RCRA CA - Industrial	1129
		35-010(b)				
		35-010(c)				
		35-010(d)				
		35-010(e)				
933	35-011(a)		Underground storage tank	Yes	RCRA CA - Industrial	1129
934	35-013(a)		Sump	Yes	RCRA CA - Industrial	1129
935	35-013(b)		Sump	Yes	RCRA CA - Industrial	1129
936	35-013(c)		Sump	Yes	RCRA CA - Industrial	1129
937	35-013(d)		Floor drains	Yes	RCRA CA - Industrial	1129
938	35-014(a)		Operational release	Yes	RCRA CA - Industrial	1129
939	35-014(b)		Leaking drum	Yes	RCRA CA - Industrial	1129
940	35-014(e)		Oil spill	Yes	RCRA CA - Industrial	1129
941	35-014(e2)		Oil spill	No	RCRA CA - Industrial	1129
942	35-014(e3)		Operational release	No	RCRA CA - Industrial	1129
943	35-014(f)		Soil contamination	No	RCRA CA - Industrial	1129

Table B-1 (continued)

	Unit No.	Consolidated PRSs[a]	Unit Description	HSWA SWMU[b]	Focus Area	Former OU[c]
944	35-014(g)		Soil contamination	Yes	RCRA CA - Industrial	1129
945	35-014(g2)		Soil contamination	No	RCRA CA - Industrial	1129
946	35-014(g3)		Soil contamination	No	RCRA CA - Industrial	1129
947	35-015(a)		Soil contamination	Yes	RCRA CA - Industrial	1129
948	35-016(a)		Drains and outfalls	Yes	RCRA CA - Industrial	1129
949	35-016(b)		Outfall	No	RCRA CA - Industrial	1129
950	35-016(c)		Outfall	Yes	RCRA CA - Industrial	1129
951	35-016(d)		Outfall	Yes	RCRA CA - Industrial	1129
952	35-016(e)		Outfall	No	RCRA CA - Industrial	1129
953	35-016(f)		Storm drain	No	RCRA CA - Industrial	1129
954	35-016(g)		Outfall	No	RCRA CA - Industrial	1129
955	35-016(h)		Storm drain	No	RCRA CA - Industrial	1129
956	35-016(i)		Drains and outfalls	Yes	RCRA CA - Industrial	1129
957	35-016(j)		Storm drain	No	RCRA CA - Industrial	1129
958	35-016(k)		Drains and outfalls	Yes	RCRA CA - Industrial	1129
959	35-016(l)		Storm drain	No	RCRA CA - Industrial	1129
960	35-016(m)		Drains and outfalls	Yes	RCRA CA - Industrial	1129
961	35-016(n)		Storm drain	No	RCRA CA - Industrial	1129
962	35-016(o)		Drains and outfalls	Yes	RCRA CA - Industrial	1129
963	35-016(p)		Outfall	Yes	RCRA CA - Industrial	1129
964	35-016(q)		Drains and outfalls	Yes	RCRA CA - Industrial	1129
965	35-018(a)		Transformer	No	RCRA CA - Industrial	1129
966	C-35-007		Soil contamination	No	RCRA CA - Industrial	1129
967	15-008(f)		I-J Firing site mounds at TA-36 (active)	No	RCRA CA - Firing Sites	1130
968	36-001		Material disposal area (MDA AA)	Yes	RCRA CA - Firing Sites	1130
969	36-002		Sump	Yes	RCRA CA - Firing Sites	1130
970	36-003(a)		Septic system	Yes	RCRA CA - Firing Sites	1130
971	36-003(b)		Septic system, I-J site	Yes	RCRA CA - Firing Sites	1130
972	36-004(b)		Firing site (active)	No	RCRA CA - Firing Sites	1130
973	36-004(c)		Firing site (active), (open detonation)	No	RCRA CA - Firing Sites	1130
974	36-004(d)		Firing site (lower Slabovia, skunk works, burn pit) (active)	Yes	RCRA CA - Firing Sites	1130
975	36-004(e)		I-J firing site (active)	No	RCRA CA - Firing Sites	1130
976	36-005		Surface disposal site	Yes	RCRA CA - Firing Sites	1130
977	36-006-99	36-004(a)	Firing site	Yes	RCRA CA - Firing Sites	1130
		36-006				
978	C-36-001		Containment vessel	No	RCRA CA - Firing Sites	1130
979	C-36-003		Storm drainages	Yes	RCRA CA - Firing Sites	1130

Table B-1 (continued)

	Unit No.	Consolidated PRSs[a]	Unit Description	HSWA SWMU[b]	Focus Area	Former OU[c]
980	C-36-006(e)		I-J firing site - projectile test area [duplicate of 15-006(e)] (active)	No	RCRA CA - Firing Sites	1130
981	39-001(a)		Landfill	Yes	RCRA CA - Firing Sites	1132
982	39-001(b)		Material disposal area (MDA Y)	Yes	RCRA CA - Firing Sites	1132
983	39-002(a)		Storage area	Yes	RCRA CA - Firing Sites	1132
984	39-002(b)		Storage area	No	RCRA CA - Firing Sites	1132
985	39-002(c)		Storage area	No	RCRA CA - Firing Sites	1132
986	39-002(d)		Storage area	No	RCRA CA - Firing Sites	1132
987	39-002(e)		Storage area	No	RCRA CA - Firing Sites	1132
988	39-002(f)		Storage area	No	RCRA CA - Firing Sites	1132
989	39-004(a)		Firing site (active), (open detonation)	Yes	RCRA CA - Firing Sites	1132
990	39-004(b)		Firing site (active)	Yes	RCRA CA - Firing Sites	1132
991	39-004(c)		Firing site (active), (open detonation) - RCRA unit	Yes	RCRA CA - Firing Sites	1132
992	39-004(d)		Firing site (active), (open detonation) - RCRA unit	Yes	RCRA CA - Firing Sites	1132
993	39-004(e)		Firing site (active)	Yes	RCRA CA - Firing Sites	1132
994	39-005		Seepage pit	Yes	RCRA CA - Firing Sites	1132
995	39-006(a)		Septic system	Yes	RCRA CA - Firing Sites	1132
996	39-007(a)		Storage area	Yes	RCRA CA - Firing Sites	1132
997	39-007(d)		Storage area	No	RCRA CA - Firing Sites	1132
998	39-008		Firing range (inactive)	Yes	RCRA CA - Firing Sites	1132
999	40-001(b)		Septic system	Yes	RCRA CA - HE Production	1111
1000	40-001(c)		Septic system	Yes	RCRA CA - HE Production	1111
1001	40-003(a)		Scrap burn site - completed RCRA closure	Yes	RCRA CA - HE Production	1111
1002	40-004		Operational release	Yes	RCRA CA - HE Production	1111
1003	40-005		Sump	Yes	RCRA CA - HE Production	1111
1004	40-006(a)		Firing site (active)	Yes	RCRA CA - HE Production	1111
1005	40-006(b)		Firing site (active)	Yes	RCRA CA - HE Production	1111
1006	40-006(c)		Firing site (active)	Yes	RCRA CA - HE Production	1111
1007	40-007(a)		Storage area	No	RCRA CA - HE Production	1111
1008	40-007(b)		Storage area	No	RCRA CA - HE Production	1111
1009	40-007(c)		Storage area	No	RCRA CA - HE Production	1111
1010	40-007(d)		Storage area	No	RCRA CA - HE Production	1111
1011	40-007(e)		Storage area	No	RCRA CA - HE Production	1111
1012	40-009		Landfill	Yes	RCRA CA - HE Production	1111
1013	40-010		Surface disposal site	Yes	RCRA CA - HE Production	1111
1014	41-001		Septic system	Yes	Canyon	1098
1015	41-002(a)-99	41-002(a)	Wastewater treatment plant	Yes	Canyon	1098
		41-002(b)				
		41-002(c)				

Table B-1 (continued)

	Unit No.	Consolidated PRSs[a]	Unit Description	HSWA SWMU[b]	Focus Area	Former OU[c]
1016	41-003		Sump	No	Canyon	1098
1017	C-41-004		Storm drains	No	Canyon	1098
1018	42-001(a)-99	42-001(a)	Former structures	Yes	RCRA CA - Industrial	1129
		42-001(b)				
		42-001(c)				
		42-002(a)				
		42-002(b)				
		42-003				
1019	43-001(a1)		Waste lines (Pre-1981)	Yes	RCRA CA - Townsite	1136
1020	43-001(a2)		Waste lines (Post-1981)	No	RCRA CA - Townsite	1136
1021	43-001(b2)		Outfall	No	RCRA CA - Townsite	1136
1022	43-002		Incinerator	Yes	RCRA CA - Townsite	1136
1023	C-43-001		Outfall	No	RCRA CA - Townsite	1136
1024	45-001		Wastewater treatment facility	Yes	RCRA CA - Townsite	1079
1025	45-002		Vehicle decontamination facility	Yes	RCRA CA - Townsite	1079
1026	45-003		Waste lines	Yes	RCRA CA - Townsite	1079
1027	45-004		Sanitary sewer outfall	Yes	RCRA CA - Townsite	1079
1028	C-45-001		Parking lot of former treatment plant	No	RCRA CA - Townsite	1079
1029	46-002		Surface impoundment	Yes	RCRA CA - Industrial	1140
1030	46-003(a)		Septic system	Yes	RCRA CA - Industrial	1140
1031	46-003(b)		Septic system	Yes	RCRA CA - Industrial	1140
1032	46-003(c)		Septic system	Yes	RCRA CA - Industrial	1140
1033	46-003(d)		Septic system	Yes	RCRA CA - Industrial	1140
1034	46-003(e)		Septic system	Yes	RCRA CA - Industrial	1140
1035	46-003(f)		Septic system	Yes	RCRA CA - Industrial	1140
1036	46-003(g)		Septic system	Yes	RCRA CA - Industrial	1140
1037	46-003(h)		Operational release	Yes	RCRA CA - Industrial	1140
1038	46-004(a)		Waste line	Yes	RCRA CA - Industrial	1140
1039	46-004(a2)		Outfall	Yes	RCRA CA - Industrial	1140
1040	46-004(b)		Operational release	Yes	RCRA CA - Industrial	1140
1041	46-004(b2)		Operational release	Yes	RCRA CA - Industrial	1140
1042	46-004(c)		Sump	Yes	RCRA CA - Industrial	1140
1043	46-004(c2)		Outfall	Yes	RCRA CA - Industrial	1140
1044	46-004(d)-99	46-004(d)	Miscellaneous	Yes	RCRA CA - Industrial	1140
		46-004(e)				
1045	46-004(d2)-99	46-004(d2)	Miscellaneous	Yes	RCRA CA - Industrial	1140
		46-004(g)				
		46-004(h)				

Table B-1 (continued)

	Unit No.	Consolidated PRSs[a]	Unit Description	HSWA SWMU[b]	Focus Area	Former OU[c]
		C-46-002				
		C-46-003				
1046	46-004(e2)		Outfall from building TA-46-42	No	RCRA CA - Industrial	1140
1047	46-004(f)		Outfall	Yes	RCRA CA - Industrial	1140
1048	46-004(f2)		Outfall from building TA-46-31	No	RCRA CA - Industrial	1140
1049	46-004(m)		Outfall	Yes	RCRA CA - Industrial	1140
1050	46-004(p)		Sump	Yes	RCRA CA - Industrial	1140
1051	46-004(q)		Outfall	Yes	RCRA CA - Industrial	1140
1052	46-004(r)		Outfall	Yes	RCRA CA - Industrial	1140
1053	46-004(s)		Outfall	Yes	RCRA CA - Industrial	1140
1054	46-004(t)		Outfall	Yes	RCRA CA - Industrial	1140
1055	46-004(u)		Outfall	Yes	RCRA CA - Industrial	1140
1056	46-004(v)		Outfall	Yes	RCRA CA - Industrial	1140
1057	46-004(w)		Outfall	Yes	RCRA CA - Industrial	1140
1058	46-004(x)		Outfall	Yes	RCRA CA - Industrial	1140
1059	46-004(y)		Outfall	Yes	RCRA CA - Industrial	1140
1060	46-004(z)		Outfall	Yes	RCRA CA - Industrial	1140
1061	46-005		Surface impoundment	Yes	RCRA CA - Industrial	1140
1062	46-006(a)		Operational release	Yes	RCRA CA - Industrial	1140
1063	46-006(b)		Operational release	Yes	RCRA CA - Industrial	1140
1064	46-006(c)		Operational release	Yes	RCRA CA - Industrial	1140
1065	46-006(d)		Operational release	Yes	RCRA CA - Industrial	1140
1066	46-006(f)		Storage area	Yes	RCRA CA - Industrial	1140
1067	46-006(g)		Operational release	Yes	RCRA CA - Industrial	1140
1068	46-007		Operational release	Yes	RCRA CA - Industrial	1140
1069	46-008(a)		Storage area	Yes	RCRA CA - Industrial	1140
1070	46-008(b)		Storage area	Yes	RCRA CA - Industrial	1140
1071	46-008(d)		Storage area	Yes	RCRA CA - Industrial	1140
1072	46-008(e)		Storage area	Yes	RCRA CA - Industrial	1140
1073	46-008(f)		Storage area	Yes	RCRA CA - Industrial	1140
1074	46-008(g)		Storage area	Yes	RCRA CA - Industrial	1140
1075	46-009(a)		Surface disposal	Yes	RCRA CA - Industrial	1140
1076	46-009(b)		Surface disposal	Yes	RCRA CA - Industrial	1140
1077	46-010(d)		Operation release SAA	Yes	RCRA CA - Industrial	1140
1078	C-46-001		One-time spill	No	RCRA CA - Industrial	1140
1079	48-001		Air exhaust system	No	RCRA CA - Industrial	1129
1080	48-002(a)		Container storage area	Yes	RCRA CA - Industrial	1129
1081	48-002(b)		Container storage area	Yes	RCRA CA - Industrial	1129
1082	48-002(e)		Container storage	No	RCRA CA - Industrial	1129

Table B-1 (continued)

	Unit No.	Consolidated PRSs[a]	Unit Description	HSWA SWMU[b]	Focus Area	Former OU[c]
1083	48-003		Septic system	Yes	RCRA CA - Industrial	1129
1084	48-004(a)-99	48-004(a)	Tanks/sumps/outfalls	Yes	RCRA CA - Industrial	1129
		48-004(b)				
		48-004(c)				
1085	48-005		Waste lines	Yes	RCRA CA - Industrial	1129
1086	48-007(a)		Drains and outfalls	Yes	RCRA CA - Industrial	1129
1087	48-007(b)		Drains and outfalls	Yes	RCRA CA - Industrial	1129
1088	48-007(c)		Drains and outfalls	Yes	RCRA CA - Industrial	1129
1089	48-007(d)		Drains and outfalls	Yes	RCRA CA - Industrial	1129
1090	48-007(f)		Drains and outfalls	Yes	RCRA CA - Industrial	1129
1091	48-010		Surface impoundment	Yes	RCRA CA - Industrial	1129
1092	48-011		Disposal shaft	No	RCRA CA - Industrial	1129
1093	49-001(a)		Material disposal area (MDA AB) - experimental shafts	Yes	MDA	1144
1094	49-001(b)		Material disposal area (MDA AB) - experimental shafts	Yes	MDA	1144
1095	49-001(c)		Material disposal area (MDA AB) - experimental shafts	Yes	MDA	1144
1096	49-001(d)		Material disposal area (MDA AB) - experimental shafts	Yes	MDA	1144
1097	49-001(e)		Material disposal area (MDA AB) - experimental shafts	Yes	MDA	1144
1098	49-001(f)		Material disposal area (MDA AB) - experimental shafts	Yes	MDA	1144
1099	49-001(g)		Material disposal area (MDA AB) - miscellaneous	Yes	MDA	1144
1100	49-002		Operational facility - Area 10 underground chamber	No	MDA	1144
1101	49-003		Leach field - Area 11 Radchem and small shot area	Yes	MDA	1144
1102	49-004		Burn site and landfill - Area 6	Yes	MDA	1144
1103	49-005(a)		Landfill - east of Area 10	Yes	MDA	1144
1104	49-005(b)		Landfill - Area 5	No	MDA	1144
1105	49-006		Sump - Area 5	Yes	MDA	1144
1106	49-007(a)		Septic system - Area 6	No	MDA	1144
1107	49-007(b)		Septic system - HDT area	No	MDA	1144
1108	49-008(a)		Soil contamination - Area 5	No	MDA	1144
1109	49-008(b)		Soil contamination - Area 6	No	MDA	1144
1110	49-008(c)		Soil contamination - Area 11	No	MDA	1144
1111	49-008(d)		Firing sites (bottle house area) - soil contamination and underground chamber (inactive)	No	MDA	1144
1112	49-009		Aboveground tank (former location)	No	MDA	1144
1113	50-001(a)		Waste treatment facility - RCRA unit	Yes	MDA	1147
1114	50-001(b)		Waste lines and manholes	No	MDA	1147
1115	50-002(a)		Underground tanks	Yes	MDA	1147
1116	50-002(b)		Underground tank	Yes	MDA	1147
1117	50-002(c)		Underground tank	Yes	MDA	1147
1118	50-002(d)		Underground tank	No	MDA	1147

Table B-1 (continued)

	Unit No.	Consolidated PRSs[a]	Unit Description	HSWA SWMU[b]	Focus Area	Former OU[c]
1119	50-003(a)		Storage area	No	MDA	1147
1120	50-004(a)		Waste lines	Yes	MDA	1147
1121	50-004(b)		Underground tanks	Yes	MDA	1147
1122	50-004(c)		Waste lines	Yes	MDA	1147
1123	50-006(a)		Operational release	Yes	MDA	1147
1124	50-006(c)		Operational release	Yes	MDA	1147
1125	50-006(d)		Effluent discharge	Yes	MDA	1147
1126	50-007		Incinerator	No	MDA	1147
1127	50-008		Reduction site	No	MDA	1147
1128	50-009		Material disposal area (MDA C)	Yes	MDA	1147
1129	50-010		Decontamination facility	No	MDA	1147
1130	50-011(a)		Septic system	Yes	MDA	1147
1131	50-011(b)		Septic system	No	MDA	1147
1132	C-50-001		Transformer	No	MDA	1147
1133	51-001		Septic system	No	MDA	1148
1134	52-001(d)		UHTREX equipment	Yes	RCRA CA - Industrial	1129
1135	52-002(a)		Septic system	Yes	RCRA CA - Industrial	1129
1136	52-003(a)		Waste treatment facility	No	RCRA CA - Industrial	1129
1137	53-001(a)		Storage area - PCB only site	Yes	RCRA CA - Industrial	1100
1138	53-001(b)		Storage area	Yes	RCRA CA - Industrial	1100
1139	53-001(c)		Storage area	No	RCRA CA - Industrial	1100
1140	53-001(e)		Storage area	No	RCRA CA - Industrial	1100
1141	53-001(g)		Storage area	No	RCRA CA - Industrial	1100
1142	53-002(a)-99	53-002(a)	Surface impoundments	Yes	RCRA CA - Industrial	1100
		53-002(b)				
1143	53-004		Operational facility	No	RCRA CA - Industrial	1100
1144	53-005		Disposal pit	Yes	RCRA CA - Industrial	1100
1145	53-006(b)-99	53-006(a)	Tanks/sumps/outfalls	Yes	RCRA CA - Industrial	1100
		53-006(b)				
		53-006(c)				
1146	53-006(d)-99	53-006(d)	Tanks/sumps/outfalls	Yes	RCRA CA - Industrial	1100
		53-006(e)				
1147	53-006(f)		Underground tank	Yes	RCRA CA - Industrial	1100
1148	53-007(a)		Aboveground neutralizer tank	Yes	RCRA CA - Industrial	1100
1149	53-008		Storage area - boneyard	No	RCRA CA - Industrial	1100
1150	53-009		Aboveground tanks (3)	No	RCRA CA - Industrial	1100
1151	53-010		Container storage	No	RCRA CA - Industrial	1100
1152	53-012(a)		Outfall	No	RCRA CA - Industrial	1100
1153	53-012(b)		Outfall	No	RCRA CA - Industrial	1100

Table B-1 (continued)

	Unit No.	Consolidated PRSs[a]	Unit Description	HSWA SWMU[b]	Focus Area	Former OU[c]
1154	53-012(c)		Outfall	No	RCRA CA - Industrial	1100
1155	53-012(d)		Outfall	No	RCRA CA - Industrial	1100
1156	53-012(e)		Outfall	No	RCRA CA - Industrial	1100
1157	53-012(f)		Outfall	No	RCRA CA - Industrial	1100
1158	53-012(g)		Outfall	No	RCRA CA - Industrial	1100
1159	53-012(h)		Outfall	No	RCRA CA - Industrial	1100
1160	53-013		Soil contamination - lead storage site I	No	RCRA CA - Industrial	1100
1161	53-014		Soil contamination - lead storage site II	No	RCRA CA - Industrial	1100
1162	54-001(a)		Storage area	Yes	MDA	1148
1163	54-001(b)		Storage area	No	MDA	1148
1164	54-001(d)		Storage area	No	MDA	1148
1165	54-001(e)		Storage area	No	MDA	1148
1166	54-002		Storage area - gas cylinder storage area	No	MDA	1148
1167	54-004		Material disposal area (MDA H) (except Shaft 9)	Yes	MDA	1148
1168	54-005		Material disposal area (MDA J) (Pits 1-5, Shafts 1–4)	Yes	MDA	1148
1169	54-006		Material disposal area (MDA L) (All subsurface units such as Pit A, SI B,C,D Shafts 1–28, 29–34)	Yes	MDA	1148
1170	54-007(a)		Septic system - tank and seepage trench	Yes	MDA	1148
1171	54-007(b)		Septic system	Yes	MDA	1148
1172	54-007(c)-99	54-007(c)	Tanks/sumps/outfalls	Yes	MDA	1148
		54-007(e)				
1173	54-007(d)		Septic system	No	MDA	1148
1174	54-009		Aboveground tanks (treatment tanks)	No	MDA	1148
1175	54-012(a)		Reduction site (drum compactor)	No	MDA	1148
1176	54-012(b)		Reduction site	Yes	MDA	1148
1177	54-013(b)-99	54-013(b)	MDA G	Yes	MDA	1148
		54-014(b)				
		54-014(c)				
		54-014(d)				
		54-015(k)				
		54-017				
		54-018				
		54-019				
		54-020				
1178	54-014(a)		Material disposal area (MDA L) - storage shafts (Pb stringer shafts)	No	MDA	1148
1179	54-015(a)		Storage area - active surface corrosive inhibitor	No	MDA	1148
1180	54-015(b)		Storage area - TRU surface storage	No	MDA	1148
1181	54-015(c)		Storage area, TRU Pad 1	No	MDA	1148
1182	54-015(d)		Storage area, TRU Pad 2	No	MDA	1148

Table B-1 (continued)

	Unit No.	Consolidated PRSs[a]	Unit Description	HSWA SWMU[b]	Focus Area	Former OU[c]
1183	54-015(e)		Storage area, TRU Pad 3	No	MDA	1148
1184	54-015(f)		Storage area, TRU Pad 4	No	MDA	1148
1185	54-015(h)		Storage area - drums	Yes	MDA	1148
1186	54-015(j)		Storage area - Dome #49 - mixed waste sludge	No	MDA	1148
1187	54-016(b)		Sump	No	MDA	1148
1188	55-008		Sumps and tanks	Yes	RCRA CA - Industrial	1129
1189	55-009		Sumps and tanks	Yes	RCRA CA - Industrial	1129
1190	57-001(b)		Drilling mud pits	No	RCRA CA - Townsite	1154
1191	57-001(c)		Drilling mud pits	No	RCRA CA - Townsite	1154
1192	57-002		Landfill	No	RCRA CA - Townsite	1154
1193	57-003		Storage area	No	RCRA CA - Townsite	1154
1194	57-004(a)		Surface impoundment	No	RCRA CA - Townsite	1154
1195	57-004(b)		Surface impoundment	No	RCRA CA - Townsite	1154
1196	57-006		Drum and contents, Fenton Hill (removed)	No	RCRA CA - Townsite	1154
1197	57-007		Leach Field	No	RCRA CA - Townsite	1154
1198	59-001		Septic system	Yes	RCRA CA - Industrial	1114
1199	59-004		Outfall	No	RCRA CA - Industrial	1114
1200	C-59-001		PCB containing capacitors & transformer	No	RCRA CA - Industrial	1114
1201	60-002		Storage area	Yes	RCRA CA - Industrial	1114
1202	60-004(b)		Storage area	No	RCRA CA - Industrial	1114
1203	60-004(c)		Storage area	No	RCRA CA - Industrial	1114
1204	60-004(d)		Storage area	No	RCRA CA - Industrial	1114
1205	60-004(e)		Storage area	No	RCRA CA - Industrial	1114
1206	60-004(f)		Storage area	No	RCRA CA - Industrial	1114
1207	60-005(a)		Surface impoundment [formerly 3-029(a)]	Yes	RCRA CA - Industrial	1114
1208	60-006(a)		Septic tank	Yes	RCRA CA - Industrial	1114
1209	60-007(a)		Systematic or intent. prod. release	Yes	RCRA CA - Industrial	1114
1210	60-007(b)		Systematic or intent. prod. release	Yes	RCRA CA - Industrial	1114
1211	C-60-001		Underground tank	No	RCRA CA - Industrial	1114
1212	C-60-002		Underground tank	No	RCRA CA - Industrial	1114
1213	C-60-003		One-time spill at pesticide shed	No	RCRA CA - Industrial	1114
1214	C-60-004		Underground tank	No	RCRA CA - Industrial	1114
1215	61-002		Transformer storage area - PCB only site	Yes	RCRA CA - Industrial	1114
1216	61-004(a)		Septic tank	Yes	RCRA CA - Industrial	1114
1217	61-005		Landfill - LA County Municipal	Yes	RCRA CA - Industrial	1114
1218	61-006		Waste oil tank	Yes	RCRA CA - Industrial	1114
1219	61-007		Transformer site - systematic leak (PCB only site)	Yes	RCRA CA - Industrial	1114
1220	C-61-001		Transformer storage area - PCB leak	No	RCRA CA - Industrial	1114
1221	C-61-002		Subsurface contamination (new AOC)	No	RCRA CA - Industrial	1114

Table B-1 (continued)

	Unit No.	Consolidated PRSs[a]	Unit Description	HSWA SWMU[b]	Focus Area	Former OU[c]
1222	63-001(a)		Septic system	Yes	RCRA CA - Industrial	1129
1223	63-001(b)		Septic system	Yes	RCRA CA - Industrial	1129
1224	69-001		Incinerator and assoc. equipment	Yes	RCRA CA - HE Production	1157
1225	72-001		Firing range	No	RCRA CA - Industrial	1100
1226	73-001(a)-99	73-001(a)	MDA	Yes	RCRA CA - Townsite	1071
		73-004(d)				
1227	73-001(b)-99	73-001(b)	MDA	Yes	RCRA CA - Townsite	1071
		73-001(c)				
		73-001(d)				
1228	73-002-99	73-002	Incinerator surface disposal	Yes	RCRA CA - Townsite	1071
		73-003				
		73-004(a)				
		73-004(b)				
		73-006				
1229	73-004(c)		Septic tank	Yes	RCRA CA - Townsite	1071
1230	73-005-99	73-005	Miscellaneous	Yes	RCRA CA - Townsite	1071
		73-007				
		C-73-005(a)				
		C-73-005(b)				
		C-73-005(c)				
		C-73-005(d)				
		C-73-005(e)				
		C-73-005(f)				
1231	C-73-001		Underground tank	No	RCRA CA - Townsite	1071
1232	C-73-002		Underground tank	No	RCRA CA - Townsite	1071
1233	C-73-003		Underground tank	No	RCRA CA - Townsite	1071
1234	C-73-004		Underground tank	No	RCRA CA - Townsite	1071

[a] PRS = potential release site.
[b] HSWA SWMU = Hazardous and Solid Waste Amendment solid waste management unit.
[c] OU = operable unit.
[d] RCRA CA = Resource Conservation and Recovery Act Corrective Action (Focus Area).
[e] MDA = material disposal area.

Table B-2
Los Alamos Environmental Restoration Project Potential Release Sites
Investigation Complete and Removed from Project (sorted by PRS Number)

	PRS[a] Number	Description	HSWA SWMU[b]	Focus Area	OU[c]
1	00-005	Landfill	Yes - Removed	RCRA CA[d] - Townsite	1071
2	00-008	Surface disposal site	No	RCRA CA - Townsite	1071
3	00-010(a)	Surface disposal site	No	RCRA CA - Townsite	1071
4	00-015	Firing range, Rendija Canyon (active)	No	RCRA CA - Townsite	1071
5	00-024	Cistern (never located)	No	RCRA CA - Townsite	1071
6	00-025	Landfill	No	RCRA CA - Townsite	1071
7	00-026	Landfill	No	RCRA CA - Townsite	1071
8	00-035(a)	Surface disposal	No	RCRA CA - Townsite	1071
9	00-040	Underground tank (new AOC)	No	RCRA CA - Townsite	1071
10	01-001(h)	Septic tank 142	Yes - Removed	RCRA CA - Townsite	1078
11	01-001(I)	Septic tank 143	Yes - Removed	RCRA CA - Townsite	1078
12	01-001(j)	Septic tank 149	Yes - Removed	RCRA CA - Townsite	1078
13	01-001(k)	Septic tank 268	Yes - Removed	RCRA CA - Townsite	1078
14	01-001(l)	Septic tank 269	Yes - Removed	RCRA CA - Townsite	1078
15	01-001(n)	Septic tank 276	Yes - Removed	RCRA CA - Townsite	1078
16	01-001(p)	Septic system	No	RCRA CA - Townsite	1078
17	01-001(q)	Septic system	No	RCRA CA - Townsite	1078
18	01-001(r)	Septic system	No	RCRA CA - Townsite	1078
19	01-001(v)	Septic system	No	RCRA CA - Townsite	1078
20	01-001(w)	Septic system	No	RCRA CA - Townsite	1078
21	01-006(f)	Drainlines and outfall	No	RCRA CA - Townsite	1078
22	01-006(I)	Drainlines and outfall	No	RCRA CA - Townsite	1078
23	01-006(j)	Drainlines and outfall	No	RCRA CA - Townsite	1078
24	01-006(k)	Drainlines and outfall	No	RCRA CA - Townsite	1078
25	01-006(l)	Drainlines and outfall	No	RCRA CA - Townsite	1078
26	01-006(m)	Drainlines and outfall	No	RCRA CA - Townsite	1078
27	01-006(q)	Drainlines and outfall	No	RCRA CA - Townsite	1078
28	01-006(r)	Drainlines and outfall	No	RCRA CA - Townsite	1078
29	01-006(s)	Drainlines and outfall	No	RCRA CA - Townsite	1078
30	01-006(t)	Drainlines and outfall	No	RCRA CA - Townsite	1078
31	01-007(g)	Soil contamination area	No	RCRA CA - Townsite	1078
32	01-007(n)	Soil contamination area	No	RCRA CA - Townsite	1078
33	01-007(p)	Soil contamination area	No	RCRA CA - Townsite	1078
34	02-001	Open burning ground (does not exist)	No	Canyon	1098
35	02-002	Storage area	No	Canyon	1098
36	02-013	Storage area SAA	No	Canyon	1098
37	03-001(a)	<90 day storage	Yes - Removed	RCRA CA - Industrial	1114

Table B-2 (continued)

	PRS[a] Number	Description	HSWA SWMU[b]	Focus Area	OU[c]
38	03-001(b)	Satellite accumulation area	Yes - Removed	RCRA CA - Industrial	1114
39	03-001(c)	<90 day storage	Yes - Removed	RCRA CA - Industrial	1114
40	03-001(m)	Satellite accumulation area	No	RCRA CA - Industrial	1114
41	03-001(p)	Satellite accumulation area	No	RCRA CA - Industrial	1114
42	03-001(r)	Satellite accumulation area	No	RCRA CA - Industrial	1114
43	03-002(b)	Storage area	Yes - Removed	RCRA CA - Industrial	1114
44	03-009(b)	Surface disposal	Yes - Removed	RCRA CA - Industrial	1114
45	03-009(e)	Surface disposal	Yes - Removed	RCRA CA - Industrial	1114
46	03-009(f)	Surface disposal - landfill	Yes - Removed	RCRA CA - Industrial	1114
47	03-009(h)	Surface disposal	Yes - Removed	RCRA CA - Industrial	1114
48	03-010(b)	Operational release	No	RCRA CA - Industrial	1114
49	03-010(c)	Operational release	No	RCRA CA - Industrial	1114
50	03-010(d)	Operational release	No	RCRA CA - Industrial	1114
51	03-012(a)	One-time spill	Yes - Removed	RCRA CA - Industrial	1114
52	03-013(c)	Operational release	No	RCRA CA - Industrial	1114
53	03-013(d)	Operational release	No	RCRA CA - Industrial	1114
54	03-013(e)	Operational release	No	RCRA CA - Industrial	1114
55	03-013(f)	Operational release	No	RCRA CA - Industrial	1114
56	03-013(g)	Operational release	No	RCRA CA - Industrial	1114
57	03-013(h)	Operational release	No	RCRA CA - Industrial	1114
58	03-018	Septic system	Yes - Removed	RCRA CA - Industrial	1114
59	03-020(a)	Disposal pit	Yes - Removed	RCRA CA - Industrial	1114
60	03-020(b)	Surface disposal site	No	RCRA CA - Industrial	1114
61	03-024	Tank and/or assoc. equipment	Yes - Removed	RCRA CA - Industrial	1114
62	03-035(a)	Underground tank	Yes - Removed	RCRA CA - Industrial	1114
63	03-035(b)	Underground storage tank	Yes - Removed	RCRA CA - Industrial	1114
64	03-039(a)	Silver recovery unit	Yes - Removed	RCRA CA - Industrial	1114
65	03-039(b)	Silver recovery unit	No	RCRA CA - Industrial	1114
66	03-039(c)	Silver recovery unit	No	RCRA CA - Industrial	1114
67	03-039(d)	Silver recovery unit	No	RCRA CA - Industrial	1114
68	03-039(e)	Silver recovery unit	No	RCRA CA - Industrial	1114
69	03-044(b)	Container storage	No	RCRA CA - Industrial	1114
70	03-045(d)	Aboveground storage tank - ind. or san. wastewater treatment	Yes - Removed	RCRA CA - Industrial	1114
71	03-055(b)	Outfall	No	RCRA CA - Industrial	1114
72	C-04-001	Former building location	No	RCRA CA - Industrial	1129
73	05-006(a)	Former building location	No	RCRA CA - Industrial	1129
74	05-006(d)	Former building location	No	RCRA CA - Industrial	1129
75	05-006(f)	Former building location	No	RCRA CA - Industrial	1129

Table B-2 (continued)

	PRS[a] Number	Description	HSWA SWMU[b]	Focus Area	OU[c]
76	05-006(g)	Former building location	No	RCRA CA - Industrial	1129
77	C-05-001	Former building location	No	RCRA CA - Industrial	1129
78	06-003(b)	Firing site (inactive)	No	RCRA CA - HE Production	1111
79	06-004	Sump	No	RCRA CA - HE Production	1111
80	C-06-020	Building TA-6-19 - former rest house	No	RCRA CA - HE Production	1111
81	07-003(c)	Never existed	Yes - Removed	RCRA CA - HE Production	1111
82	07-003(d)	Never existed	Yes - Removed	RCRA CA - HE Production	1111
83	08-003(b)	Septic system	Yes - Removed	RCRA CA - HE Production	1157
84	08-003(c)	Septic system	Yes - Removed	RCRA CA - HE Production	1157
85	08-006(b)	Landfill [duplicate of 8-006(a)] (MDA Q)	Yes - Removed	RCRA CA - HE Production	1157
86	08-007	Silver recovery unit	Yes - Removed	RCRA CA - HE Production	1157
87	08-008(a)	Storage area	No	RCRA CA - HE Production	1157
88	08-008(b)	Storage area	No	RCRA CA - HE Production	1157
89	08-008(c)	Storage area	No	RCRA CA - HE Production	1157
90	08-008(d)	Storage area	No	RCRA CA - HE Production	1157
91	08-009(b)	Ind. or san. wastewater treatment	No	RCRA CA - HE Production	1157
92	08-010(a)	Storage area	No	RCRA CA - HE Production	1157
93	08-010(b)	Storage area	No	RCRA CA - HE Production	1157
94	08-010(c)	Storage area	No	RCRA CA - HE Production	1157
95	08-011(a)	Underground tank	No	RCRA CA - HE Production	1157
96	08-011(b)	Underground tank	No	RCRA CA - HE Production	1157
97	C-08-001	Building	No	RCRA CA - HE Production	1157
98	C-08-002	Building	No	RCRA CA - HE Production	1157
99	C-08-003	Building	No	RCRA CA - HE Production	1157
100	C-08-004	Building	No	RCRA CA - HE Production	1157
101	C-08-005	Building	No	RCRA CA - HE Production	1157
102	C-08-006	Building	No	RCRA CA - HE Production	1157
103	C-08-007	Building	No	RCRA CA - HE Production	1157
104	C-08-008	Building	No	RCRA CA - HE Production	1157
105	C-08-009	Building	No	RCRA CA - HE Production	1157
106	C-08-011	Building	No	RCRA CA - HE Production	1157
107	C-08-012	Building	No	RCRA CA - HE Production	1157
108	C-08-013	Building	No	RCRA CA - HE Production	1157
109	C-08-015	Building	No	RCRA CA - HE Production	1157
110	C-08-016	Building	No	RCRA CA - HE Production	1157
111	C-08-017	Storage area	No	RCRA CA - HE Production	1157
112	C-08-018	Storage area	No	RCRA CA - HE Production	1157
113	C-08-019	Storage area	No	RCRA CA - HE Production	1157
114	C-08-020	Disposal area	No	RCRA CA - HE Production	1157

Table B-2 (continued)

	PRS[a] Number	Description	HSWA SWMU[b]	Focus Area	OU[c]
115	09-003(c)	Electric manhole	Yes - Removed	RCRA CA - HE Production	1157
116	09-003(f)	Settling tank	Yes - Removed	RCRA CA - HE Production	1157
117	09-005(b)	Septic system	Yes - Removed	RCRA CA - HE Production	1157
118	09-005(c)	Septic system	Yes - Removed	RCRA CA - HE Production	1157
119	09-005(e)	Septic system	Yes - Removed	RCRA CA - HE Production	1157
120	09-005(f)	Septic system	Yes - Removed	RCRA CA - HE Production	1157
121	09-005(h)	Septic system	Yes - Removed	RCRA CA - HE Production	1157
122	09-007	Basket pit	Yes - Removed	RCRA CA - HE Production	1157
123	09-008(a)	Surface impoundment	No	RCRA CA - HE Production	1157
124	09-010(c)	Storage area	No	RCRA CA - HE Production	1157
125	09-011(a)	Storage area	No	RCRA CA - HE Production	1157
126	09-015	Manhole	No	RCRA CA - HE Production	1157
127	09-016	Underground tank	No	RCRA CA - HE Production	1157
128	C-09-002	Buildings	No	RCRA CA - HE Production	1157
129	C-09-003	Buildings	No	RCRA CA - HE Production	1157
130	C-09-004	Building	No	RCRA CA - HE Production	1157
131	C-09-006	Buildings	No	RCRA CA - HE Production	1157
132	C-09-007	Building	No	RCRA CA - HE Production	1157
133	C-09-008	Underground tank	No	RCRA CA - HE Production	1157
134	C-09-009	Non-intentional release	No	RCRA CA - HE Production	1157
135	C-09-010	Burn site (does not exist)	No	RCRA CA - HE Production	1157
136	C-09-011	Burn site	No	RCRA CA - HE Production	1157
137	10-001(e)	Detonation test area (does not exist)	No	RCRA CA - Townsite	1079
138	11-003(a)	Mortar impact area	No	RCRA CA - HE Production	1082
139	11-007	Surface disposal - landfill	Yes - Removed	RCRA CA - HE Production	1082
140	11-008	Surface disposal	No	RCRA CA - HE Production	1082
141	11-010(a)	Container storage area	No	RCRA CA - HE Production	1082
142	11-010(b)	Container storage	No	RCRA CA - HE Production	1082
143	C-11-003	One-time release site (never located)	No	RCRA CA - HE Production	1082
144	12-003	Storage area	No	RCRA CA - Firing Sites	1085
145	C-12-006	Pole [duplicate of 12-004(a)]	No	RCRA CA - Firing Sites	1085
146	14-004(a)	Storage area (still active)	No	RCRA CA - Firing Sites	1085
147	14-004(b)	Storage area	Yes - Removed	RCRA CA - Firing Sites	1085
148	14-004(c)	Storage area	No	RCRA CA - Firing Sites	1085
149	14-008	Landfill and surface disposal	No	RCRA CA - Firing Sites	1085
150	15-004(e)	Mistakenly called firing site (actually manhole bunker)	No	RCRA CA - Firing Sites	1086
151	15-005(a)	Storage area	No	RCRA CA - Firing Sites	1086
152	15-005(d)	Storage area	No	RCRA CA - Firing Sites	1086

Table B-2 (continued)

	PRS[a] Number	Description	HSWA SWMU[b]	Focus Area	OU[c]
153	15-008(e)	Surface disposal	No	RCRA CA - Firing Sites	1086
154	15-009(d)	Septic tank	No	RCRA CA - Firing Sites	1086
155	15-013(a)	Underground tank	No	RCRA CA - Firing Sites	1086
156	15-013(b)	Underground tank	No	RCRA CA - Firing Sites	1086
157	15-014(c)	Ind. or san. wastewater treatment	No	RCRA CA - Firing Sites	1086
158	15-014(f)	Ind. or san. wastewater treatment	No	RCRA CA - Firing Sites	1086
159	15-014(m)	Outfall (still active)	Yes - Removed	RCRA CA - Firing Sites	1086
160	C-15-002	Surface disposal	No	RCRA CA - Firing Sites	1086
161	C-15-003	Surface disposal	No	RCRA CA - Firing Sites	1086
162	C-15-008	Non-intentional release	No	RCRA CA - Firing Sites	1086
163	C-15-009	Underground tank	No	RCRA CA - Firing Sites	1086
164	C-15-012	Underground tank (still active)	No	RCRA CA - Firing Sites	1086
165	C-15-013	Underground tank	No	RCRA CA - Firing Sites	1086
166	16-005(f)	Decommissioned septic system	Yes - Removed	RCRA CA - HE Production	1082
167	16-005(i)	Septic tank [duplicate of 13-003(a)]	Yes - Removed	RCRA CA - HE Production	1082
168	16-005(o)	Septic system	Yes - Removed	RCRA CA - HE Production	1082
169	16-006(b)	Septic system	Yes - Removed	RCRA CA - HE Production	1082
170	16-006(f)	Septic system	Yes - Removed	RCRA CA - HE Production	1082
171	16-006(i)	Septic system	Yes - Removed	RCRA CA - HE Production	1082
172	16-007(b)	Surface disposal site (does not exist)	No	RCRA CA - HE Production	1082
173	16-008(b)	Surface impoundment	No	RCRA CA - HE Production	1082
174	16-010(g)	Wastewater treatment facility	Yes - Removed	RCRA CA - HE Production	1082
175	16-012(a)	Container storage - rest house	Yes - Removed	RCRA CA - HE Production	1082
176	16-012(a2)	Container storage	No	RCRA CA - HE Production	1082
177	16-012(b)	Container storage - rest house	Yes - Removed	RCRA CA - HE Production	1082
178	16-012(c)	Container storage - rest house	Yes - Removed	RCRA CA - HE Production	1082
179	16-012(d)	Satellite accumulation area	Yes - Removed	RCRA CA - HE Production	1082
180	16-012(e)	Container storage - rest house	Yes - Removed	RCRA CA - HE Production	1082
181	16-012(f)	Container storage - rest house	Yes - Removed	RCRA CA - HE Production	1082
182	16-012(g)	Container storage - rest house	Yes - Removed	RCRA CA - HE Production	1082
183	16-012(h)	Container storage - rest house	Yes - Removed	RCRA CA - HE Production	1082
184	16-012(i)	Satellite accumulation area	Yes - Removed	RCRA CA - HE Production	1082
185	16-012(j)	Satellite accumulation area	Yes - Removed	RCRA CA - HE Production	1082
186	16-012(k)	Container storage - rest house	Yes - Removed	RCRA CA - HE Production	1082
187	16-012(l)	Satellite accumulation area	Yes - Removed	RCRA CA - HE Production	1082
188	16-012(m)	Satellite accumulation area	Yes - Removed	RCRA CA - HE Production	1082
189	16-012(n)	Satellite accumulation area	Yes - Removed	RCRA CA - HE Production	1082
190	16-012(o)	Container storage - rest house	Yes - Removed	RCRA CA - HE Production	1082
191	16-012(p)	Container storage	Yes - Removed	RCRA CA - HE Production	1082

Table B-2 (continued)

	PRS[a] Number	Description	HSWA SWMU[b]	Focus Area	OU[c]
192	16-012(q)	Container storage - rest house	Yes - Removed	RCRA CA - HE Production	1082
193	16-012(r)	Container storage - rest house	Yes - Removed	RCRA CA - HE Production	1082
194	16-012(s)	Container storage - rest house	Yes - Removed	RCRA CA - HE Production	1082
195	16-012(t)	Satellite accumulation area	Yes - Removed	RCRA CA - HE Production	1082
196	16-012(u)	Satellite accumulation area	Yes - Removed	RCRA CA - HE Production	1082
197	16-012(v)	Container storage - rest house	Yes - Removed	RCRA CA - HE Production	1082
198	16-012(w)	Container storage - rest house	Yes - Removed	RCRA CA - HE Production	1082
199	16-012(x)	Satellite accumulation area	Yes - Removed	RCRA CA - HE Production	1082
200	16-012(y)	Container storage - rest house	Yes - Removed	RCRA CA - HE Production	1082
201	16-012(z)	Container storage - rest house	Yes - Removed	RCRA CA - HE Production	1082
202	16-023(a)	Incinerator (does not exist)	No	RCRA CA - HE Production	1082
203	16-025(c)	Abandoned HE building & appurtenances	Yes - Removed	RCRA CA - HE Production	1082
204	16-025(g2)	Magazine	Yes - Removed	RCRA CA - HE Production	1082
205	16-026(i2)	Outfall (inactive)	Yes - Removed	RCRA CA - HE Production	1082
206	16-031(g)	Cooling tower outfall (inactive)	Yes - Removed	RCRA CA - HE Production	1082
207	16-032(b)	Decommissioned HE sump	No	RCRA CA - HE Production	1082
208	16-032(d)	Decommissioned HE sump	Yes - Removed	RCRA CA - HE Production	1082
209	16-032(e)	Decommissioned HE sump	Yes - Removed	RCRA CA - HE Production	1082
210	16-034(g)	Soil contamination	Yes - Removed	RCRA CA - HE Production	1082
211	C-16-003	septic system [see 16-005(n)]	No	RCRA CA - HE Production	1082
212	C-16-004	Building	No	RCRA CA - HE Production	1082
213	C-16-007	Tank stand	No	RCRA CA - HE Production	1082
214	C-16-021	Building	No	RCRA CA - HE Production	1082
215	C-16-022	Building	No	RCRA CA - HE Production	1082
216	C-16-023	Warehouse	No	RCRA CA - HE Production	1082
217	C-16-024	Building	No	RCRA CA - HE Production	1082
218	C-16-027	Building	No	RCRA CA - HE Production	1082
219	C-16-029	Building	No	RCRA CA - HE Production	1082
220	C-16-032	Building	No	RCRA CA - HE Production	1082
221	C-16-033	Warehouse	No	RCRA CA - HE Production	1082
222	C-16-037	Storage area	No	RCRA CA - HE Production	1082
223	C-16-038	Storage area	No	RCRA CA - HE Production	1082
224	C-16-039	Building	No	RCRA CA - HE Production	1082
225	C-16-040	Building	No	RCRA CA - HE Production	1082
226	C-16-042	Steam manhole	No	RCRA CA - HE Production	1082
227	C-16-043	Steam manhole	No	RCRA CA - HE Production	1082
228	C-16-045	Manhole	No	RCRA CA - HE Production	1082
229	C-16-048	Steam manhole	No	RCRA CA - HE Production	1082

Table B-2 (continued)

	PRS[a] Number	Description	HSWA SWMU[b]	Focus Area	OU[c]
230	C-16-052	Steam manhole	No	RCRA CA - HE Production	1082
231	C-16-053	Water manhole	No	RCRA CA - HE Production	1082
232	C-16-054	Steam manhole	No	RCRA CA - HE Production	1082
233	C-16-055	Switch box	No	RCRA CA - HE Production	1082
234	C-16-056	Steam manhole	No	RCRA CA - HE Production	1082
235	C-16-057	Steam manhole	No	RCRA CA - HE Production	1082
236	C-16-059	Electrical pit	No	RCRA CA - HE Production	1082
237	C-16-066	Storage area	No	RCRA CA - HE Production	1082
238	18-005(b)	Storage area	No	Canyon	1093
239	18-005(c)	Storage area	No	Canyon	1093
240	18-009(a)	Transformer	No	Canyon	1093
241	18-009(c)	Transformer	No	Canyon	1093
242	18-009(d)	Transformer	No	Canyon	1093
243	18-009(e)	Transformer	No	Canyon	1093
244	18-010(a)	Outfall	No	Canyon	1093
245	18-012(d)	Drainline	No	Canyon	1093
246	C-18-001	Laboratory	No	Canyon	1093
247	C-18-002	Building	No	Canyon	1093
248	C-18-003	Storage area	No	Canyon	1093
249	20-003(d)	Firing site	No	RCRA CA - Industrial	1100
250	C-20-001	Storage building	No	RCRA CA - Industrial	1100
251	21-008	Incinerator	No	MDA[e]	1106
252	21-012(a)	Dry well	Yes - Removed	MDA	1106
253	21-024(m)	Drainline	Yes - Removed	MDA	1106
254	21-025(a)	Operational facility	No	MDA	1106
255	21-025(b)	Operational facility	No	MDA	1106
256	21-027(b)	Outfalls	Yes - Removed	MDA	1106
257	21-028(b)	Container storage	No	MDA	1106
258	21-028(e)	Container storage	No	MDA	1106
259	C-21-002	Non-intentional release area	No	MDA	1106
260	C-21-003	Non-intentional release area	No	MDA	1106
261	C-21-004	Non-intentional release area	No	MDA	1106
262	C-21-008	One-time spill	No	MDA	1106
263	C-21-010	Systematic leak	No	MDA	1106
264	C-21-011	One-time spill	No	MDA	1106
265	C-21-013	Disposal pit	No	MDA	1106
266	C-21-014	Warehouse	No	MDA	1106
267	C-21-015	Building	No	MDA	1106
268	C-21-016	Storage area	No	MDA	1106

Table B-2 (continued)

	PRS[a] Number	Description	HSWA SWMU[b]	Focus Area	OU[c]
269	C-21-017	Storage area	No	MDA	1106
270	C-21-018	Storage area	No	MDA	1106
271	C-21-019	Storage area	No	MDA	1106
272	C-21-020	Storage area	No	MDA	1106
273	C-21-021	Storage area	No	MDA	1106
274	C-21-022	Laboratory	No	MDA	1106
275	C-21-023	Laboratory	No	MDA	1106
276	C-21-024	Warehouse	No	MDA	1106
277	C-21-025	Building	No	MDA	1106
278	C-21-026	Building	No	MDA	1106
279	C-21-029	Aboveground tank	No	MDA	1106
280	C-21-030	Aboveground tank	No	MDA	1106
281	22-001	Building	No	RCRA CA - HE Production	1111
282	22-003(a)	Satellite accumulation area	No	RCRA CA - HE Production	1111
283	22-003(b)	Satellite accumulation area	No	RCRA CA - HE Production	1111
284	22-003(c)	Satellite accumulation area	No	RCRA CA - HE Production	1111
285	22-003(d)	Satellite accumulation area	No	RCRA CA - HE Production	1111
286	22-003(e)	Satellite accumulation area	No	RCRA CA - HE Production	1111
287	22-003(f)	Satellite accumulation area	No	RCRA CA - HE Production	1111
288	22-003(g)	Satellite accumulation area	No	RCRA CA - HE Production	1111
289	22-013	Liquid waste treatment/storage	No	RCRA CA - HE Production	1111
290	22-014(c)	Unit does not exist	No	RCRA CA - HE Production	1111
291	25-001	Pit	No	RCRA CA - HE Production	1082
292	C-25-001	Building	No	RCRA CA - HE Production	1082
293	27-004	Building	No	Canyon	1093
294	30-001	Surface disposal and landfill	No	RCRA CA - Industrial	1114
295	C-31-001	Buildings	No	RCRA CA - Townsite	1079
296	C-32-001	Buildings	No	RCRA CA - Townsite	1079
297	33-004(e)	Seepage pit	Yes - Removed	RCRA CA - Firing Sites	1122
298	33-004(f)	Septic system	Yes - Removed	RCRA CA - Firing Sites	1122
299	33-004(l)	Outfall	No	RCRA CA - Firing Sites	1122
300	33-004(n)	Septic system	No	RCRA CA - Firing Sites	1122
301	33-010(e)	Surface disposal (Area 6)	No	RCRA CA - Firing Sites	1122
302	33-012(b)	Satellite accumulation area	No	RCRA CA - Firing Sites	1122
303	33-012(c)	Satellite accumulation area	No	RCRA CA - Firing Sites	1122
304	33-012(d)	Satellite accumulation area	No	RCRA CA - Firing Sites	1122
305	35-001	Material disposal area (MDA W)	No	RCRA CA - Industrial	1129
306	35-003(i)	Wastewater treatment facility storage tanks	Yes - Removed	RCRA CA - Industrial	1129

Table B-2 (continued)

	PRS[a] Number	Description	HSWA SWMU[b]	Focus Area	OU[c]
307	35-004(c)	Storage areas	No	RCRA CA - Industrial	1129
308	35-004(d)	Container storage area	No	RCRA CA - Industrial	1129
309	35-004(f)	Container storage area	No	RCRA CA - Industrial	1129
310	35-004(i)	Container storage area	No	RCRA CA - Industrial	1129
311	35-004(j)	Container storage area	No	RCRA CA - Industrial	1129
312	35-004(k)	Container storage area	No	RCRA CA - Industrial	1129
313	35-004(l)	Container storage area	No	RCRA CA - Industrial	1129
314	35-004(n)	Container storage area	No	RCRA CA - Industrial	1129
315	35-004(o)	Container storage area	No	RCRA CA - Industrial	1129
316	35-005(a)	Surface impoundment (closure) Bldg. 85 (duplicate of 35-006)	No	RCRA CA - Industrial	1129
317	35-005(b)	Surface impoundment (closure) Bldg. 125	No	RCRA CA - Industrial	1129
318	35-007	Waste oil treatment	No	RCRA CA - Industrial	1129
319	35-011(b)	Underground storage tank	No	RCRA CA - Industrial	1129
320	35-011(c)	Underground storage tank	No	RCRA CA - Industrial	1129
321	35-011(d)	Underground storage tank	No	RCRA CA - Industrial	1129
322	35-012(a)	Underground storage tank	No	RCRA CA - Industrial	1129
323	35-012(b)	Underground storage tank (inactive)	No	RCRA CA - Industrial	1129
324	35-014(c)	Operational release	No	RCRA CA - Industrial	1129
325	35-017	Soil contamination from reactor	No	RCRA CA - Industrial	1129
326	35-018(b)	Former transformer site	No	RCRA CA - Industrial	1129
327	C-35-001	Former UST site	No	RCRA CA - Industrial	1129
328	C-35-002	Former UST site	No	RCRA CA - Industrial	1129
329	C-35-003	Former UST site	No	RCRA CA - Industrial	1129
330	C-35-004	Operational release	No	RCRA CA - Industrial	1129
331	C-35-005	Operational release	No	RCRA CA - Industrial	1129
332	C-35-006	Operational release	No	RCRA CA - Industrial	1129
333	C-35-008	Leaking transformer	No	RCRA CA - Industrial	1129
334	36-003(c)	Septic system	Yes - Removed	RCRA CA - Firing Sites	1130
335	36-003(d)	Septic system	No	RCRA CA - Firing Sites	1130
336	36-004(f)	Firing site (active)	No	RCRA CA - Firing Sites	1130
337	36-007(a)	Storage area	No	RCRA CA - Firing Sites	1130
338	36-007(b)	Storage area	No	RCRA CA - Firing Sites	1130
339	36-007(c)	Storage area	No	RCRA CA - Firing Sites	1130
340	36-007(d)	Storage area	No	RCRA CA - Firing Sites	1130
341	36-007(e)	Storage area	No	RCRA CA - Firing Sites	1130
342	36-007(f)	Storage area	No	RCRA CA - Firing Sites	1130
343	C-36-002	Surface disposal	No	RCRA CA - Firing Sites	1130

Table B-2 (continued)

	PRS[a] Number	Description	HSWA SWMU[b]	Focus Area	OU[c]
344	37-001	Septic system	No	RCRA CA - HE Production	1082
345	39-002(g)	Storage area (still active)	No	RCRA CA - Firing Sites	1132
346	39-003	Incinerator	Yes - Removed	RCRA CA - Firing Sites	1132
347	39-006(b)	Septic system	Yes - Removed	RCRA CA - Firing Sites	1132
348	39-007(b)	Storage area	No	RCRA CA - Firing Sites	1132
349	39-007(c)	Storage area	No	RCRA CA - Firing Sites	1132
350	39-007(e)	Storage area	No	RCRA CA - Firing Sites	1132
351	39-009	Outfall	No	RCRA CA - Firing Sites	1132
352	40-001(a)	Septic system	Yes - Removed	RCRA CA - HE Production	1111
353	40-002(a)	Container storage area SAA located inside building TA-40-23	No	RCRA CA - HE Production	1111
354	40-002(b)	Container storage area SAA located inside building TA-40-23	No	RCRA CA - HE Production	1111
355	40-002(c)	Container storage area SAA located inside building TA-40-05	No	RCRA CA - HE Production	1111
356	40-003(b)	Burning area/open detonation (closure)	No	RCRA CA - HE Production	1111
357	40-008	HE storage area (decommissioned)	No	RCRA CA - HE Production	1111
358	C-40-001	Usage site	No	RCRA CA - HE Production	1111
359	41-004	Container storage	No	Canyon	1098
360	C-41-001	Sump	No	Canyon	1098
361	C-41-002	Underground tank	No	Canyon	1098
362	C-41-003	Underground tank	No	Canyon	1098
363	C-41-005	Underground tank	No	Canyon	1098
364	42-004	Canyon disposal	No	RCRA CA - Industrial	1129
365	43-001(b1)	Outfall	No	RCRA CA - Townsite	1136
366	43-003	Carcass storage	No	RCRA CA - Townsite	1136
367	43-004	Waste storage	No	RCRA CA - Townsite	1136
368	43-005	Radioactive liquid storage	No	RCRA CA - Townsite	1136
369	46-001	Aboveground tank	No	RCRA CA - Industrial	1140
370	46-004(i)	Outfall	No	RCRA CA - Industrial	1140
371	46-004(j)	Outfall	No	RCRA CA - Industrial	1140
372	46-004(k)	Outfall	No	RCRA CA - Industrial	1140
373	46-004(l)	Outfall	No	RCRA CA - Industrial	1140
374	46-004(n)	Outfall	No	RCRA CA - Industrial	1140
375	46-004(o)	Outfall	No	RCRA CA - Industrial	1140
376	46-006(e)	Surface disposal	No	RCRA CA - Industrial	1140
377	46-008(c)	Storage area (does not exist)	Yes - Removed	RCRA CA - Industrial	1140
378	46-008misc	Storage area (does not exist)	No	RCRA CA - Industrial	1140
379	46-010(a)	Storage area	No	RCRA CA - Industrial	1140
380	46-010(b)	Storage area	No	RCRA CA - Industrial	1140

Table B-2 (continued)

	PRS[a] Number	Description	HSWA SWMU[b]	Focus Area	OU[c]
381	46-010(c)	Storage area	No	RCRA CA - Industrial	1140
382	46-010(e)	Storage area	No	RCRA CA - Industrial	1140
383	46-010(f)	Storage area	No	RCRA CA - Industrial	1140
384	46-010misc	Storage area (does not exist)	No	RCRA CA - Industrial	1140
385	48-002(c)	Container storage area	No	RCRA CA - Industrial	1129
386	48-002(d)	Container storage	No	RCRA CA - Industrial	1129
387	48-004(d)	Sumps and tanks	No	RCRA CA - Industrial	1129
388	48-006	Septic system	No	RCRA CA - Industrial	1129
389	48-007(e)	Outfall	No	RCRA CA - Industrial	1129
390	48-008	Transformer leak	No	RCRA CA - Industrial	1129
391	48-009	Soil contamination	No	RCRA CA - Industrial	1129
392	50-003(b)	Storage area	No	MDA	1147
393	50-003(c)	Storage area	No	MDA	1147
394	50-003(d)	Storage area	No	MDA	1147
395	50-003(e)	Storage area	No	MDA	1147
396	50-005	Waste treatment facility	No	MDA	1147
397	50-006(b)	Operational release	No	MDA	1147
398	50-006(e)	Aboveground tank	No	MDA	1147
399	51-002(a)	Usage site (Environmental Research Caisson)	No	MDA	1148
400	51-002(b)	Usage site (Environmental Research Caisson)	No	MDA	1148
401	C-51-001	Storage area	No	MDA	1148
402	C-51-002	Buildings	No	MDA	1148
403	52-001(a)	UHTREX equipment	Yes - Removed	RCRA CA - Industrial	1129
404	52-001(b)	UHTREX equipment	Yes - Removed	RCRA CA - Industrial	1129
405	52-001(c)	UHTREX equipment	Yes - Removed	RCRA CA - Industrial	1129
406	52-002(b)	Septic system	Yes - Removed	RCRA CA - Industrial	1129
407	52-002(c)	Septic system (does not exist)	Yes - Removed	RCRA CA - Industrial	1129
408	52-002(d)	Septic system (does not exist)	Yes - Removed	RCRA CA - Industrial	1129
409	52-002(e)	Septic system with 63-001(a)	Yes - Removed	RCRA CA - Industrial	1129
410	52-002(f)	Septic system	Yes - Removed	RCRA CA - Industrial	1129
411	52-002(g)	Septic system	No	RCRA CA - Industrial	1129
412	52-003(b)	Industrial waste line	No	RCRA CA - Industrial	1129
413	52-004	Evaporator	No	RCRA CA - Industrial	1129
414	C-52-001	Former transformer site	No	RCRA CA - Industrial	1129
415	C-52-002	Former transformer site	No	RCRA CA - Industrial	1129
416	53-001(d)	Storage area	No	RCRA CA - Industrial	1100
417	53-001(f)	Storage area	No	RCRA CA - Industrial	1100

Table B-2 (continued)

	PRS[a] Number	Description	HSWA SWMU[b]	Focus Area	OU[c]
418	53-001(h)	Storage area	No	RCRA CA - Industrial	1100
419	53-001(i)	Storage area	No	RCRA CA - Industrial	1100
420	53-001(j)	Storage area	No	RCRA CA - Industrial	1100
421	53-001(k)	Storage area	No	RCRA CA - Industrial	1100
422	53-001(l)	Storage area	No	RCRA CA - Industrial	1100
423	53-001(m)	Storage area	No	RCRA CA - Industrial	1100
424	53-001(n)	Storage area	No	RCRA CA - Industrial	1100
425	53-001(o)	Storage area	No	RCRA CA - Industrial	1100
426	53-003	Septic tank	No	RCRA CA - Industrial	1100
427	53-007(b)	Aboveground tanks (2)	Yes - Removed	RCRA CA - Industrial	1100
428	53-011(a)	Transformer	No	RCRA CA - Industrial	1100
429	53-011(b)	Transformer	No	RCRA CA - Industrial	1100
430	53-011(c)	Transformer	No	RCRA CA - Industrial	1100
431	53-011(d)	Transformer	No	RCRA CA - Industrial	1100
432	53-011(e)	Transformer (does not exist)	No	RCRA CA - Industrial	1100
433	C-53-001	Transformer	No	RCRA CA - Industrial	1100
434	C-53-002	Transformer	No	RCRA CA - Industrial	1100
435	C-53-003	Transformer	No	RCRA CA - Industrial	1100
436	C-53-004	Transformer	No	RCRA CA - Industrial	1100
437	C-53-005	Transformer	No	RCRA CA - Industrial	1100
438	C-53-006	Transformer	No	RCRA CA - Industrial	1100
439	C-53-007	Transformer	No	RCRA CA - Industrial	1100
440	C-53-008	Transformer	No	RCRA CA - Industrial	1100
441	C-53-009	Transformer	No	RCRA CA - Industrial	1100
442	C-53-010	Transformer	No	RCRA CA - Industrial	1100
443	C-53-011	Transformer	No	RCRA CA - Industrial	1100
444	C-53-012	Transformer	No	RCRA CA - Industrial	1100
445	C-53-013	Transformer	No	RCRA CA - Industrial	1100
446	C-53-014	Transformer	No	RCRA CA - Industrial	1100
447	C-53-015	Transformer	No	RCRA CA - Industrial	1100
448	C-53-016	Transformer	No	RCRA CA - Industrial	1100
449	C-53-017	One-time spill	No	RCRA CA - Industrial	1100
450	C-53-018	One-time spill	No	RCRA CA - Industrial	1100
451	C-53-019	One-time spill	No	RCRA CA - Industrial	1100
452	54-001(c)	Storage area	Yes - Removed	MDA	1148
453	54-001(f)	Storage area	No	MDA	1148
454	54-008	Underground tank	No	MDA	1148
455	54-010	Underground tank - supply wash-water tank	No	MDA	1148

Table B-2 (continued)

	PRS[a] Number	Description	HSWA SWMU[b]	Focus Area	OU[c]
456	54-013(a)	Decontamination facility (not built)	Yes - Removed	MDA	1148
457	54-015(g)	Storage area - Pb casks near shaft 4	No	MDA	1148
458	54-015(i)	Storage area - forklift battery	No	MDA	1148
459	54-016(a)	Sump	No	MDA	1148
460	54-021	Aboveground oil storage tanks (6)	No	MDA	1148
461	54-022	Transformer spill (PCB)	No	MDA	1148
462	55-001	Cement plant	No	RCRA CA - Industrial	1129
463	55-002(a)	Rad waste storage area	No	RCRA CA - Industrial	1129
464	55-002(b)	Rad waste storage area	No	RCRA CA - Industrial	1129
465	55-002(c)	Container storage area	No	RCRA CA - Industrial	1129
466	55-003	Containment area	No	RCRA CA - Industrial	1129
467	55-004	Evaporator	No	RCRA CA - Industrial	1129
468	55-005	Filtration unit	No	RCRA CA - Industrial	1129
469	55-006	Glass breaker	No	RCRA CA - Industrial	1129
470	55-007	Thermal combustion unit	No	RCRA CA - Industrial	1129
471	55-010	Solvent spills	No	RCRA CA - Industrial	1129
472	55-011(a)	Storm drain	No	RCRA CA - Industrial	1129
473	55-011(b)	Storm drain	No	RCRA CA - Industrial	1129
474	55-011(c)	Storm drain	No	RCRA CA - Industrial	1129
475	55-011(d)	Storm drain	No	RCRA CA - Industrial	1129
476	55-011(e)	Storm drain	No	RCRA CA - Industrial	1129
477	55-012	Container storage area	No	RCRA CA - Industrial	1129
478	55-013(a)	Storage area	No	RCRA CA - Industrial	1129
479	55-013(b)	Storage area	No	RCRA CA - Industrial	1129
480	57-001(a)	Drilling mud pits	No	RCRA CA - Townsite	1154
481	57-005	Pond filtration unit	No	RCRA CA - Townsite	1154
482	59-002	Container storage area	No	RCRA CA - Industrial	1114
483	59-003	Sump	No	RCRA CA - Industrial	1114
484	60-001(a)	Storage area (active)	No	RCRA CA - Industrial	1114
485	60-001(b)	Storage area (active)	No	RCRA CA - Industrial	1114
486	60-001(c)	Storage area (active)	No	RCRA CA - Industrial	1114
487	60-001(d)	Storage area - pesticide shed	No	RCRA CA - Industrial	1114
488	60-003	Oil-water separator	No	RCRA CA - Industrial	1114
489	60-004(a)	Storage area	No	RCRA CA - Industrial	1114
490	60-005(b)	Drilling mud pit	No	RCRA CA - Industrial	1114
491	60-006(b)	Septic system	No	RCRA CA - Industrial	1114
492	60-006(c)	Septic tank	No	RCRA CA - Industrial	1114
493	61-001	Storage area	No	RCRA CA - Industrial	1114
494	61-003	Burn sites	No	RCRA CA - Industrial	1114

Table B-2 (continued)

	PRS[a] Number	Description	HSWA SWMU[b]	Focus Area	OU[c]
495	61-004(b)	Septic tank	No	RCRA CA - Industrial	1114
496	61-004(c)	Septic tank	No	RCRA CA - Industrial	1114
497	63-002	Container storage area	No	RCRA CA - Industrial	1129
498	64-001	Storage area	No	RCRA CA - Industrial	1114
499	69-002(a)	Septic system	No	RCRA CA - HE Production	1157
500	69-002(b)	Septic system	No	RCRA CA - HE Production	1157
501	72-002	Firing site	No	RCRA CA - Industrial	1100
502	72-003(a)	Septic system	No	RCRA CA - Industrial	1100
503	72-003(b)	Septic system	No	RCRA CA - Industrial	1100

[a] PRS = potential release site.

[b] HSWA SWMU = Hazardous and Solid Waste Amendment solid waste management unit.

[c] OU = operable unit.

[d] RCRA CA = Resource Conservation and Recovery Act Corrective Action (Focus Area).

[e] MDA = material disposal area.

Appendix C

Methodology for Calculating Human Health Screening Action Levels in Soils and Sediments

APPENDIX C METHODOLOGY FOR CALCULATING HUMAN HEALTH SCREENING ACTION LEVELS IN SOILS AND SEDIMENTS

This appendix provides guidance to Environmental Restoration (ER) Project risk assessors at Los Alamos National Laboratory (the Laboratory) for the calculation of human health screening action levels (SALs) for organic and inorganic chemicals in soils and sediments. A residential exposure scenario that includes exposure pathways for soil ingestion, inhalation, and dermal absorption is used as the basis of the SAL calculations. US Environmental Protection Agency (EPA) guidance documents were used to identify appropriate model equations and parameter values consistent with "reasonable maximum exposure" conditions.

C-1.0 INTRODUCTION

C-1.1 Purpose

Implementation of this guidance is intended to ensure consistency in the calculation of SALs and in their application for evaluating specific media. SALs are used for screening soils and sediments for direct human contact and are not necessarily protective for ecological endpoints or protection of groundwater resources. Any deviations from the procedure in this appendix will be made only with approval from the administrative authority.

Sufficient discussion is provided in this appendix regarding assumptions and conditions of use to allow stakeholders and concerned citizens an independent review of the methodology for calculating SALs. This appendix is not intended to provide complete guidance for the application of SALs in ER Project assessments.

The accuracy in calculating SAL values resides completely with the ER Project rather than with an outside source. Independent calculation of SAL values allows incorporation of updated toxicity values in real time rather than on periodic updates from outside sources.

The equations and parameter values proposed in this appendix are consistent with those employed by EPA Region 6 in the derivation of its medium-specific human health screening levels (EPA 1999, 64637). The ER Project has adopted the approach of EPA Region 6 for three reasons. The first is to use Region 6 values as a quality assessment tool to check the values that the ER Project calculates. The second is to allow other risk assessors, who are familiar with the Region 6 approach, a greater understanding of the ER Project's guidelines and procedures. The third is to provide continuity within the ER Project by maintaining the same methodology for calculating SAL values that has been, and currently is being, used.

Exceptions to the calculation of SALs described by this methodology are values for lead and polychlorinated biphenyls (PCBs). Lead has been found to be a concern at several Laboratory corrective action sites, and EPA-approved toxicity values have not been published for this inorganic. A soil screening level of 400 mg/kg, from EPA guidance for screening soil-lead concentrations, is used in lieu of an independently calculated SAL value (EPA 1994, 59894). A PCB SAL of 1 mg/kg is used for both residential and industrial land use. This SAL is applied to the individual and summed concentrations of all PCB congeners and is based on guidance from the Toxic Substances Control Act.

C-1.2 Applicable Regulations and Guidance

ER Project investigations and remedial actions are conducted in accordance with the Hazardous and Solid Waste Amendments of 1984 and follow the regulatory requirements in Module VIII of the Laboratory's Hazardous Waste Facility Permit. For the derivation of SAL values, the Laboratory ER Project adheres to the guidelines in Part B of the risk assessment guidance for Superfund (RAGS) (EPA

1991, 58234) and EPA's soil screening guidance (EPA 1996, 58917), as well as the "EPA Region 6 Human Health Medium-Specific Screening Levels" document (EPA 1999, 64637).

C-2.0 IDENTIFICATION OF ACCEPTABLE RISK LEVELS

Excess incremental cancer risk (ICR) levels used in the calculation of SAL values are consistent with the National Contingency Plan (*Federal Register* Vol. 55, p. 8666), where risks at or below 10^{-6} are considered negligible and risks greater than 10^{-4} are deemed unacceptable. An ICR of 10^{-6} is used when calculating SALs for EPA cancer class A, B1, and B2 carcinogens. An ICR of 10^{-5} is used when calculating SALs for EPA cancer class C carcinogens. These ICR levels are consistent with guidelines from the New Mexico Environment Department's Hazardous and Radioactive Material Bureau and EPA Region 6. The less restrictive risk level of 10^{-5} is used for class C carcinogens because evidence for their carcinogenicity is not as compelling. Cancer classification rankings and their association with weight-of-evidence for carcinogenicity are discussed in guidelines for carcinogen risk assessment (*Federal Register* Vol. 51, No. 185, pp. 33992-34003).

The screening values for noncarcinogens are based upon a hazard quotient (HQ) of 1. The HQ represents the ratio of the site concentration to the SAL concentration; hence adverse effects are not expected below an HQ of 1. For use in a screening assessment, SALs for noncarcinogens are divided by 10 when two or more noncarcinogenic chemicals of potential concern (COPCs) are identified. Dividing SALs by 10 is functionally equivalent to using an HQ of 0.1. The purpose of the additional safety margin is to address the potential that two or more COPCs may affect similar target organs or organ systems.

C-3.0 IDENTIFICATION AND USE OF TOXICITY VALUES

Toxicity values (reference doses and cancer slope factors) associated with chronic exposure are preferentially used for calculating SAL values. The preferred source of toxicity values is EPA's Integrated Risk Information System (IRIS) located on the World Wide Web site at `http://www.epa.gov/iris`. EPA's Health Effects Assessment Summary Tables (HEAST) are used as a source of toxicity values if they are not published in IRIS. Finally, provisional toxicity values may be obtained for some chemicals and routes of exposure from EPA's National Center for Environmental Assessment (NCEA). NCEA publishes issue papers on certain chemicals' toxicity values for use by EPA regional offices. These NCEA provisional values have not, however, been subjected to rigorous scientific review and therefore cannot be used with the confidence of values obtained from IRIS or HEAST. However, they are used in calculating SAL values for performing screening assessments because (1) they reflect the state of knowledge within NCEA at the time of their publication and therefore incorporate a level of review beyond peer reviewed publications, and (2) SAL values are calculated incorporating several upper-bound exposure estimates and conservatively biased submodels for dermal absorption and dust resuspension. Therefore, the uncertainty associated with the provisional toxicity value is balanced by known biases for protecting the public. If provisional values are used in SAL calculations for chemicals that are potential risk-drivers, consequences on the confidence of the screening decision are discussed in the relevant report.

Toxicity values are specified separately by EPA for ingestion and inhalation intake routes. Extrapolation of toxicity values between ingestion and inhalation exposure routes, when a value has been published for one route only, is not performed for metals due to the potential differences in absorption efficiencies between these intake routes. Because absorption of organic chemicals more closely approximates 100% for both ingestion and inhalation, route-to-route extrapolation is performed for organic chemicals. If extrapolation of toxicity values between ingestion and inhalation exposure routes is used in SAL calculations for chemicals that are potential risk-drivers, consequences on the confidence of the screening decision are discussed in the relevant report.

EPA toxicity values for ingestion of a chemical are also used to evaluate risks associated with dermal absorption. Depending on the chemical and on the method of administration in the studies from which oral toxicity values are derived, these values may reflect varying absorption efficiencies from the gastrointestinal (GI) tract into the bloodstream. Because specific information on absorption efficiency is rarely available, oral toxicity values used to evaluate risks associated with dermal absorption are not adjusted to account for the chemical-specific oral absorption fraction associated with the oral toxicity value. Using oral toxicity values without adjustment for GI absorption efficiency may result in a slight underestimate of intake via the dermal pathway. However, this is balanced by the conservative assumptions incorporated into the dermal absorption model, as discussed in Section C-5.3 of this appendix.

The relative bioavailability of a chemical in the GI tract is not incorporated into the SAL calculations for the soil ingestion pathway. In general, bioavailability of a chemical in soil is expected to be lower than one in water due to the time required for a chemical to desorb from a soil particle and/or diffuse from within pores in the soil particle. Desorption rates should also normally be longer for soil contamination than for “spiked” food used in laboratory toxicity studies because desorption rates are correlated with the length of time that a chemical has been sorbed. Some fraction of a chemical adsorbed onto soil may desorb at so slow a rate as to be effectively unavailable during the transit time through the GI tract. Factors such as chemical form, soil-particle diameter, geochemical factors, and the nutritional status of an individual may affect the degree of bioavailability from soil. The assumption of equivalent bioavailability from soil and from the administration vehicle used in the toxicity studies on which many toxicity values are based (e.g., food or water) should result in an overestimate of uptake from soil ingestion.

Some chemicals that are routinely analyzed and detected do not have EPA-approved or provisional toxicity values. The approach to this issue is to identify a similar chemical for which toxicity values are available and incorporate it as a surrogate. Identification of an appropriate surrogate value, and whether the evaluation should be performed within the context of a screening assessment or a risk assessment, is a chemical-specific and assessment-specific decision that is beyond the scope and purpose of this appendix. Surrogates and the assumptions affecting their choice and use are submitted to the administrative authority for approval before use and are documented in each report, where applicable.

C-4.0 EXPOSURE SCENARIOS, MEDIA, AND PATHWAYS

Three basic exposure scenarios have been identified for current and future land use at the Laboratory: residential, recreational, and commercial/industrial. The residential scenario is typically the most appropriate for townsite properties; the recreational scenario for buffer areas or areas where development is topographically limited; and the commercial/industrial scenario for areas subject to continued Laboratory use, or certain other locations where commercial development is foreseen. The SAL values described in this appendix are associated with residential land use because it is more restrictive than industrial or recreational land-use options. Therefore, sites screened and released on the basis of residential land use are also safe for recreational and commercial/industrial activities.

The SAL values described in this appendix are specifically for application at sites where residential land use is expected to follow the urban pattern characteristic of the Los Alamos townsite. Appropriate land use activities and associated exposure pathways (in addition to soil ingestion, inhalation, and dermal contact) may differ for some mesa-slope and canyon-floor settings. For example, ingestion of homegrown produce may be considered an important exposure pathway for future residential land use in some canyon-floor areas. In addition, SALs are not necessarily protective of ecological endpoints or groundwater resources.

SAL values calculated with this methodology are intended for application to surface and near-surface soils and sediments. Below depths where construction activities may reasonably be expected to occur (approximately 12 ft), and in solid environmental media (e.g., tuff), application of SAL values is at the discretion of the assessor, in coordination with the administrative authority.

Exposure equations and parameter values for SAL calculations are provided in Section C-6.0 of this appendix. The primary source of exposure parameters used in the SAL calculations is EPA's standard default exposure factors (EPA 1991, 59893). These parameter values are intended to provide estimates of "reasonable maximum exposure" for an exposure scenario that incorporates these pathways. Many of these exposure parameters describe the intensity, frequency, and duration of exposure. For the dermal absorption exposure route, parameter values for exposed body surface area, soil adherence factor, and skin absorption factors were obtained from EPA Region 6 (EPA 1999, 64637) and on the World Wide Web at `http://www.epa.gov/earth1r6/6pd/rcra_c/pd-n/screen.htm`. EPA Region 6 obtained these values from a draft version of EPA's dermal risk assessment. Although the dermal risk assessment is still in interim draft form and has not been released for general use, these parameter values reflect current EPA guidance for evaluating the dermal exposure route based on EPA review of relevant published research and are unlikely to change.

C-5.0 MODELING INHALATION AND DERMAL PATHWAYS

C-5.1 Inhalation – Volatile Organic Compounds

The concentration of volatile organic compound (VOC) vapors in the ambient air breathing zone associated with VOCs in site soils is calculated using a steady-state volatilization model. The model used is Hwang and Falco's volatilization factor (VF) model, originally described in RAGS, Part B (EPA 1991, 58234).

The version of the VF model that is used for calculating SAL values is presented in the user's guide and technical background document of EPA's soil screening guidance documents (EPA 1996, 58917; EPA 1996, 59902). The primary difference with the later version of the VF model is that the output of a separate air dispersion model (based on one year of meteorological data) has now replaced the earlier box model component. From a table of dispersion model output ordered by area and regional location, users select a value most applicable to the site under consideration for use in their assessment.

The VF model assumes an effectively infinite depth of contaminated soil and no cover of clean soil. The first assumption may contribute to significant overestimates of risk for sites with a relatively small volume of contamination because calculated VOC emissions over a chronic exposure period of many years can easily violate conservation of mass. The assumption of no cover potentially results in an underestimation of the diffusion path length, which consequently increases the estimate of flux to the atmosphere. However, the ambient air VF model is being used to screen sites for residential and commercial land use and situations where a building may be constructed over the affected soils. Indoor air VOC concentrations at a site may be considerably higher than local concentrations in ambient air. Thus, the significant conservative biases associated with applying the VF model to ambient air impacts are balanced by its potential application to sites where indoor air impacts may be of concern.

The VF model is valid for sites where a VOC is present at concentrations below which the soil particle, pore water, and pore air phases are saturated. For conditions in which soil is saturated with one or more organic chemicals, the SAL value calculated using the VF model output is not reliable. The screening value chosen for a VOC under these conditions is the soil saturation concentration (C_{sat}). This value is used to identify the possible presence of nonaqueous phase VOC liquid (which may result in greater likelihood of off-site migration) and is not associated with toxicological endpoints.

Because the model output is not reliable above the C_{sat} of a VOC, the ER Project proposes to use the C_{sat} value for initially screening VOCs when saturated soil conditions exist and the calculated value from the VF model exceeds C_{sat}. If site concentrations of a VOC exceed the C_{sat} value, and the VOCs exist as nonaqueous phase liquids, the possibility of enhanced migration in the environment is assessed. All VOCs with site concentrations exceeding C_{sat} are subsequently evaluated for potential risk by comparing concentrations to a SAL calculated using only the soil ingestion and dermal absorption pathways. The elimination of the inhalation pathway from this SAL calculation, and the use of C_{sat} to identify VOCs for which migration is an enhanced concern, is consistent with both soil screening guidance (EPA 1996, 58917) and EPA Region 6 screening guidelines (EPA 1999, 64637). Supporting documentation for eliminating the inhalation pathway under saturated soil conditions is provided in EPA's soil screening guidance document (EPA 1996, 59902).

VF and C_{sat} model equations, and parameter values for SAL calculations, are documented in Section C-6.0 of this appendix. Parameter values for site-related factors such as soil porosities, density, and amount of organic carbon are default values recommended in EPA's soil screening guidance (EPA 1996, 58917). Chemical-specific parameter values are required for chemical diffusivity in air and water, Henry's Law constant, solubility in water, and organic carbon partition coefficient. The references that are used for obtaining these values, in order of prioritization, are (1) EPA's soil screening guidance (EPA 1996, 58917; EPA 1996, 59902), and (2) EPA's Superfund chemical data matrix (EPA 1996, 64708). Other references that may be employed if data are unavailable in the primary references include the “Handbook of Environmental Fate and Exposure Data for Organic Chemicals” (Howard 1990, 59892), EPA's subsurface contamination reference guide (EPA 1990, 59926), and EPA's Superfund exposure assessment manual (EPA 1988, 59901).

C-5.2 Inhalation - Fugitive Dust

The concentration of dust in the air above contaminated soils and sediment is calculated using a screening-level soil resuspension model. The resuspension model used is EPA's particulate emission factor (PEF) model. This model was originally described in “Rapid Assessment of Exposure to Particulate Emissions from Surface Contamination Sites” (EPA 1985, 59903). The version of the PEF model that is used for calculating SAL values is presented in the user's guide and technical background document of EPA's soil screening guidance documents (EPA 1996, 58917; EPA 1996, 59902). The primary difference with the later version of the PEF model is that the output of a separate air dispersion model (based on one year of meteorological data) has replaced the earlier box model component. From a table of dispersion model output ordered by area and regional location, users select a value most applicable to the site under consideration for use in their assessment.

The PEF model used for screening the dust inhalation pathway is based on wind erosion of surfaces that have an unlimited reservoir of particles. The model calculates the concentration of respirable particles in the air due to wind erosion. Depending on site soil conditions, there may not, in fact, be an unlimited supply of particles of this size available throughout the exposure period. This may result in a significant overestimation of intake via dust inhalation. A limitation of the model is that it does not address resuspension of particulates due to mechanical forces. Therefore, fugitive dust concentrations calculated using this model are not applicable for activities such as construction. If a construction scenario is used during site assessment, an alternative approach is used for estimating airborne dust concentrations in coordination with the administrative authority.

PEF model equations and parameter values for SAL calculations are documented in Section C-6.0 of this appendix. Parameter values for the PEF model, including the dispersion term (Q/C), vegetative cover, and windspeeds are default values recommended in EPA's soil screening guidance (EPA 1996, 58917). No chemical-specific parameter values are required in the PEF model.

C-5.3 Dermal Absorption

Dermal absorption from soil is evaluated using an absorption factor (ABS) to model desorption of a chemical from soil, absorption through skin, and transfer to the bloodstream. The amount of soil residing on a unit area of skin is described using an adherence factor (AF). The literature on AFs recognizes that they are dependent upon body part, soil type, particle size, soil moisture content, and other variables. Because information for quantifying these variables often is unavailable, and because a focus of screening is to streamline the assessment process, single recommended default values are used for the AFs when SALs are calculated. According to EPA screening guidelines, default ABS values for organic chemicals are assumed to be 0.1, while default absorption for inorganic chemicals is no longer recommended (EPA 1999, 64637).

Chemical-specific ABS values are used in SAL calculations for the following chemicals: arsenic (0.03); cadmium (0.01); chlordane (0.04); 2,4-D (0.05); DDT/DDD/DDE (0.03); hexachlorocyclohexane (lindane) (0.04); TCDD (dioxin) (0.03); polyaromatic hydrocarbons (0.13); PCBs (0.14); and pentachlorophenol (0.25). These chemical-specific ABS values were obtained from EPA Region 6 (EPA 1999, 64637).

The approach used to model dermal absorption incorporates several conservative assumptions that may result in an overestimation of actual absorption. The ABS value reflects an assumption that absorption is independent of concentration and does not change with time. All (100%) of a chemical is assumed to be available for absorption from adhered soil. For example, no loss of volatile or semivolatile chemicals is assumed to occur due to volatilization when soil is present on the skin. Finally, 100% of the specified surface area is assumed to be covered with a layer of soil at a depth corresponding to the AF.

The dermal absorption pathway also includes assumptions that may result in an underestimation of absorption. As described in Section C-3.0 of this appendix, oral toxicity values are not corrected for GI absorption efficiency resulting in a potential underestimation of risk via this pathway. An additional assumption is that skin is presumed to be intact; abrasions or cuts on the skin surface that could result in greater absorption on an individual basis are not considered. These two assumptions that tend to underestimate dermal risk are balanced by the conservative assumptions already discussed in this section. When considered in light of the conservative biases introduced in other transport models and exposure parameter values, these assumptions do not compromise the protective quality of the SAL values.

C-6.0 SCREENING ACTION LEVEL EQUATIONS AND PARAMETER VALUES

The following two equations are used to calculate SAL values for noncarcinogenic and carcinogenic chemicals, respectively, via direct soil ingestion, inhalation of chemical vapors or airborne dust, and dermal absorption from soil.

Combined Exposures for Noncarcinogenic Chemicals in Soil

$$C = \frac{THQ \times BW_c \times AT_n}{EF \times ED_c \times \left[\left(\frac{1}{RfD_o} \times \frac{IRS_c}{10^6 \, mg/kg} \right) + \left(\frac{1}{RfD_o} \times \frac{SA_c \times AF_c \times ABS}{10^6 \, mg/kg} \right) + \left(\frac{1}{RfD_i} \times \frac{IRA_c}{(VF_s \text{ or } PEF)} \right) \right]}$$

Note: Use VF_S for volatile chemicals (defined as having a Henry's Law Constant [atm-m^3/mol] greater than 10^{-5} and a molecular weight less than 200 grams/mol) and PEF for nonvolatile chemicals.

Combined Exposures for Carcinogenic Chemicals in Soil

$$C = \frac{TR \times AT_c}{EF \times \left[\left(\frac{IFS_{adj} \times CSF_o}{10^6 \, mg/kg} \right) + \left(\frac{SFS_{adj} \times ABS \times CSF_o}{10^6 \, mg/kg} \right) + \left(\frac{InhF_{adj} \times CSF_i}{(VF_s \text{ or } PEF)} \right) \right]}$$

Note: Use VF_S for volatile chemicals (defined as having a Henry's Law Constant [atm-m^3/mol] greater than 10^{-5} and a molecular weight less than 200 grams/mol) and PEF for nonvolatile chemicals.

The parameter definitions and units for the SAL equations are provided below. References for these parameter values are described in Section C-4.0 of this appendix.

C	=	chemical SAL in soil (mg/kg)	
THQ	=	target hazard quotient	1
TR	=	target cancer risk	10^{-6} for class A, B1, and B2 carcinogens 10^{-5} class C carcinogens
AT_c	=	averaging time (carcinogen)	70 yr x 365 days
AT_n	=	averaging time (noncarcinogen)	exposure duration (ED) x 365 days
ABS	=	skin absorption factor	(organic: 0.1)
AF_c	=	adherence factor – child	0.2 mg/cm^2
BW_c	=	body weight – child	15 kg
CSF_o	=	cancer slope factor – oral	(mg/kg-day)$^{-1}$ (see Section C-3.0 of this appendix)
CSF_i	=	cancer slope factor – inhalation	(mg/kg-day)$^{-1}$ (see Section C-3.0 of this appendix)
EF	=	exposure frequency	350 day/yr
ED_c	=	exposure duration – child	6 yr
IFS_{adj}	=	age-adjusted ingestion factor	114 mg-yr/kg-day
$InhF_{adj}$	=	age-adjusted inhalation factor	11 m^3-yr/kg-day
IRA_c	=	inhalation rate – child	10 m^3/day
IRS_c	=	soil ingestion rate – child	200 mg/day
PEF	=	particulate emission factor	(m^3/kg) (see below)

RfD_o	=	reference dose – oral	(mg/kg-day) (see Section C-3.0 of this appendix)
RfD_i	=	reference dose – inhalation	(mg/kg-day) (see Section C-3.0 of this appendix)
SA_c	=	exposed surface area – child	2900 cm^2/day
SFS_{adj}	=	age-adjusted skin contact factor for carcinogens	340 mg-yr/kg-day
VF_s	=	volatilization factor for soil	(m^3/kg) (see below)

Note: See exceptions for ABS and Af_c in Section C-5.3 of this appendix.

Because contact rates may be different for children and adults, carcinogenic risks during the first 30 yr of life are calculated using age-adjusted factors ("adj"). Use of age-adjusted factors is especially important for soil ingestion exposures, which are higher during childhood and decrease with age. However, for purposes of combining exposures across pathways, additional age-adjusted factors are used for inhalation and dermal exposures.

For **ingestion** (mg-yr)/(kg-day), the following equation is used:

$$IFS_{adj} = \frac{ED_c \times IRS_c}{BW_c} + \frac{(ED_r - ED_c) \times IRS_a}{BW_a}$$

For **dermal contact** (mg-yr)/(kg-day), the following equation is used:

$$SFS_{adj} = \frac{ED_c \times AF_c \times SA_c}{BW_c} + \frac{(ED_r - ED_c) \times AF_a \times SA_a)}{BW_a}$$

For **inhalation** (m^3-yr)/(kg-day), the following equation is used:

$$InhF_{adj} = \frac{ED_c \times IRA_c}{BW_c} + \frac{(ED_r - ED_c) \times IRA_a)}{BW_a}$$

where:

BW_a	=	body weight – adult	70 kg
ED_r	=	exposure duration – residential	30 yr
Af_a	=	adherence factor – adult	0.07 mg/cm^2
IRS_a	=	soil ingestion rate – adult	100 mg/day
SA_a	=	exposed surface area – adult	5700 cm^2/day
IRA_a	=	inhalation rate – adult	20 m^3/day

Note: Values not defined in this statement are defined above.

Derivation of the Volatilization Factor

$$VF_s = \left(\frac{Q}{C}\right) \times \frac{\left(3.14 \times D_A \times T\right)^{1/2}}{2 \times \rho_b \times D_A} \times 10^{-4}\left(m^2/cm^2\right)$$

where:

$$D_A = \frac{\left(\Theta_a^{10/3} D_i H' + \Theta_w^{10/3} D_w\right)/n^2}{\rho_b K_d + \Theta_w + \Theta_a H'}$$

where:

VF_s	=	volatilization factor	(m^3/kg)
D_A	=	apparent diffusivity	(cm^2/sec)
Q/C	=	inverse of the mean concentration at the center of a 0.5-ac^2 source	68.81 g/m^2-sec per kg/m^3
T	=	exposure interval	9.5 x 10^8 sec
ρ_b	=	dry soil bulk density	1.5 g/cm^3
Θ_a	=	air filled soil porosity (L_{air}/L_{soil})	0.28 or n – Θ_w
Θ_w	=	water filled soil porosity (L_{water}/L_{soil})	0.15
D_i	=	diffusivity in air (cm^2/sec)	chemical-specific
H'	=	dimensionless Henry's Law constant	chemical-specific
D_w	=	diffusivity in water (cm^2/sec)	chemical-specific
n	=	total soil porosity (L_{pore}/L_{soil})	0.43 or 1 – (ρ_b/ρ_s)
ρ_s	=	soil particle density	2.65 g/cm^3
K_d	=	soil-water partition coefficient (cm^3/g)	$K_{oc}f_{oc}$ (chemical-specific)
K_{oc}	=	soil organic carbon/water partition coefficient (L/kg)	chemical-specific
f_{oc}	=	fraction organic carbon content of soil	0.006 (g/g)

Note: $H' = \dfrac{\text{Henry's Law Constant}}{\text{Universal Gas Constant} \times \text{Temperature}}$

Derivation of the Soil Saturation Concentration

$$sat = \frac{S}{\rho_b}\left(K_d \rho_b + \Theta_w + H'\,\Theta_a\right)$$

where:

sat	=	soil saturation concentration	(mg/kg)
S	=	solubility in water (mg/L)	chemical-specific
K_d	=	soil-water partition coefficient (cm^3/g)	$K_{oc}f_{oc}$ (chemical-specific)

K_{oc}	=	soil organic carbon/water partition coefficient (L/kg)	chemical-specific
f_{oc}	=	fraction organic carbon content of soil	0.006 (g/g)
ρ_b	=	dry soil bulk density	1.5 g/cm^3
Θ_w	=	water filled soil porosity (L_{water}/L_{soil})	0.15
H'	=	dimensionless Henry's Law constant	chemical-specific
Θ_a	=	air filled soil porosity (L_{air}/L_{soil})	0.28 or n – Θ_w

Note: $H' = \dfrac{\text{Henry's Law Constant}}{\text{Universal Gas Constant} \times \text{Temperature}}$

See Section C-5.1 for guidance on the application of the soil saturation concentration for development of a SAL for VOCs.

Derivation of the Particulate Emission Factor

$$PEF\left(m^3/kg\right) = \frac{Q}{C} \times \frac{3{,}600\ \text{sec/h}}{0.036 \times (1 - V) \times \left(U_m/U_t\right)^3 \times F(x)}$$

where:

PEF	=	particulate emission factor	(m^3/kg)
Q/C	=	inverse of the mean concentration at the center of a 0.5-ac^2 source	90.8 g/m^2-sec per kg/m^3
V	=	fraction of vegetative cover	0.5 (unitless)
U_m	=	mean annual windspeed	4.69 m/sec
U_t	=	equivalent threshold value of windspeed at 7 m	11.32 m/sec
F(x)	=	function dependent on U_m/U_t (derived using EPA 1985 [59903])	0.194 (unitless)

A PEF value of 1.316 x 10^9 is calculated using the default parameter values described.

REFERENCES FOR APPENDIX C

The following list includes all references cited in this appendix. The parenthetical information following the reference provides the author, publication date, and ER Project identification (ER ID) number. This information is also included in the citation in the text and can be used to locate the document.

ER ID numbers are assigned by the Laboratory's ER Project to track all material associated with Los Alamos National Laboratory corrective action sites. These numbers can be used to locate copies of the documents at the ER Project's Records Processing Facility and, where applicable, within the ER Project reference library. The references cited in this report can be found in the volumes of the reference library titled "Reference Set for Regulatory Compliance Focus Area."

Copies of the reference library are maintained at the New Mexico Environment Department Hazardous and Radioactive Materials Bureau, the Los Alamos Area Office of the US Department of Energy, the US Environmental Protection Agency, and the ER Project Office. This library is a living document that was developed to ensure that the administrative authority has all the necessary material to review the decisions and actions proposed in this report. However, documents previously submitted to the administrative authority are not included in the reference library.

EPA (US Environmental Protection Agency), February 1985. "Rapid Assessment of Exposure to Particulate Emissions from Surface Contamination Sites," EPA/600/8-85/002, prepared for Office of Health and Environmental Assessment, US Environmental Protection Agency, Washington, DC. (EPA 1985, 59903)

EPA (US Environmental Protection Agency), April 1988. "Superfund Exposure Assessment Manual," EPA/540/1-88/001, OSWER Directive 9285.5-1, Office of Emergency and Remedial Response, Washington, DC. (EPA 1988, 59901)

EPA (US Environmental Protection Agency), October 1990. "Subsurface Contamination Reference Guide," EPA/540/2-90/011, Office of Emergency and Remedial Response, Washington, DC. (EPA 1990, 59926)

EPA (US Environmental Protection Agency), April 1991. "Use of Standard Default Exposures Factors," Office of Emergency and Remedial Response, Washington, DC. (EPA 1991, 59893)

EPA (US Environmental Protection Agency), December 1991. "Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual (Part B, Development of Preliminary Remediation Goals)," Interim, EPA/540/R-93-057, Publication 9285.7-01B, Office of Emergency and Remedial Response, Washington, DC. (EPA 1991, 58234)

EPA (US Environmental Protection Agency), 1994. "Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities," OSWER Directive 9355.4-12, Office of Solid Waste and Emergency Response, Washington, DC. (EPA 1994, 59894)

EPA (US Environmental Protection Agency), 1996. "Soil Screening Guidance: Technical Background Document," EPA/540/R-95/128, OSWER Directive 9355.4-17A, Office of Emergency and Remedial Response, Washington, DC. (EPA 1996, 59902)

EPA (US Environmental Protection Agency), 1996. “Soil Screening Guidance: User's Guide,” EPA/540/R-96/018, OSWER Directive 9355.4-23, Office of Emergency and Remedial Response, Washington, DC. (EPA 1996, 58917)

EPA (US Environmental Protection Agency), 1996. “Superfund Chemical Data Matrix,” EPA/540/R-96/028, Office of Emergency and Remedial Response, Washington, DC. (EPA 1996)

EPA (US Environmental Protection Agency), June 1999. “EPA Region 6 Human Health Medium-Specific Screening Levels,” Dallas, Texas. (EPA 1999, 64637)

Howard, P. H., 1990. “Handbook of Environmental Fate and Exposure Data for Organic Chemicals,” ISBN 0-87371-151-3, Lewis Publishers, Chelsea Michigan. (Howard 1990, 59892)

Appendix D

Reporting Requirements

APPENDIX D REPORTING REQUIREMENTS

D-1.0 GENERAL REPORTING REQUIREMENTS

All Los Alamos National Laboratory (the Laboratory) Environmental Restoration (ER) Project plans/reports

- comply with the Resource Conservation and Recovery Act (RCRA);
- comply with the reporting requirements specified in Module VIII of the Laboratory's Hazardous Waste Facility Permit (EPA 1994, 44146);
- conform to US Department of Energy (DOE) Order 430.1, "Life-Cycle Asset Management";
- conform to the outlines specified in the New Mexico Environment Department (NMED) "RPMP Document Requirement Guide" (NMED 1998, 57897), or other outlines as negotiated;
- are consistent with the substantive requirements of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) as applicable; and
- comply with internal Laboratory administrative controls.

In addition, ER Project plans/reports are consistent with other applicable guidance from DOE, the US Environmental Protection Agency (EPA), and NMED.

D-2.0 RFI PLANS

A RCRA facilities investigation (RFI) entails preparing a work plan/sampling and analysis plan (SAP) before any sampling begins. Twenty-four RFI work plans were prepared by the Laboratory's ER Project between 1990 and 1996. Additionally, the ER Project has written (or will write) SAPs for each corrective action site under its purview. Work plans/SAPs are available through the information repositories described in Chapter 7 of this document.

In writing work plans/SAPs, the ER Project adheres to Section 2, Volume 1, of EPA's RFI guidance document (EPA 1989, 08794) to the extent practicable. Specific RFI work plan/SAP requirements are described in detail in Module VIII, Task II, of the Laboratory's Hazardous Waste Facility Permit (EPA 1994, 44146). The administrative authority generally has an opportunity to review work plans/SAPs before they are implemented.

In conjunction with the administrative authority, the ER Project has prepared a work plan/SAP annotated outline that is provided as Attachment 1 of this appendix. The work plan/SAP annotated outline details the information to be included in work plans/SAPs, such as

- a description of the corrective action site to be investigated and its operational history (including a preliminary site conceptual model);
- the objectives of and the decisions to be made for the proposed investigation;
- identification of the media to be sampled and sampling frequency;
- identification of the types of samples to be collected;
- identification of target analyte suites for which samples will be analyzed;

- identification of applicable sampling methods, analytical methods, and verification and validation procedures to be used; and
- a discussion of why the quality and type of data proposed will be adequate to resolve relevant regulatory issues.

Sites for which accelerated corrective actions are conducted fall under the RFI corrective action process. Accelerated corrective actions include voluntary corrective actions (VCAs), voluntary corrective measures (VCMs), and interim measures (IMs). VCA and VCM plans focus on final remedies, while IMs focus on immediate needs. Although plans for these actions may not follow the format of the SAP annotated outline, the type of information contained within these plans is similar to that included in work plans/SAPs.

D-3.0 RFI REPORTS

An RFI entails preparing a report on the progress and or outcome of completed work for each corrective action site under its purview. Completed reports are available through the information repositories described in Chapter 7 of this document.

In writing reports, the ER Project adheres to Section 2, Volume 1, of EPA's RFI guidance document (EPA 1989, 08794) to the extent practicable. Specific RFI reporting requirements are described in detail in Module VIII, Task II, of the Laboratory's Hazardous Waste Facility Permit (EPA 1994, 44146). The administrative authority comments on or approves reports. The ER Project resolves any comments and amends the reports as applicable.

In conjunction with the administrative authority, the ER Project has prepared an annotated outline for RFI reports that is provided as Attachment 2 of this appendix. The report annotated outline details the information to be included in reports, such as

- a description of the corrective action site to be investigated and its operational history (including a revised site conceptual model);
- a description of any previous investigations;
- a description of the field investigation, including any deviations from the SAP;
- a summary of the samples collected, including any deviations from the SAP;
- a review of the data and the results of the data review;
- a description of the human health and ecological risk screening and/or risk assessments undertaken and their results; and
- a discussion of conclusions and recommendations.

As stated in Section D-2.0, sites for which accelerated corrective actions are conducted fall under the RFI corrective action process. Although the reports for these actions (VCAs, VCMs, IMs) may not follow the format of the RFI annotated outline, the type of information contained within the reports is similar to that included in RFI reports.

D-4.0 CORRECTIVE MEASURES STUDY PLANS

When an RFI report specifies that corrective measures are required, the Laboratory ER Project implements the corrective measures study (CMS) process in accordance with EPA guidance, including EPA's RCRA corrective action plan (EPA 1988, 0295) and EPA's proposed rule on corrective action for solid waste management units (SWMUs) (Proposed Rule, Title 40 CFR, Parts 264, 265, 270, and 271, "Corrective Action for Solid Waste Management Units (SWMUs) at Hazardous Waste Management Facilities," *Federal Register*, Vol. 55., pp. 30798-30884). This proposed rule hereafter is called "Subpart S." The Laboratory's approach to CMSs is addressed in subsequent sections of this installation work plan (IWP). Table D-4.0-1 crosswalks IWP discussions of CMS (and corrective measures implementation [CMI] plan) requirements to corresponding sections in Subpart S.

Table D-4.0-1
Crosswalk of CMS Requirements

IWP		Subpart S	
Section	**Title**	**Section**	**Title**
3.1.4.5 D-4.0	CMS/CMI Plans and Reports Corrective Measures Study Plans	VI., E., 3.	Scope of Corrective Measures Study
3.1.4.5 D-4.0	CMS/CMI Plans and Reports Corrective Measures Study Plans	VI., E., 4.	Plans for Corrective Measures Study
3.2.1.7 D-5.0	Preferred Action Identification Corrective Measures Study Reports	VI., E., 5.	Reports of Corrective Measures Study
3.1.4.5	CMS/CMI Plans and Reports	VI., F., 2.	General Standards for Remedies
3.2.1.7	Preferred Action Identification	VI., F., 5.	Media Cleanup Standards
3.2.1.7	Preferred Action Identification	VI., F., 7.	Demonstration of Compliance with Media Cleanup Standards
3.2.1.7	Preferred Action Identification	VI., F., 8.	Conditional Remedies
3.1.4.5 D.5-0	CMS/CMI Plans and Reports Corrective Measures Study Reports	VI., F., 3.	Remedy Selection Decision Factors
3.1.5	Permit Modifications	VI., G.	Permit Modification for Selection of Remedy

When required by the NMED, the Laboratory must submit for review and approval a CMS plan that defines the activities to be conducted during the CMS. The CMS plan is due at NMED within 90 calendar days of notification of the requirement to conduct a CMS. NMED then reviews and approves the CMS plan or issues a request for supplemental information or notice of deficiency on the plan to the Laboratory. Each CMS plan is specific to a corrective action site. CMS plans must be consistent with the scope of work for a CMS that is presented in Module VIII, Section R, pp. 56–57, of the Laboratory's Hazardous Waste Facility Permit (EPA 1994, 44146), and with proposed Subpart S, as applicable.

The CMS is used to identify and develop a scheme for evaluating alternatives for final remediation of a site. A CMS plan must provide sufficient information for the administrative authority to adequately review the methods for evaluating potential corrective measure alternatives. Each site-specific CMS is unique to the environmental setting and type of contaminants present at the site.

At a minimum, a CMS plan must contain

- a description of the general approach to investigating and evaluating potential alternatives;
- a definition of the overall objectives of the study;
- a description of the specific remedial alternatives to be studied;

- a plan for conducting treatability (bench or pilot-scale) studies, if appropriate, to determine the suitability of alternatives for site restoration;
- a plan for evaluating remedial alternatives to ensure compliance with the standards for remedial alternatives specified in EPA guidance;
- a schedule for conducting the CMS; and
- a proposed format for presenting the results (CMS report).

In addition to these requirements**,** the Laboratory integrates RCRA and National Environmental Policy Act compliance through the CMS process. CMS plans can trigger a determination of the need for an environmental impact statement (EIS); in such cases, the CMS report can serve as the EIS. When a full EIS is required, the CMS report becomes only support documentation to the full EIS.

In accordance with Module VIII, Section M, p. 34, of the Laboratory's Hazardous Waste Facility Permit, after CMS plans have been approved and revised as necessary, the Laboratory must initiate CMS studies within fifteen (15) calendar days (EPA 1994, 44146). The Laboratory conducts the CMS following the approved CMS plan, which in accordance with Module VIII, Section L, Part 2, pp. 33–34, of the Laboratory's Hazardous Waste Facility Permit, must include

- a description of the general approach to investigation and potential remedies,
- a definition of the overall objectives of the study,
- specific plans for evaluating remedies to ensure compliance with remedy standards,
- schedules for conducting the study,
- the proposed format for the presentation of information, and
- any pilot or bench-scale studies necessary.

Other considerations include

- evaluating performance of the remedy or remedies,
- assessing effectiveness,
- assessing the time required for implementation,
- estimating costs of implementation, and
- assessing institutional requirements.

The scope and level of technical detail in each study will be adequate to allow the Laboratory to propose a remedy based on the results of the study and to allow NMED to review and approve that remedy. The evaluation of the alternatives will be based on technical, environmental, human health, and institutional concerns.

Meeting the requirements of a remedy may be technically impractical. The Laboratory expects to minimize such situations through the use of new and innovative remedial technologies developed by the Laboratory and by others. However, if meeting remedy requirements is impossible for technical reasons, the Laboratory will propose that NMED modify the permit so that additional or alternate methods may be used.

The Laboratory also will propose to NMED a schedule for implementing the proposed remedy. As appropriate, the schedule will address the following criteria, although additional factors may influence the timing of the implementation:

- the extent and nature of contamination,
- the Laboratory's ability to implement the remedy,
- availability of treatment technology,
- desirability of currently unavailable technologies that may offer significant advantages,
- potential risks related to implementation of the remedy, and
- any other relevant factors.

The Laboratory recognizes the need for innovative and cost-effective remedial technologies. New technologies could offer distinct advantages over currently available technologies (e.g., downhole monitors and stabilization techniques) not fully developed at the time a remedy is selected. In such cases, the Laboratory may propose that NMED postpone selecting a remedy until these technologies are functional if there is a distinct technical, time, or cost advantage and if a site does not pose an imminent or substantial threat to human health and the environment. If a site poses an imminent or substantial threat to human health or the environment, the Laboratory may perform immediate risk-reduction activities and consider implementing existing technologies.

D-5.0 CORRECTIVE MEASURES STUDY REPORTS

In accordance with Module VIII, Section N, Part 1, p. 34, of the Laboratory's Hazardous Waste Facility Permit, within sixty (60) calendar days of completing a CMS, a CMS final report is prepared and provided to NMED (EPA 1994, 44146). The final report is based on the study results, corrective measures evaluations, and final corrective measure recommendations for a specific release to a site or groups of sites. At a minimum, this report must evaluate alternatives consistent with the scope of work required for CMS reports described in Module VIII.

The primary purpose of the CMS report is to enable the Laboratory to justify and recommend a corrective measure alternative for NMED approval. The report must include a detailed description of the remedies assessed and must describe how the proposed remedy meets the standards for remedies specified in the CMS plan. The primary criteria for developing and selecting remedy standards are

- long-term reliability and effectiveness;
- reduction of toxicity, mobility, or volume of contaminants;
- short-term effectiveness;
- implementability; and
- cost.

NMED will approve the remedy proposed by the Laboratory, based on how well the remedy satisfies the selection criteria during implementation of the CMS process. At a minimum, these criteria should address

- standards for remedies,
- criteria for selecting the remedy,

- schedules for implementing the remedy,
- media cleanup levels, and
- compliance with media cleanup levels.

The Laboratory has a wide variety of corrective action sites. Each CMS study is tailored to the needs of each site. In many cases, site conditions may not require extensive evaluation of several alternatives, and when the number of possible remedies is limited, the process is as focused and as streamlined as possible to expedite the corrective action process.

NMED will approve the CMS final report or request a revision. NMED's response addresses comments received from EPA and the public. The Laboratory incorporates comments received from NMED within thirty (30) calendar days of receipt.

Presumptive remedies are a subset of CMSs and therefore conform to the same requirements listed in this section.

D-6.0 CORRECTIVE MEASURES IMPLEMENTATION PLAN

The Laboratory prepares corrective measures implementation (CMI) plans after approval of the CMS plan and upon NMED request.

Table D-6.0-1 crosswalks IWP discussions of CMI requirements to corresponding sections in Subpart S.

Table D-6.0-1
Crosswalk of CMI Requirements

IWP		Subpart S	
Section	**Title**	**Section**	**Title**
3.1.4.5 D-6.0	CMS/CMI Plans and Reports Corrective Measures Implementation Plan	VI.H.	Implementation of Remedy
3.2.1.7 D-6.0	Preferred Action Identification Corrective Measures Implementation Plan	VI.H.1.	Remedy Design
3.1.4.5 D-6.0	CMS/CMI Plans and Reports Corrective Measures Implementation Plan	VI.H.2.	Progress Reports
3.1.4.5 D-6.0	CMS/CMI Plans and Reports Corrective Measures Implementation Plan	VI.H.3.	Review of Remedy Implementation
3.1.4.5	CMS/CMI Plans and Reports	VI.H.4	Completion of Remedies

The standard outline for Laboratory CMI plans has not been developed but will be submitted for approval after development. In general, CMI plans include

- remedy designs (i.e., detailed construction plans and specifications to implement the selected remedy);
- type and frequency of reports on progress of implementation,
- type of NMED implementation reviews,

- requirements for remedy completion,
- determination of technical practicability, and
- verification plans.

CMI plans include detailed construction plans for implementing corrective action remedies. In some cases, the technical details may have been provided in the CMS report. CMI plans may cite those specifics and propose to NMED that they be adopted in the final design. In either case, NMED approval of CMI plans will constitute approval of the remedy design and schedule. The remedy design should include the following:

- design specifications for corrective action sites,
- criteria for a performance assessment,
- implementation and long-term maintenance plans,
- major milestones,
- project schedule, and
- a quality assurance plan for construction.

NMED will approve a CMI plan or request a revision. The Laboratory implements the remedies as approved. Approved plans are placed in the Laboratory's Outreach Center and Reading Room. The Laboratory provides written notice of the availability of the approved plan to all individuals on the ER Project mailing list. In addition, the cost estimate provided in the CMS report will be revised as necessary upon request.

Depending on the type of remedial action being implemented, it may be necessary to provide frequent and detailed information about the effectiveness and progress of remedies. Data for CMI reports are maintained in the Records Processing Facility and are available for public review upon request.

The schedule and content of CMI progress reports are developed in CMI plans, thus tailoring each to a specific corrective action site. CMI progress reports may include

- summaries of progress,
- problems encountered and resolutions,
- personnel changes,
- upcoming work for the next reporting period, and
- laboratory and field sampling reports.

NMED periodically reviews the progress of remedy implementation and may recommend modification of the schedule of compliance or additional remedial measures. The reviews may consist of reviews of the progress reports and/or site visits. Because each remedy requires varying levels of NMED oversight, CMI plans are tailored to each site according to the level of review and progress evaluation required.

REFERENCES FOR APPENDIX D

The following list includes all references cited in this appendix. The parenthetical information following the reference provides the author, publication date, and ER Project identification (ER ID) number. This information is also included in the citation in the text and can be used to locate the document.

ER ID numbers are assigned by the Laboratory's ER Project to track all material associated with Los Alamos National Laboratory corrective action sites. These numbers can be used to locate copies of the documents at the ER Project's Records Processing Facility and, where applicable, within the ER Project reference library. The references cited in this report can be found in the volumes of the reference library titled "Reference Set for Regulatory Compliance Focus Area."

Copies of the reference library are maintained at the New Mexico Environment Department Hazardous and Radioactive Materials Bureau, the Los Alamos Area Office of the US Department of Energy, the US Environmental Protection Agency, and the ER Project Office. This library is a living document that was developed to ensure that the administrative authority has all the necessary material to review the decisions and actions proposed in this report. However, documents previously submitted to the administrative authority are not included in the reference library.

EPA (US Environmental Protection Agency), June 1988. "RCRA Corrective Action Plan," EPA/530-SW-88-028, OSWER Directive 9902.3, Washington, DC. (EPA 1988, 0295)

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, 08794)

EPA (US Environmental Protection Agency), April 19, 1994. Module VIII of RCRA Permit No. NM0890010515, EPA Region VI, new requirements issued to Los Alamos National Laboratory, Los Alamos, New Mexico, effective May 19, 1994, EPA Region VI, Hazardous Waste Management Division, Dallas, Texas. (EPA 1994, 44146)

NMED (New Mexico Environment Department), March 3, 1998. "RPMP Document Requirement Guide," Hazardous and Radioactive Materials Bureau, RCRA Permits Management Program, Santa Fe, New Mexico. (NMED 1998, 57897)

Attachment 1

SAP Annotated Outline

CHANGES MADE PER 8/26 IN GREEN

CAVEATS

The section headings in this outline were distributed to all facilities regulated by NMED at a workshop on March 4 and 5, 1998. **At that workshop, NMED mandated that every SAP submitted to the State after March 4, 1998, must follow the numbered and lettered section headings in this outline.** All annotations are subject to change because none of the annotations in this outline have been reviewed by the State.

If an item called for in this outline is currently unknown or unavailable do what is **reasonable** to provide that information. You are not expected to perform a study to provide this information unless it is integral to a decision for a complex PRS. Check with the Regulatory Compliance Focus Area before undertaking such a study.

SAMPLING AND ANALYSIS PLAN

LANL ANNOTATED OUTLINE

GENERAL GUIDELINES

Follow this outline when preparing SAPs unless special permission to deviate is obtained. All requests for deviation should be addressed to the Regulatory Compliance Focus Area Leader (Tori George at 5-6953, torig@lanl.gov), who will coordinate discussion with the State. Deviations will be permitted for cases in which adherence to the outline compromises technical quality.

This annotated outline must be used for LANL sampling and analysis plans (SAPs) that are being submitted to the Administrative Authority (AA) for review. In accordance with the NMED RCRA Permits Management Program Document Requirement Guide, March 4, 1998, Section III.C.1, Accelerated Corrective Action Approach, a SAP must be submitted to the AA for approval if it meets one of the following three conditions**. (This section is more appropriate for a QP and should be removed once we have the QP. Add Joe's comments to QP)**

1. Original SAP: A SAP must be prepared and a copy sent to NMED for LANL PRS. For PRSs that are on the HSWA Module, AA review and approval of the SAP is required.

2. Significant Revision: A SAP previously approved by the AA is significantly revised, e.g., the changes require the development of a new framework to support the revision (e.g., new DQOs, QAPP, etc.). The cost and schedule to support the changes may also require revision. Examples of significant revisions include (i) the addition of a substantial area to the PRS (e.g. field work leads to the discovery of contamination in a channel not previously believed to be connected to the PRS); and/or (ii) a decrease in the number of samples and/or analytes is proposed.

3. Significant Additions: Additions to an approved SAP require the development of a new framework (e.g., new DQOs, QAPP, etc.). to support the work in order to more fully define the nature and extent of contamination for completing the RFI.

This draft annotated outline includes detailed instructions in the sections that address the PRS description, operational history, existing data, and conceptual model. These detailed instructions are taken directly from the LANL RFI Report Annotated Outline and represent the desired level of detail for AA review of LANL documents. Therefore, while the SAP preparation may take longer, the material prepared for the SAP can also be used for the RFI report.

Address the following general guidance throughout the document.

- The audience for this document includes the public. Therefore, SAPs should be written so that the public can understand the decision presented for the PRS investigation.

- Do not refer the reader to the work plan or other documents for information relevant to the SAP presented. Instead, include in the SAP all details and descriptions from the work plan or other documents that are relevant to the PRS and the proposed investigation. Consider the following when referencing documents.

    - The preferred method is to include a verbatim in-text reproduction of the relevant information from the work plan or other documents, providing enough reference information that the reader can locate the reference (include both the section number and page number). If terminology in the quotation is no longer in use, provide current terms in brackets following out-of-date terms. This should be explained in the introduction to the quotation. For example:

> "The following information was reproduced from Section 3.4.1, pages 56–58, of the RFI Work Plan for OU 1079 (LANL 1992, ER ID XXXXX). Certain terminology in the work plan is no longer in use. Therefore, current terms have been included in brackets following the out-of-date terms in this quotation."

- When the verbatim reproduction is so lengthy that it would break up the flow of the text, provide a detailed summary in the text with enough reference information that the reader can locate the reference (include both the section number and page number).

- When discussing the description and operational history for the PRS, make sure that all details are included (whether in a verbatim reproduction or in a summary). The reader should not have to refer to a copy of the work plan to understand the complete history of the PRS.

- In cases where new information has become available since the work plan was submitted, summarize the information from the work plan and discuss the changes that have occurred. The result should be a new, complete write-up that incorporates current understanding of the PRS with previous information.

- All SAPs, reports, etc. submitted to the AA for review and approval must also submit a reference set of all archival documents, methodology documents, technical guidance, etc. referenced in AA submittals. For each TA or other broad region of consideration, the focus area responsible for that region must begin assembling a reference set. The ER Project Office will be responsible for submitting project-wide documents such as the IWP (this list of project-wide documents will be distributed to avoid duplication in the AAs'reference set. Guidelines for submittal of the reference set can be obtained from ER technical editors (at a min. one set for NMED, one set for DOE, one set for Project office).

- The AA and the public need to be aware that we considered all of the items specified in this outline. If an item called for in the annotation is unknown or unavailable, state that it is unknown or unavailable (e.g., no interflow map is available for this PRS, the amount of liquid released is unknown, etc.).

- Present the PRSs in sequential order unless there is a reason for presenting them in a different order (e.g., it might make sense to organize related PRSs together).

- Create subheadings under the sections in this outline as needed to organize the text, but do not number the additional subheadings. Use bold font to set them apart.

- Use consistent units for all measurements in the SAP, especially when reporting COPC concentrations in soil/sediment and water samples. Clearly identify the units for all numbers in all tables in the SAP.

- When discussing structures, provide both the structure name and number. For example, it is not sufficient to refer to "structure TA-32-6." Refer instead to "structure TA-32-6, a valve house containing access points to piping at PRS 32-002." This information should be provided both on the first occurrence, and on all subsequent occurrences. If the description is too complicated to fit in the text, use a footnote.

- Provide references for documentation of ongoing actions discussed (e.g., ongoing water monitoring, etc.). In text discussions of ongoing actions, include the frequency of the activity, the regulatory authority that drives the activity, the expected duration of the activity, etc.

- Do not use jargon, LANL-specific terms, vague terms, or other imprecise language. Also, be explicit in all discussions and do not expect the reader to make assumptions or inferences based on limited information.

- Use the term "regional aquifer" instead of "main aquifer."

- When recommending a future corrective action for a PRS, use the general term "accelerated corrective action" rather than "voluntary corrective action" or "voluntary corrective measure."Note the following:

    - VCAs are typically low-cost, short-term corrective action sites. Approval for a VCA must be obtained from the AA before proposing a PRS for NFA. Sites appropriate for VCAs are typically low priority sites.

    - VCMs are performed on relatively small-scale sites with obvious remedies that require enhanced regulatory involvement because of complexity, cost, or location. the AA must approve the VCM plan before field activities, and approve the VCM report before the PRS is proposed for NFA.

- Follow ER Project formatting standards for font, type size, header and footer style, references, and other formatting issues. Contact an ER Project editor for information about formatting standards.

- Format textual references using ER ID numbers rather than Master Reference List or other reference numbers. Contact an ER Project editor for further information.

1.0 INTRODUCTION

This section is intended to be a brief overview of the contents of the SAP and an introduction to the PRSs included in the SAP. For most SAPs, this section should not exceed one-half page. Address the following items:

- Describe the organization of the SAP, indicating the section in which each PRS is discussed (e.g., Sections 2.0, 3.0, etc.).
- Identify the PRS numbers and types included in the SAP. If PRSs are grouped for investigation (aggregated), present the logic for grouping them (e.g., geographic location, similar contaminants, similar unit types, contribution to the same problem, etc.).
- If two or more PRSs are described in the SAP, include a table that shows the PRS, PRS type, description (e.g., outfall, septic tank, etc.), HSWA status, whether the PRS is a SWMU or an AOC, and where it is discussed in the document. If there is only one PRS, include this discussion in the text.
- Include the following text

  "Los Alamos National Laboratory (the Laboratory) is a multi-disciplinary research facility owned by the Department of Energy and managed by the University of California. The Laboratory is located in north-central New Mexico approximately 60 miles north-east of Albuquerque and 20 miles north-west of Santa Fe. The Laboratory site covers 43 square miles of the Pajarito Plateau which consists a series of fingerlike mesas separated by deep canyons containing ephemeral and intermittent streams that run from west to east. Mesa tops range in elevation from approximately 6,200 ft to 7,800 ft. The eastern portion of the plateau stands 300-900 ft above the Rio Grand."
- Reference figure 1-1 showing the location of the TA(s) discussed in the SAP. This figure should also present the general locations of the PRSs discussed in the SAP.
- Briefly summarize previous relevant corrective action reports and/or reference relevant RFI reports.
- Briefly summarize the corrective action history of the PRS, including NODs, RSIs, requests for additional work, approvals, other correspondence received from the AA, or other relevant regulatory history. Identify which AA sent the document and give the date received.

1.1 Objectives and Scope

This section should provide the problem definition. Address the following items:

- Present the objectives of the proposed investigation. State and discuss the decisions to be made, relating them to the regulatory requirements discussed in Sections 1.3.1 and 1.3.2. Ensure that the quality and type of data proposed in the SAP will be adequate to resolve relevant regulatory issues.
- Present concrete and specific questions that will be addressed by the investigation and relate them directly to SAP decisions. These questions should correlate to the data gaps identified in Section 2.2.2.3.

1.2 Approach and Implementation

This section should provide an overview of the information to be collected. Address the following items

- Describe, in general terms, the sample collection design (e.g., biased, stratified random, etc.).
- Identify the media to be sampled and frequency (if more than one sample will be collected).
- Discuss the types of samples to be collected (e.g., borehole cores, surface water grab samples, etc.)
- Identify target analyte suites for which samples will be analyzed.

Provide a brief explanation of how the approach will satisfy the objectives of the investigation.

1.3 Background Issues

1.3.1 Regulatory Requirements

In this section, identify the pertinent RCRA and RCRA-related statutory provisions, regulations, and permits that apply to this investigation.

If the SAP addresses only SWMUs, begin this section with the following statement: "The investigation, including sampling and analysis, of solid waste management units (SWMUs) is conducted under the requirements of the Module VIII Hazardous and Solid Waste Amendments (HSWA) of the Laboratory's hazardous waste facility permit, which was issued on May 23, 1990 (EPA 1990, 1585) and modified on May 19, 1994."

If the SAP addresses only AOCs (that is, PRSs not included in the HSWA permit module, begin this section with the following statement: "The investigation including sampling and analysis, of AOCs is conducted under the requirements of RCRA."

If the SAP addresses both SWMUs and AOCs, begin this section with the following statement: "This investigation, including sampling and analysis, is conducted under the requirements of the Module VIII Hazardous and Solid Waste Amendments (HSWA) of the Laboratory's hazardous waste facility permit, which was issued on May 23, 1990 (EPA 1990, 1585) and modified on May 19, 1994."

If sampling and analyses for radionuclides are proposed in this SAP also include the following statement. "An additional standard for radiological contaminants is Department of Energy (DOE) Order 5400.5, 'Radiation Protection of the Public and the Environment." In 1993 this DOE order was issued as a Proposed Rule (proposed 10CFR834) in the Federal Register and covers, among other topics, establishment of dose limits to the public from radiation and radionuclides associated with DOE operations (58 Federal Register 16268 (use most current version), **Radiation Protection of the Public and the Environment**). Although radionuclides are regulated by the DOE and are not regulated under RCRA, it is more efficient and cost effective to investigate all types of potential contamination during a single site characterization. Therefore, radiochemical concerns are addressed as part of this SAP."

1.3.2 Other Issues

In this section, identify nonRCRA regulatory issues including TSCA, surface water, groundwater, and underground storage tanks. Also include a discussion of Laboratory Policies (not ER Policies) that address regulatory issues.

If there are no other issues for the PRS(s), state "No other regulatory issues are applicable for the PRSs presented in this SAP."

If there are stakeholder issues for the PRS(s), discuss them here and refer to Section 5.4, Community Relations Plan.

1.4 Data Quality Objectives Process

Provide a discussion of the specific planning process that was used to develop the objectives and requirements of this SAP. Do not describe the data quality objective process in general terms (i.e., Steps 1 -7 of the EPA DQO Process), but rather describe the specific process that led you to develop the sampling design for the PRSs included within this SAP. Include a flow diagram that illustrates this process.

VSAP PEER REVIEW COMMENT: Discuss what data will be taken and how this data will be used. Cathy, isn't this done somewhere else? If so, we need to discuss.

2.0 Potential Release (PRS) X–PRS X Descriptor

2.1 Characterization and Setting

2.1.1 Site Description

This section should provide a detailed description of the PRS at a scale appropriate to the complexity of the PRS. The author should use judgment about the level of detail. Address the following items as appropriate to describe the general physical properties of the PRS:

- Define the PRS type (e.g., tank, dry well, firing site, etc.),
- Indicate whether the PRS is an AOC or a SWMU (state whether it is listed on HSWA Module VIII).
- Indicate whether the PRS is active or inactive.
- Explain the relationship of the PRS to the TA, OU, or other general area that contains it.
- Describe the geographical location of the PRS (e.g., near what road, portion of TA, location on mesa, etc.)
- If known, provide the total surface area of the PRS and the extent of contamination.
- Identify PRS components (e.g., leach fields, outfalls, inlet pipes, outlet pipes, manholes, etc.) and their construction materials. Provide dimensions, and discuss general physical condition and integrity. Discuss the spatial relationship of PRS components.
- Identify nearby structures and features (e.g., buildings, tanks, roads, fences, paved areas, curbing, drainage features, etc.) and discuss their spatial relationship to the PRS components.

- Include Fig. 2.1-1 showing the location of the PRS in relation to the overall TA. Multiple figures may be used if necessary. Address the following in the figure:
    - Clearly delineate the boundaries of the PRS. Note that the PRS boundary in FIMAD is usually a preliminary guess. The boundary should be updated based on available data to delineate the estimated lateral extent of contamination if it has been determined.
    - Individually identify all of the PRS components and the associated structures and features.
    - Provide labeled coordinate tics to indicate New Mexico State Plane Coordinates.
- Include photographs of the site showing the PRS in the context of the surrounding area, and identify all components and structures associated with the PRS.
- Discuss the current and anticipated future operations and land use of the PRS and all of the PRS components and associated structures and features. Include proposed EM/ER D&D activities or facility management activities and their potential impact on the PRS.
- Identify other PRSs that potentially affect the recommendations for the subject PRS (e.g., nearby outfalls, firing sites, stack emissions, etc.), and provide the operational time frames for these PRSs. If this does not apply, indicate explicitly that this is an isolated unit.

Describe the PRS-specific geomorphology, surface geology, and topography including PRS-specific features in enough detail to support the conceptual model presented in Section 2.2.2. Address the following items:

- Provide the geographical location descriptor for the PRS (e.g., mesa top; mesa edge; canyon bottom; on, near, or in a water course; valley margin; flood plain; alluvial fan; colluvium; etc.).
- List the soil types and depth to bedrock. If available, describe the soil properties (e.g., permeability, porosity, grain size distribution, etc.), and include an assessment of whether contaminants may have affected these properties.
- Describe the occurrence of A, B, and C horizons if it is relevant to the conceptual model.
- Describe the percent and type of vegetative cover and average slope of the site. This information should be consistent with the LANL-ER-AP-4.5 assessment for the PRS.
- Discuss topographic features at the PRS where contaminants may collect.

Describe the PRS-specific hydrology in enough detail to support the conceptual model presented in Section 2.2.2. Address the following items:

- Identify the watershed into which the site drains and whether the stream is ephemeral, perennial, or intermittent at this point.
- Include Fig. 2.1-2 showing all drainages, wetlands, springs, and streams within or adjacent to the PRS that represent potentially impacted media or are important to the conceptual model. This figure may be combined with Fig. 2.1-1 and referenced here if appropriate. Also include the following in the figure:

  - relevant groundwater and surface water monitoring stations, and
  - active and inactive local water-supply and production wells.

- If applicable, discuss the potential for interflow in the soil or tuff. If interflow is a suspected contaminant migration pathway, discuss it in the site conceptual model in Section 2.2.2.
- Describe man-made or natural hydraulic structures or features that might affect the site hydrology (e.g., pipelines; French drains; ditches; unlined ponds; septic tanks; NPDES outfalls; retention areas; topographic influences; geologic features such as fractures, surge beds, and faults; etc.).
- Describe run-on and runoff at the PRS (including direction) and evidence of erosion. This information should be consistent with the LANL-ER-AP-4.5 for the PRS.
- Indicate whether the PRS includes debris in a watercourse (contact the Regulatory Compliance Focus Area (Steve Veenis) for a determination). If there is no debris in a watercourse at the PRS, state that here. This information should be consistent with the LANL-ER-AP-4.5 assessment for the PRS.

In addition address the following items:

- Discuss PRS-specific climatic information that might influence the conceptual model for the PRS (e.g., wind direction for a firing site).
- Identify PRS-specific cultural and biological resources that may be present at the PRS (e.g., threatened and endangered species).

2.1.2 Operational History

This section should provide a complete, stand-alone description of the PRS-specific operational history. Include activities associated with the PRS (e.g., stack emissions, dispersion from firing sites, activities in buildings that contributed to septic tanks, etc.). This information should include sufficient detail so that the nature (and possibly the location) of all sources of contamination at the PRS are identified. Do not simply refer to the work plan or other archival documents (see the general guidelines for guidance on referencing archival documents).

Address the following items:

- Describe the past operations at the PRS, including basic operational activities, maintenance activities, cleaning and storing of equipment, and waste management practices (including whether there was treatment, storage, or disposal of hazardous wastes at the PRS). Provide dates and durations for these activities. Discuss the processes and the chemicals used at the PRS that may have contributed to contamination.
- Describe the past land use at the PRS (when relevant, include the land use for surrounding and/or adjacent areas), including a description of site accessibility and authorized and unauthorized human use of the site.
- If the PRS is active, describe current operations at the PRS. Include a discussion of current waste management practices that affect the PRS.
- If remedial activities have occurred (e.g., UST Bureau-required cleanups, TSCA cleanups, interim measures, stabilization activities, etc.), describe these activities and indicate the RCRA corrective action status of the PRS (i.e., Phase I, Phase II, VCA, VCM, etc.).

- Describe the volumes and periods of known releases or discharges that occurred at the PRS. This discussion should include both permitted and unpermitted releases or discharges (e.g., stacks, spills, etc.). Include information on quantity, physical form (solid, liquid or gas), physical description (e.g., powder, oily sludge, etc.), and chemical class (e.g. acid, base, solvent). If there is actual release or discharge data, include it in Section 2.2.1, Existing Data. If information regarding releases or discharges is unknown, state so.

2.1.3 Waste Characteristics

In this section briefly summarize the potential contaminants that may be present at the PRS based on PRS description and operational history. Begin this section with the following paragraph:

> "This section addresses the potential contaminants that may be present at this PRS based on the information contained in Section 2.1.1, Site Description, and Section 2.1.2, Operational History. This information is potentially relevant to 'waste' only to the extent that 'solid waste,' as that term is defined under RCRA, is subsequently generated at this PRS. This discussion of potential contaminants in no way implies that the materials present at this PRS are 'solid waste' or 'hazardous waste' as those terms are defined under the New Mexico Statutes Annotated (NMSA), the New Mexico Administrative Code (NMAC), RCRA, HSWA, SWDA, or other statutes or regulations."

2.2 Investigatory Approach

2.2.1 Existing Data

2.2.1.1 Nonsampling

This section should describe nonsampling investigations (e.g., geophysical surveys, threatened and endangered species surveys, wetland delineation, key elements of AP-4.5 assessments, radiological walkover surveys, waterflow data, etc.) that have occurred at the PRS. Do not simply refer to the work plan or other archival documents for information regarding the previous investigations (see the guidance on referencing archival documents under Section 2.1.2).

Address the following items:

- Summarize the nonsampling data that are available for the PRS (i.e., data that are not based on analysis of a discrete sample) and that are pertinent to the site conceptual model and the sampling design. Include both ER investigations and non-ER investigations (e.g., ongoing LANL Environmental Surveillance work, etc.). Provide the collection dates for these data, and identify the organization that collected the data (e.g., ESH, ER, etc.).

- Include data from known releases or discharges that occurred at the PRS (e.g). This discussion should include both permitted and unpermitted releases or discharges (e.g., stacks, spills, etc.). Include detected contaminant concentrations, and the volumes, periods, and durations of releases or discharges. If information is unknown, state so.

- Discuss the data and results of each nonsampling investigation and include a summary table if appropriate (use judgment as to format). If providing summary tables, use separate tables for various media (e.g., water, soil and tuff, etc.)

If no previous nonsampling investigations have been performed, indicate that no previous investigations have been performed at the PRS.

2.2.1.2 Sampling

This section should describe sampling investigations that have occurred at the PRS, including previous sampling efforts (e.g., RFI, environmental surveillance, fixed-point [discrete sample] radiological surveys, etc.). Do not simply refer to the work plan or other archival documents for information regarding the previous investigations (see the guidance on referencing archival documents under Section 2.1.2).

Address the following items:

- Summarize the sampling investigations that have occurred at the PRS (i.e., data that are based on the analysis of a discrete sample) and that are pertinent to the site conceptual model and the sampling design. Include both ER investigations and non-ER investigations (e.g., ongoing LANL Environmental Surveillance work, etc.). Provide the dates of field work for all previous investigations, and identify the organization conducting the investigation (e.g., ESH, ER, etc.).

- Discuss the data and results of each investigation and include a summary table of the analytical results (use judgment as to format). For previous RFI investigations that provide input to the conceptual model presented in Section 2.2.2, include a summary table of the investigation results that provides enough information to adequately support the conceptual model. When data from previous investigations are not sufficient to support the conceptual model, state why the existing data are inconclusive and refer to Section 2.2.2.3, Data Gaps for a detailed discussion. For broader data such as surveillance data, summarize the data and provide a reference for the complete data set (Editors, it is not necessary to attach the complete data set in the SAP).

- If relevant, include a figure (or multiple figures if needed) showing sampling locations for each investigation.

If no previous sampling investigations have been performed, indicate that no previous investigations have been performed at the PRS.

2.2.2 Conceptual Model

Sections 2.2.2.1 and 2.2.2.2 should present the conceptual model of contaminant occurrence and distribution at the PRS being investigated. This model is based on archival information and/or previous field investigations. The individual components of a conceptual model described in this outline are not universally applicable at all PRSs. The conceptual model should be sufficient to support the rational for the sample collection design. The author should use judgment to ensure that the level of detail in these sections is appropriate to address the complexity and existing knowledge for the PRS.

2.2.2.1 Nature and Extent of Contamination

Summarize the relevant information pertaining to the operational history and physical setting presented Sections 2.1.1 and 2.1.2. This may include the following items:

- The boundaries of the PRS investigation (e.g., the toe of the colluvial slope below an outfall, a topographic feature constraining migration, the boundary of an adjacent investigation or remedial action, etc.)

- The time period of releases at the PRS.

- The estimated types, quantities, and physical form of environmental media potentially receiving contaminant releases at the PRS.

- The site topography, soil properties, vegetative features, and hydrological properties of the PRS. This should include, if relevant, alluvial or perched aquifers, the distance to the main aquifer, the locations of nearby springs and seeps, etc., and the potential hydraulic interconnections between them.
- Anthropogenic activities that may have disturbed the PRS subsequent to releases.

Describe the current understanding of the nature and extent (both vertical and horizontal) of potential contaminants that may be present above background. Refer to the relevant data presented in Sections 2.2.1.1 and 2.2.1.2. This may include the following items:

- Graphical presentation of the extent of contamination when appropriate and feasible (e.g., a cross section showing vertical definition and a topographic map showing horizontal definition).
- Discussion of the adequacy of existing sample analyses to identify potential contaminants at the PRS.
- Discussion of whether the observed types and locations of contaminants are consistent with the PRS history and environmental setting.
- Discussion of whether assumptions used to select sampling locations are consistent with expectations derived from the PRS history and environmental setting.
- Analysis of spatial and/or temporal trends to establish extent. This might include answering questions such as the following: Are complicating factors (e.g., variability in soil characteristics such as organics content) potentially affecting the observed spatial distribution? Provide an attachment for specific statistical methods and calculations employed.

If statistical methods are used to estimate contaminant concentrations (e.g., kriging or some other interpolation method), briefly discuss the methods used and why they were used. Refer to a detailed description of the methodology in the IWP and/or a statistical attachment to this SAP. If applicable, include isopleth maps of contaminant distributions here or, if they interfere with the flow of the text, place them in the statistical attachment to this SAP and reference them here.

2.2.2.2 Fate and Transport

This section should identify and provide a discussion of the chemical and physical aspects of environmental fate. Discuss the consequences of environmental distribution of contaminants for sampling activities.

Identify and discuss the chemical and physical aspects of transport and partitioning among various environmental media. Discuss chemical and biological transformation and degradation in various environmental media, including what is known about chemical speciation, biotic and abiotic mechanisms of environmental transformation, and transfer of contaminants among environmental media. This may include the following items:

- Prediction of chemical valence states and associated complexes based on pH and redox conditions.
- Susceptibility of contaminants to chemical degradation such as hydrolysis and photolysis and the human health or ecological significance of possible breakdown products.
- Susceptibility of contaminants to biotic (microbial) degradation and their possible breakdown products.

- Affinity of contaminants for soil (adsorption), water (solubility) and air (volatility) phases of soil, sediment, or tuff. Discuss the likely fate of contaminants among these compartments and, if possible, the residence time of these contaminants in the environment.
- Chemical characteristics affecting contaminant migration (including vapor pressure, solubility, organic carbon partitioning coefficient, etc.) and their interpretation. This may also include volatilization potential for individual contaminants, sorption, desorption, and bioconcentration in biota.
- Relevant atmospheric parameters including wind roses, measured airborne particulate concentrations, etc.
- Vertical migration in the saturated zone and erosion of potentially contaminated soil as a potential contaminant transport pathway.
- Infiltration and leaching of contaminants into soil and/or tuff with surface water. This evaluation may include, if applicable, retardation characteristics, fracture flow dynamics, etc.
- Groundwater transport parameters, if applicable, such as direction of flow, hydraulic conductivity, retardation factors, etc.
- Potential for transport in surface water including sheet flow and channels as identified in LANL-ER-AP-4.5.
- Potential for uptake transport of contaminants in the food chain with particular emphasis on biomagnification.
- In a generic sense, identify pathways by which exposure can occur for both human and ecological receptors.

If relevant, discuss in detail the point at which the Canyons Focus Area (or other potential analysis area) will supplement or take over the investigation for further analysis. Provide the rationale for the hand off.

2.2.2.3 Data Gaps

Describe information gaps or uncertainties in the conceptual site model. Specifically, identify where the current understanding of the PRS remains incomplete or limited by the quantity, location; the spatial variability of PRS contamination; incomplete site history; etc.

2.2.3 Sampling Activities

In this section, describe the sampling design and the rationale for the design based on the site conceptual model presented in Section 2.2.2. This section is **PRS-specific only** and intended to identify the assumptions underlying the design, such as:

- expectations about spatial distributions and levels of contamination;
- the rationale for selecting sampling locations;
- whether the sampling design was influenced by the existence and reliability of field kits and other on-site analytical tools;
- collocation of contaminants or the use of indicator contaminants;

- how nonsampling activities (e.g. radiological survey) will be used to guide sampling; and
- physical and temporal constraints affecting the design.
- collocation of contaminants.

Describe with the appropriate level of detail the sampling design that will be used (e.g. grid sampling, judgmental approach, or a statistically based design). If some of the items in Section 2.2.3, apply to all PRSs presented in this SAP, the material should be presented only once in Section X.1, Data Quality Objectives, rather than repeating the information numerous times. Some discussion of the sampling design may be better presented in Sections 2.2.3.1, Contaminant Source, and 2.2.3.2, Media Characterization. Authors may use judgment in the presentation of this material.

Note: for a given PRS it is possible that both Sections 2.2.3.1 and 2.2.3.2 (below) may apply; or only one of these sections may be applicable.

Describe the following as appropriate:

- Evaluation of the investigation data including statistical analyses and target levels with which PRS data will be compared.
- Identify sources of information for statistical or other comparisons as appropriate. Sources of information may include background data sets, previously collected baseline data, or data from an upgradient well, etc.
- Identify data quality assessment information to be collected to verify critical assumptions.
- Describe how data usability will be evaluated with respect to the assumptions and requirements of the SAP design. For example, describe how field screening data will be correlated with fixed laboratory results.
- Discuss reasonably anticipated contingencies that might lead to major variances from this SAP. Be sure that these contingencies ~~are constrained by~~ follow the requirements of "Accelerated Corrective Action Approach" (NMED RCRA Permits Management Program Document Requirement Guide, March 4, 1998, Section III.C.1).

Conclude this section with the following statement: "Based on the sampling design discussion above and in Sections 2.2.3.1 and 2.2.3.2, the samples to be collected are presented in Table XX and the sampling locations are shown on Figure XX."

- Provide a table (or tables) of all samples to be collected, including analytical and QA/QC samples. Include the analytical suites and methods to be requested for each analytical sample, sample matrixes and/or geological media, and planned sampling depths and/or intervals. Include in the table the type of sample to be collected (e.g., grab). If samples are a type other than grab samples, provide the sample type and method. If water samples are proposed, include in the table whether samples are filtered or unfiltered.
- Include a figure showing sample locations (including field duplicate samples) and the area where nonsampling investigations (such as geophysical investigations) will be conducted, if any. If it does not detract from the presentation, use different symbols to distinguish between surface and subsurface samples.

2.2.3.1 Contaminant Source

Contaminant source sampling includes sampling the actual source of contamination that may have been released at the PRS, such as the contents of drums, pipes, tanks, etc., and/or materials of construction such as the wall of a tank or a building foundation. Contaminant source sampling may be conducted for determining the nature of potential contaminants, and may provide an upper estimate of levels of contamination. The purpose of contaminant source characterization may include the following:

- determining the presence or absence of the contaminants at the source;
- determining the nature (type) of contaminants present at the source;

This section should present the details of the field and sampling activities to be performed. Citations of SOPs and other procedures to be followed in implementing the sampling activities are presented in Section 4.0. Be sure to address the following items (as applicable):

- Summarize the nonsampling activities (e.g., core and/or borehole logging, periodic flow measurements, geophysical surveys, geomorphologic surveys, etc.).
- Summarize the sampling activities, including the number of samples to be collected for both field screening measurements and fixed lab analyses, the media they will be collected from, the types of samples to be collected, etc. If portions of the PRS are not sampled, say so and state why (e.g., the PRS is active, etc.). Indicate the rate or frequency of field QA/QC sample collection for each matrix.
- Describe proposed installation of air, groundwater, and/or surface water monitoring stations. Refer to Section 4.3, Field Activities for installation details.
- Describe the number and types of field screening measurements and/or surveys (e.g., FIDLER, in-situ XRF, etc.) to be used. It is not necessary to include data collected exclusively for health and safety. Provide the type of field-screening instrument(s) used, and the general frequency and range of levels detected for the chemicals investigated with each type of instrument. Use judgment as to whether to use table format.
- If applicable, explain how selection of samples for laboratory analyses will be based on the results of field surveys and/or field screening measurements.
- Describe contingency plans and provide criteria to be used by the field team to determine when a contingency plan should be invoked.

If no contaminant source sampling is planned, state that no sampling is planned.

2.2.3.2 Media Characterization

Media characterization sampling at a PRS addresses media impacted by the release. Impacted media may include soil, sediment, tuff, water, air, and biota. The purpose of media characterization may include the following

- determining the presence or absence of the contaminants in various media at the PRS;
- determining the nature (type) of contaminants present at the PRS;
- bounding the extent of contamination; or
- characterizing physical properties of the affected media e.g. soil porosity, particle size, permeability, etc., that influence contaminant fate and transport.

This section should present the details of the field and sampling activities to be performed. Citations of SOPs and other procedures to be followed in implementing the sampling activities are presented in Section 4.0. Address as applicable all the items described in Section 2.2.3.1, Contaminant Source.

If no media characterization sampling is planned, state that no sampling is planned.

3.0 PRS Y–PRS Y DESCRIPTOR

Repeat all information provided in section 2.0 for each PRS covered by this SAP.

X.0 DATA COLLECTION DESIGN AND PROCEDURES

X.1 Data Quality Objectives

Describe how the data collected under this SAP will be used for decision-making, including how the usability and adequacy of the data will be determined. **Keep in mind that this section applies globally to all PRSs presented in this SAP.**

Address the following as appropriate:

- Describe how nonsampling activities (e.g. radiological survey) will be used to guide sampling.
- Discuss the physical and temporal constraints affecting the design.
- Evaluation of the investigation data including statistical analyses and target levels with which PRS data will be compared.
- Identify sources of information for statistical or other comparisons as appropriate. Sources of information may include background data sets, previously collected baseline data, or data from an upgradient well, etc.
- Specify requirements that will insure that analytical detection limits will be adequate to detect chemicals at levels of concern
- Identify data quality assessment information to be collected to verify critical assumptions.
- Describe how the precision and accuracy of measurements will be assessed.
- Describe how data usability will be evaluated with respect to the assumptions and requirements of the SAP design. For example, describe how field screening data will be correlated with fixed laboratory results.
- Describe how the data adequacy for meeting the objectives of the SAP will be determined. The data assessment process described in Section D of the ER Project QAPP in Chapter 4.0 of the 1996 IWP (ER ID # 57368) should be referenced if applicable.
- Discuss reasonably anticipated contingencies that might lead to major variances from this SAP. Be sure that these contingencies ~~are constrained by~~ follow the requirements of "Accelerated Corrective Action Approach" (NMED RCRA Permits Management Program Document Requirement Guide, March 4, 1998, Section III.C.1).

Consider including a decision logic diagram to be followed in order to implement this SAP. The diagram may address requirements to be followed for data collection, for data evaluation, to determine the need for additional data, etc.

If points of discussion provided in Section X.1 above apply only to a specific PRS presented in this SAP, the material should **not** be presented here, but rather in Section 2.2.3, Sampling Activities.

X.2 Quality Assurance/Quality Control

Specify the type, number, and frequency field quality assurance/quality control (QA/QC) samples (such as field duplicates or rinsate blanks) to be collected and submitted for fixed lab analysis.

If the use of site-specific performance evaluation (PE) samples is planned, describe the types of samples and how the sample results will be used.

State that all QA/QC activities associated with field measurements and surveys will be carried out as specified in the applicable SOP.

X.3 Field Activities

This section should provide a level of detail that makes the sampling activities outlined in Section 2.2.3 third-party implementable. Cite all applicable SOPs and procedures. Refer to the appropriate sections of the ER Project QAPP in Chapter 4 of the 1996 IWP (ER ID # 57368).

The following items should be addressed.

- Describe surveying and permanent marking of survey and sample locations.
- Describe PRS preparation for surveys and sampling.
- Describe sampling methods to be used, citing SOPs. Consider use of a table format for lengthy lists.
- Provide details for the proposed installation of air, groundwater and/or surface water monitoring stations. If the installation of wells is planned, include a detailed description of the well construction with reference to well types described in the Hydrogeologic Work Plan.
- Identify screening instruments, field test kits, etc. to be used, citing SOPs.
- Describe auxiliary field measurements to be made, e.g., dry sieving to determine particle size fractions.
- Describe the laboratory analytical methods to be used. Cite the ER Project statement of work for analytical services for routine services. If nonroutine analyses are planned, describe special requirements. Specify special requirements such as quick turnaround or special sample cleanup.
- Describe and cite the appropriate SOPs that will be followed for sample control and documentation; for handling, packaging, and shipping of samples; for data tracking; and for data management. The ER Project QAPP may be cited as appropriate.
- Describe the verification and validation procedures for analytical data. The ER Project QAPP may be cited as appropriate.

X+1.0 PROJECT MANAGEMENT

X+1.1 Project Scheduling and Reporting Requirements

Provide a schedule for the activities described in this SAP including anticipated start and finish dates for field work. Anticipate the length of time each field activity will require and include time for analyses of samples, data assessment, and preparation of reports. Identify the organizations responsible for performing the sampling. State the expected frequency and content of reports and, if possible, provide the expected deliverable date for reports to DOE and/or the AA.

X+1.2 Health and Safety Plan

Use the following statement: "A site-specific Health and Safety Plan will be developed in accordance with The Environmental Restoration Project Site-Specific Health and Safety Plan (SSHASP), LANL EM/ER:95-PCT-012, April 13, 1995 (ER ID # 56448)." These ER ID numbers will be verified and, if necessary, corrected.

X+1.3 Investigation-Derived Waste Plan

Use the following statement: "Investigation-derived waste, if any, will be handled in accordance with LANL-ER-SOP-1.06 (ER ID # 57367)." These ER ID numbers will be verified and, if necessary, corrected.

X+1.4 Community Relations Plan

Use the following statement: "Community Relations are governed by the Public Involvement Plan in Chapter 7 of 1996 IWP (ER ID # 57368)." These ER ID numbers will be verified and, if necessary, corrected.

REFERENCES

LANL (Los Alamos National Laboratory). "Los Alamos National Laboratory Environmental Restoration Program Standard Operating Procedures," Los Alamos National Laboratory report, Los Alamos, New Mexico. (ER ID # 57367). These ER ID numbers will be verified and, if necessary, corrected.

Project Consistency Team. "Project Consistency Team (PCT) Policy Memo Notebook," (Controlled), Environmental Restoration Project, Los Alamos National Laboratory, Los Alamos, New Mexico. (ER ID # 56448). These ER ID numbers will be verified and, if necessary, corrected.

LANL (Los Alamos National Laboratory), December 1996. "Installation Work Plan for Environmental Restoration Program," Revision 6, Los Alamos National Laboratory Report LA-UR-96-4629, Los Alamos, New Mexico. (ER ID # 57368). These ER ID numbers will be verified and, if necessary, corrected.

Attachment 2

RFI Report Annotated Outline

RESOURCE CONSERVATION AND RECOVERY ACT
FACILITY INVESTIGATION REPORT

LOS ALAMOS NATIONAL LABORATORY
ANNOTATED OUTLINE

GENERAL GUIDELINES

The section headings in this outline were distributed to all New Mexico Environment Department (NMED) regulated facilities at a workshop on March 4 and 5, 1998. At that workshop, NMED mandated that every Resource Conservation and Recovery Act (RCRA) facility investigation (RFI) report submitted to the State after March 4, 1998, must follow the numbered and lettered section headings in this outline.

The annotation in this outline was developed by Los Alamos National Laboratory (LANL or the Laboratory) and NMED to clarify the contents in each section. The annotation addresses a wide range of site complexities, and some items may not be applicable for all sites. If the information called for in the annotation is available, it should be provided. If the information called for is currently unknown or unavailable, do what is reasonable to provide it, but do not perform a study to provide such information unless it is integral to the potential release site (PRS) decision. Check with the Regulatory Compliance Focus Area Leader (Tori George at 5-6953, torig@lanl.gov) before undertaking such a study.

Follow this outline when preparing RFI reports unless permission to deviate is obtained. All requests for deviation should be addressed to the Regulatory Compliance Focus Area Leader (Tori George at 5-6953, torig@lanl.gov), who will coordinate discussion with the State. Deviations will be permitted for cases in which adherence to the outline compromises technical quality.

Follow these general guidelines throughout the document:

- The audience is the public. Write the report so that the public can understand the rationale for each PRS decision.
- Do not submit the RFI report if the data did not meet the objectives.
- Include all details relevant to the decisions presented.
- If PRSs are near one another or potentially affect the same media with similar contaminants, treat them together rather than as isolated units. Further guidance for aggregating PRSs will be developed by the Analysis and Assessments Focus Area to ensure that cumulative ecological and human health issues are appropriately addressed.
- It is not sufficient to state that relevant information is available in the work plan or other archival documents. The reader should not have to read the work plan or other documents to understand the PRS description, operational history, or any other information relevant to the site. Include all relevant details and descriptions from previous documents using one of the following methods:
  - The preferred method is to quote the relevant material verbatim, providing enough reference information for the reader to locate the original material (include both section numbers and page numbers). If terminology in the quotation is no longer in use, provide current terms in brackets following out-of-date terms. This

should be explained in the introduction to the quotation. The following is a sample quotation introduction:

"The following information was reproduced from Section 3.4.1, pages 56–58, of the RFI Work Plan for OU 1234 (LANL 1992, ER ID12345). Certain terminology in the work plan is no longer in use. Therefore, current terms are added in brackets following the out-of-date terms in this quotation."

- When the quotation is so lengthy that it would break up the flow of the text, summarize the information, providing enough reference information for the reader to locate the original material (include both section numbers and page numbers).
- When new information has become available since the work plan was submitted, summarize the information from the work plan and discuss the changes that have occurred. The new write-up should provide a complete account that incorporates previous information with current understanding.

- Each focus area is responsible for establishing reference sets in the LANL Environmental Restoration (ER) Project Reference Library following the guidance in the reference library quality procedure (currently in preparation). These reference sets should include all archival documents, methodology documents, technical guidance, etc. referenced in Administrative Authority (AA) submittals. Note that the ER Project Office will be responsible for submitting project-wide documents such as the Installation Work Plan. Also, it is not necessary to resubmit previously submitted work plans, sampling and analysis plans, RFI reports, voluntary corrective action (VCA) plans, VCA completion reports, etc. Documents that apply only to this RFI report may be attached in Appendix G-2.0, Referenced Documents. Guidance on referencing documents and submitting reference materials to the AA can be obtained from ER Project technical editors.
- If a no further action (NFA) recommendation is based largely on archival documents and the documents can no longer be located, it will be necessary to find another basis for justifying the NFA decision.
- The body of the RFI report should include only PRS-specific information relevant to portraying the PRS and understanding the decision presented. General information that applies to all of the PRSs in the document (e.g., descriptions of the technical area (TA) or general area containing the PRSs, descriptions of the statistical approaches, etc.) should be presented in the appendixes.
- Add appendixes as needed following Appendix G to include necessary information that does not belong in the body of the report or in one of the existing appendixes.
- Add attachments to this document as needed. Be sure to include a cover sheet for each attachment that explains what the attachment contains and gives the title and date of the RFI report with which the attachment belongs.
- If a section called for in the outline does not apply to the PRS being discussed, indicate that the section is not applicable for the PRS and provide a rationale. Provide the statement and rationale under the highest appropriate section number, and omit all sections that fall under the general section (e.g., if the statement falls under Section 2.4.3, omit Sections 2.4.3.1 and 2.4.3.2).

- The AA and the public need to be aware that we considered all of the items specified in this outline. If an item called for in the annotation is unknown or unavailable, state that it is unknown or unavailable (e.g., no interflow map is available for this PRS, the amount of liquid released is unknown, etc.).
- Present the PRSs in sequential order unless there is a reason for presenting them in a different order (e.g., it might make sense to organize related PRSs together).
- Create subheadings under the sections in this outline as needed to organize the text, but do not number the additional subheadings. Use bold font to set them apart.
- Use consistent units for all measurements in the report, especially when reporting concentrations for chemicals of potential concern in soil/sediment and water samples. Clearly identify the units for all numbers in all tables in the report.
- Provide sample identification (ID) numbers, analyte concentrations, and comparison values in text discussions. For example, it is not sufficient to say, "Mercury was present at levels exceeding the screening action level (SAL)." Say instead, "Mercury was present in sample 0153-96-4567 at 100 mg/kg, which exceeds the SAL of 23 mg/kg." Note that this bullet does not apply for summary sections where information may be presented more briefly.
- It is the data user's responsibility to present data from the Facility for Information Management, Analysis, and Display (FIMAD) in the appropriate format. This includes using the proper number of significant figures. Improper use of significant figures could indicate to the reader a lack of professionalism and inattention to the data sets being presented, thus presenting a poor image of the Laboratory. It is important to document an impact to a decision resulting from rounding data values. Make sure the data presentation is logical and defensible.
- When discussing structures, provide both the structure number and a brief statement of what the structure is. For example, it is not sufficient to refer to "structure TA-32-6." Refer instead to "structure TA-32-6, a valve house containing access points to piping at PRS 12-345." This information should be provided both on the first occurrence, and on all subsequent occurrences. If the description is too complicated to fit in the text or adds repetition to the report, a footnote may be used.
- If ongoing actions (e.g., water monitoring) are discussed, cite documents that describe the actions. In the RFI report discussion, provide the frequency of the activity, the regulatory authority that drives the activity, the expected duration of the activity, etc.
- Do not use jargon, LANL-specific terms, vague terms, or other imprecise language. Be explicit in all discussions and do not expect the reader to make assumptions or inferences based on limited information.
- Use the term "regional aquifer" instead of "main aquifer."
- When recommending a future corrective action for a PRS, use the general term "accelerated corrective action" rather than "voluntary corrective action" or "voluntary corrective measure." Note the following:

- VCAs are typically low-cost, short-term corrective actions. Approval for a VCA must be obtained from the AA before proposing a PRS for NFA. Sites appropriate for VCAs are typically low priority sites.
- Voluntary corrective measures (VCMs) are performed on relatively small-scale sites with obvious remedies that require enhanced regulatory involvement because of complexity, cost, or location. the AA must approve the VCM plan before field activities, and approve the VCM report before the PRS is proposed for NFA.

• Follow ER Project formatting standards for font, type size, header and footer style, references, and other formatting issues. A template for the appropriate format is available through the ER Project technical editors.

• Format textual references using ER ID numbers rather than Master Reference List or other reference numbers, and include reference set and tab numbers for locating referenced documents in the reference library (see the General Guidelines for information about this library). Contact an ER Project technical editor for further information.

• Be sure to use an ER Project technical editor as you plan, write, and produce RFI reports. ER Project technical editors will be updated regularly on changes to this outline. Involving an editor early in the RFI reporting process will help to ensure that the document meets current standards for content and format, and that it is submitted on schedule.

EXECUTIVE SUMMARY

The executive summary should be synopsis of the entire document, including the description and history, the investigation activities, and the results, conclusions, and recommendations for each potential release site (PRS). The executive summary should be written after the document is complete. The contents of the executive summary will vary depending on the issues at the PRS, but all of the items discussed in these annotations should be included.

Briefly summarize the PRS description and operational history. Address the following items:

- Provide the PRS numbers and types for the PRSs included in the report, and indicate whether each PRS is an area of concern (AOC) or a solid waste management unit (SWMU). Identify the PRS components (e.g., leach fields, outfalls, inlet pipes, outlet pipes, manholes, etc.) and the structures and features associated with the PRS (e.g., buildings, tanks, roads, fences, paved areas, curbing, drainage features, etc.).

- If PRSs are grouped for evaluation, provide the logic for grouping them (e.g., geographic location, similar contaminants, similar unit types, contribution to the same problem, etc.).

- Explain the relationship of the PRSs to the facility, technical area (TA), or other general area that contains them, and describe the specific location of each PRS.

- If it is relevant to the recommendations, briefly describe the PRS-specific topography, surface geology, geomorphology, and hydrology.

- Indicate whether each PRS is active or inactive, and discuss the current and anticipated future operations and land use.

- Summarize the past operations at the PRS, including basic operational activities, maintenance activities, cleaning and storage of equipment, and waste management practices. Provide the dates for these activities. Discuss the processes that may have contributed to contamination and the chemicals used at the PRS that contributed to the list of chemicals of potential concern (COPCs).

- Describe how contaminants were deposited at the PRS before the Resource Conservation and Recovery Act (RCRA) facility investigation (RFI), including quantity, physical form (i.e., solid, liquid, or gas), physical description (e.g., powder, oily sludge, etc.), and general chemical class (e.g., acid, base, solvent, etc.).

- If relevant, briefly summarize the findings of past data (e.g., contaminants previously identified) and the main implications of these findings.

Briefly summarize the investigation activities. Address the following items:

- Summarize the questions to be answered by the data, and state whether this is a first (i.e., Phase I) or continued (i.e., further or Phase II) investigation.
- Briefly describe the investigation activities and the types of data collected. Include field survey types, field screening types (both to support sampling locations and PRS decisions), and sampling types (e.g., surface, subsurface, augering, drilling, trenching, monitor-well completion, etc.).
- Summarize the analyses conducted for each PRS and summarize concerns about the quality of the data.

Briefly summarize the results and recommendations. Address the following items:

- Summarize the results of the human health screening and/or risk assessment, the ecological screening and/or risk assessment, and the other applicable assessments. Do not use screening assessment terminology or compare the data to screening action levels. Instead, focus on the conclusions of the data assessment, listing the COPCs for the PRS and making general statements such as the following:

  "Based on the analytical results, barium, aluminum, and copper were identified as COPCs for this PRS. These chemicals are not anticipated to impact human health or ecological receptors based on the site assessments conducted."
- Summarize what is known about the nature and horizontal and vertical extent of contamination. State whether the extent has been bounded and whether contaminants are being transported beyond the PRS boundaries and by what mechanism.
- Identify gaps in the data and justify the assumptions that address these gaps.
- For each PRS, summarize the conclusions and recommendations and the rationale behind them, including the assumptions made in the revised site conceptual model.
- If relevant, briefly discuss how and at what point the Canyons Focus Area (or other potential analysis area) will supplement or take over the investigation.
- Provide a projected schedule of activities associated with PRSs not recommended for no further action (NFA). If PRSs need to be added to Module VIII of the Laboratory's hazardous waste facility permit, provide a projected date for the submission of a request for permit modification

Include a table following Example Table ES-1, and state that it provides summary information for each PRS. Provide the current NFA criterion in the table when NFA is recommended, and reference the *New Mexico Environment Department RCRA Permits Management Program Document Requirement Guide* (NMED 1998, ER ID 57897).

EXAMPLE TABLE ES-1

SUMMARY OF PROPOSED ACTIONS

PRS Number	PRS Description	HSWA[a]	Radionuclide Component[b]	Proposed Action	Rationale for Recommendation	Section Number
0-001	Outfall	Yes	Yes	NFA, Criterion 5[c]	RCRA and radionuclide contamination are below SALs.	2.0
0-003	Inactive septic tank	Yes	No	Accelerated Cleanup	RCRA contamination exceeds SALs; remedy obvious.	3.0
0-004	Drum storage area	No	No	Further Investigation	Nature and extent of contamination unknown.	4.0
0-005	Storage container area	No	Yes	Accelerated Cleanup	Radionuclide contamination exceeds SALs; remedy obvious.	5.0
0-006	Sump and drain line	Yes	Yes	Further Investigation	RCRA contamination is below SALs. Radionuclide contamination will be addressed.	6.0

a. If the site is listed in Module VIII of the Laboratory's Hazardous Waste Facility Permit, then "yes" applies. Otherwise, "no" applies.

b. If a release has occurred at the PRS and radionuclides are associated with the release, then "yes" applies. Otherwise, "no" applies.

c. NFA Criteria are listed in Section II.B.4.a.(4).(b), "No Further Action (NFA) Proposals Criteria," in the *NMED RCRA Permits Management Program Document Requirement Guide* (NMED 1998, ER ID 57897).

Note: The information in this table is example data. The footnotes should be included in the table.

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TABLE OF CONTENTS

APPENDIXES

1.0 INTRODUCTION

This section is intended to be a brief overview of the contents of the report. For most reports, this section should not exceed two pages. Begin this section with the following paragraphs:

> "Los Alamos National Laboratory (LANL or the Laboratory) is a multi-disciplinary research facility owned by the Department of Energy (DOE) and managed by the University of California. The Laboratory is located in north-central New Mexico approximately 60 miles northeast of Albuquerque and 20 miles northwest of Santa Fe. The Laboratory site covers 43 square miles of the Pajarito Plateau, which consists of a series of fingerlike mesas separated by deep canyons containing ephemeral and intermittent streams that run from west to east. Mesa tops range in elevation from approximately 6,200 ft to 7,800 ft. The eastern portion of the plateau stands 300 to 900 ft above the Rio Grande.
>
> The Laboratory's Environmental Restoration (ER) Project is involved in a national effort by the DOE to clean up facilities that were formerly involved in weapons production. The goal of the ER Project is to ensure that DOE's past operations do not threaten human or environmental health and safety in and around Los Alamos County, New Mexico. To achieve that goal, the ER Project is currently investigating sites potentially contaminated by past Laboratory operations.
>
> The sites under investigation are either solid waste management units (SWMUs) or areas of concern (AOCs). In the LANL ER Project, SWMUs and AOCs are collectively referred to as potential release sites (PRSs)."

Next, establish the regulatory context for the investigation by including the following text:

> "This investigation, including sampling and analysis, is conducted under the requirements of the Resource Conservation and Recovery Act (RCRA)."

If the report addresses SWMUs and/or AOCs that are included in Module VIII of the Laboratory's Hazardous Waste Facility Permit, also include the following text:

> "For PRSs [list PRSs], the investigation is in accordance with the Hazardous and Solid Wastes Amendments of 1984 (HSWA) and follows the requirements in Module VIII of the Laboratory's Hazardous Waste Facility Permit (EPA 1990, ER ID 01585). Module VIII was issued to the Laboratory by the US Environmental Protection Agency (EPA) on May 23, 1990 and modified on May 19, 1994."

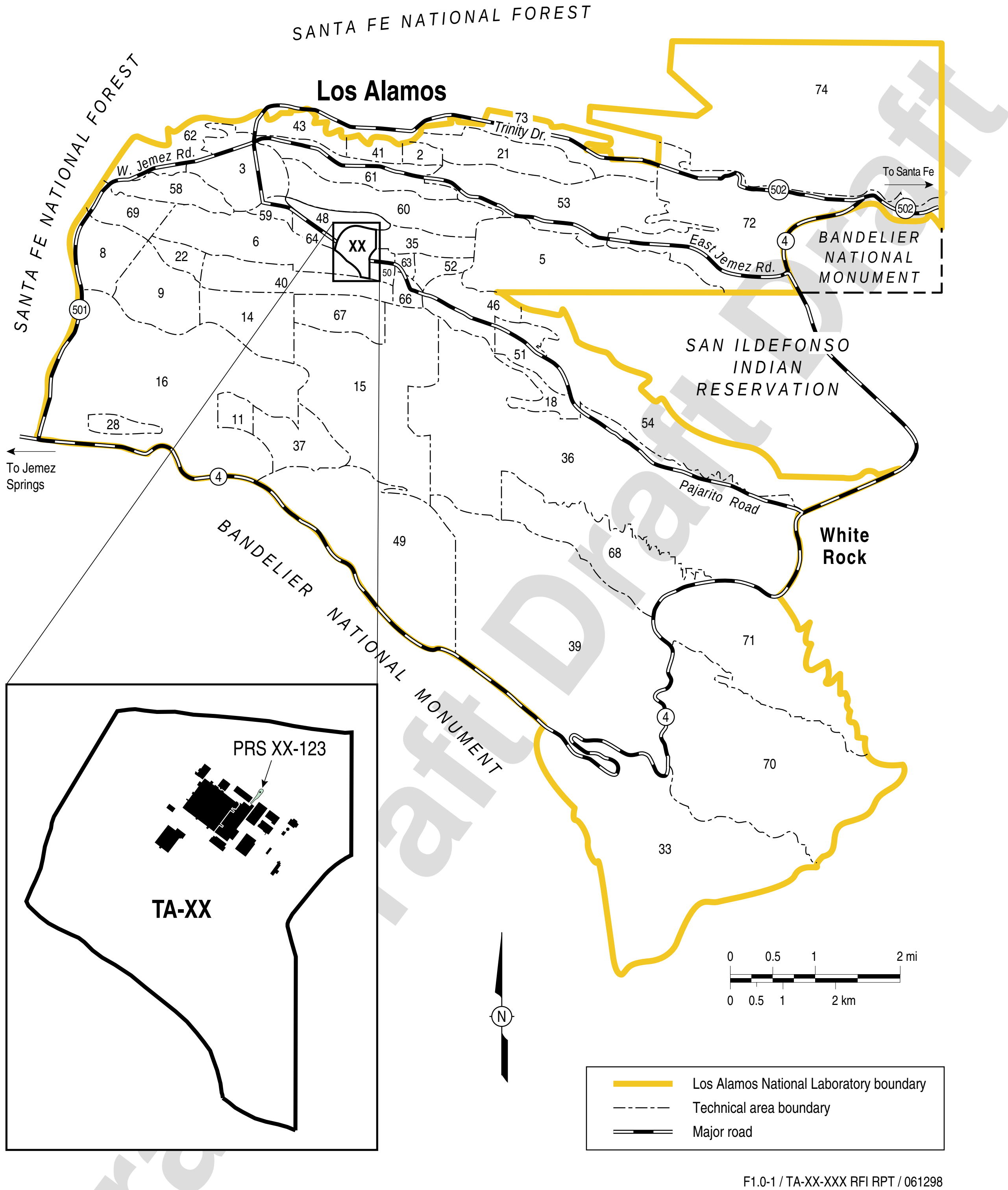
If sampling and analyses for radionuclides are discussed in this report, include the following text:

> "Radionuclides are regulated under DOE Order 5400.5, 'Radiation Protection of the Public and the Environment' (proposed rule 10 CFR 843.5 in 58 FR 16268). In this report, PRSs [list PRSs] have a radionuclide component."

State that the current Installation Work Plan (IWP) (LANL 1996, ER ID 55574) describes the methodologies used in the investigation and analysis. Recent changes to data review and screening assessment methodologies may not be reflected in the current IWP. If a methodology currently in use is not in the current IWP, include a description of the methodology in the relevant appendix and state that it is included.

Address the following items:

- Identify the PRS numbers and types for the PRSs included in the report. If PRSs are grouped for evaluation, present the logic for grouping them (e.g., geographic location, similar contaminants, similar unit types, contribution to the same problem, etc.)
- Include a figure following Example Figure 1.0-1 and state that it provides an overview of the Laboratory and indicates the locations the technical areas (TAs) and the general locations of the PRSs discussed in the report.
- Describe the organization of the report, and indicate that each PRS is discussed in a separate section (e.g., Sections 2.0, 3.0, etc.).
- Describe the contents of each appendix.
  - State that a list of acronyms and a glossary of terms is located in Appendix A.
  - State that the current and anticipated future land use of the general area that includes the PRSs (e.g., the facility, TA, or other general area) is discussed in detail in Appendix B-1.0, Operational History and Land Use. State that Appendixes B-2.0 through B-6.0 include a detailed discussion of the climate, geology, hydrology, ecological resources, and cultural resources for this general area.
  - State that Appendix C includes the complete quality assurance/quality control (QA/QC) results.
  - State that Appendix D provides an abridged version of the data for the investigation, and that the complete data have been submitted to the Administrative Authority (AA) in electronic format.
  - If statistical calculations were conducted, state that Appendix E provides these calculations.
  - If a human health or ecological risk assessment was conducted, state that Appendix F provides risk calculations.
  - State that Appendix G-1.0 summarizes the administrative history of the PRSs and provides copies of all AA correspondence and LANL's responses. State that Appendix G-2.0 contains documents referenced in this RCRA facility investigation (RFI) report that are specific to this report. Indicate that other references are or will be included in the appropriate reference set of the LANL ER Project Reference Library (see the General Guidelines for information about this library).



Example Figure 1.0-1. **Location of TA-XX with respect to Laboratory technical areas and surrounding land holdings.**

2.0 POTENTIAL RELEASE SITE X—PRS X DESCRIPTOR (e.g., PRS 12-345—INACTIVE SEPTIC TANK AND ASSOCIATED OUTFALL)

The information in the sections beginning with Section 2.0 should be PRS-specific. General information about the area that includes the PRS (e.g., the facility, TA, or other general area) should be presented in these sections only if it is relevant to the decision for the PRS. If it is not directly relevant, such information should be put in the appendixes.

2.1 Summary

This section should briefly summarize the investigation activities, results, and recommendations for the PRS. For most reports, this section should not exceed two pages. Address the following items:

- Briefly describe the PRS (one or two sentences).
- Summarize the questions to be answered by the data (this information should correspond to the problem definition section in the sampling and analysis plan [SAP]). State that details are included in Section 2.3.3, Preliminary Conceptual Model.
- Summarize the RFI activities (e.g., the types and numbers of samples collected, the analyte suites for which samples were analyzed, stabilization activities, etc.). State that details are included in Section 2.3.4.2, Field Investigation.
- Summarize what is known about the nature and extent of contamination. Briefly discuss the actual and potential migration of contaminants from the PRS. Identify gaps in the data. State that details are included in Section 2.3.5, Revised Site Conceptual Model.
- Summarize the results of the human health screening and/or risk assessment and the ecological screening and/or risk assessment. State that details for the screening assessments are included in Section 2.4.2.1 for human health and Section 2.4.2.2 for ecological. If applicable, state that details for the risk assessments are included in Section 2.4.3.1 for human health and Section 2.4.3.2 for ecological, and that all calculations are included in Appendix F, Risk Assessment Calculations.
- Summarize the conclusions and recommendations for the PRS and the rationale behind them, including the assumptions made in the revised site conceptual model. State that details are included in Section 2.5, Conclusions and Recommendations.
- If relevant, briefly discuss how and at what point the Canyons Focus Area (or other potential analysis area) will supplement or take over the investigation. State that details are included in Section 2.3.5.2, Environmental Fate.

2.2 Description and Operational History

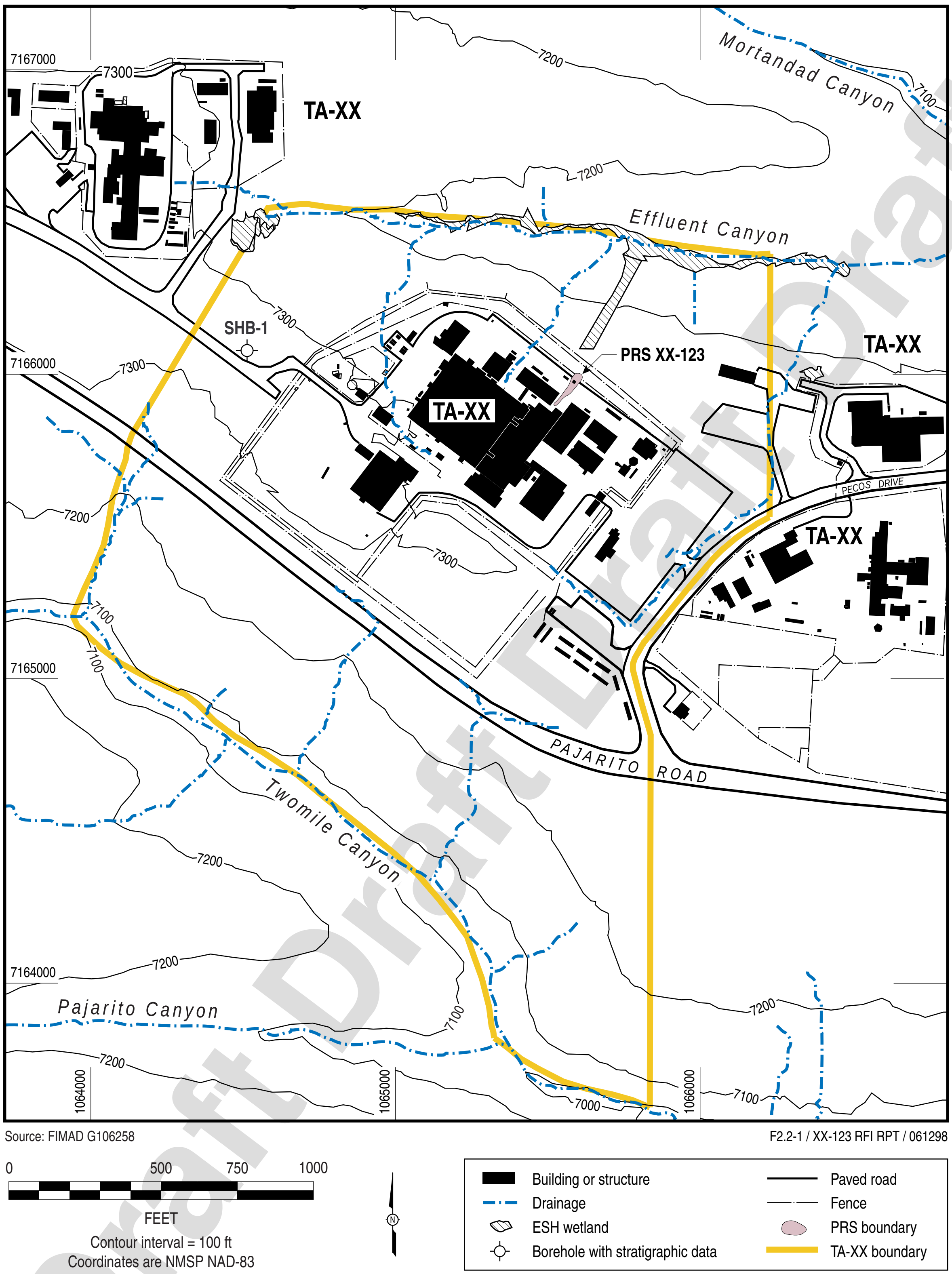
Indicate whether the PRS is an AOC or a SWMU, and state whether it is included in Module VIII of the Laboratory's Hazardous Waste Facility Permit. If it is not listed in Module VIII, explain why.

2.2.1 Site Description

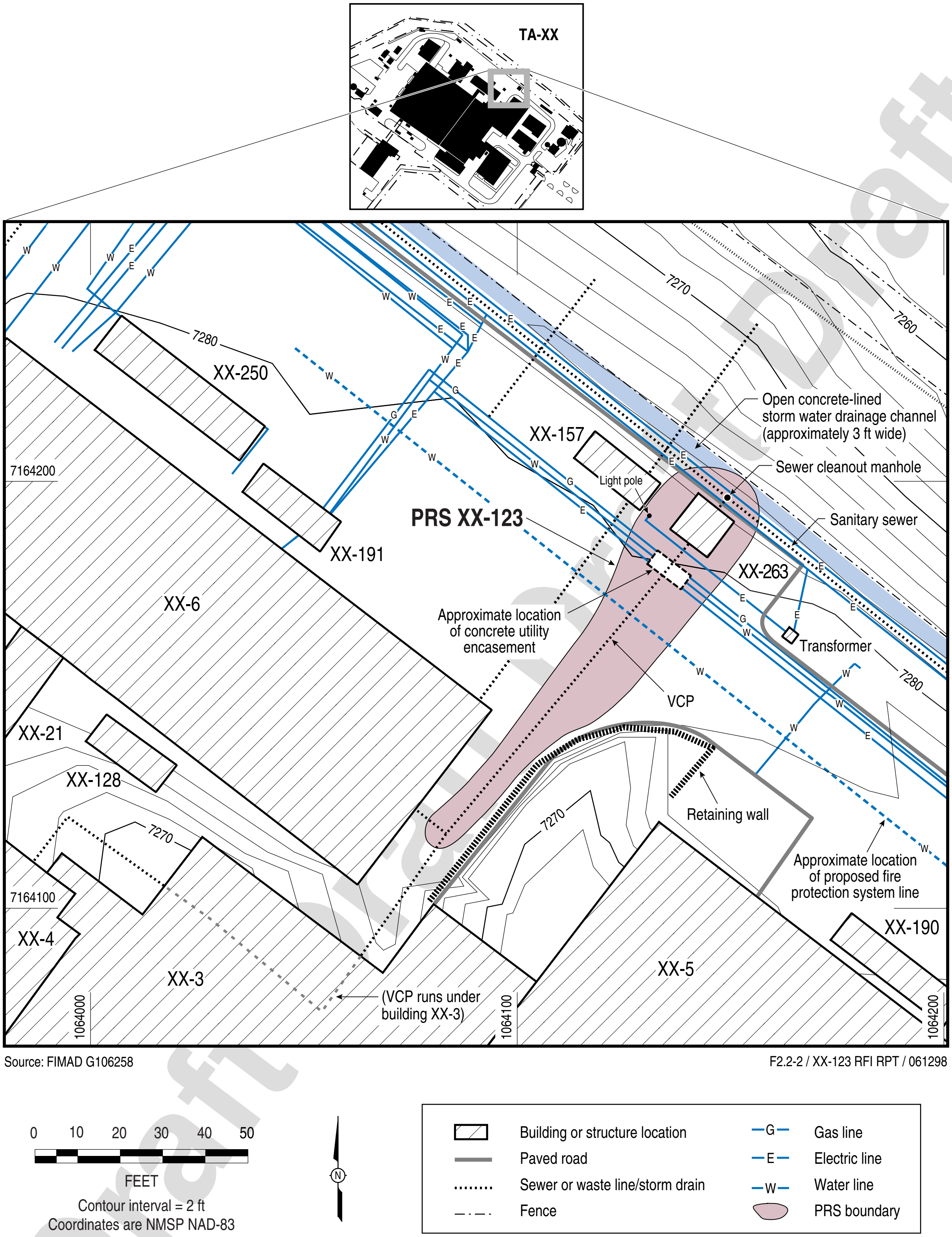
This section should be a complete, stand-alone description of the PRS. The bolded headings are examples of how the site description might be organized. Authors may choose to organize this section differently, but all of the annotated items should be addressed.

Physical Description

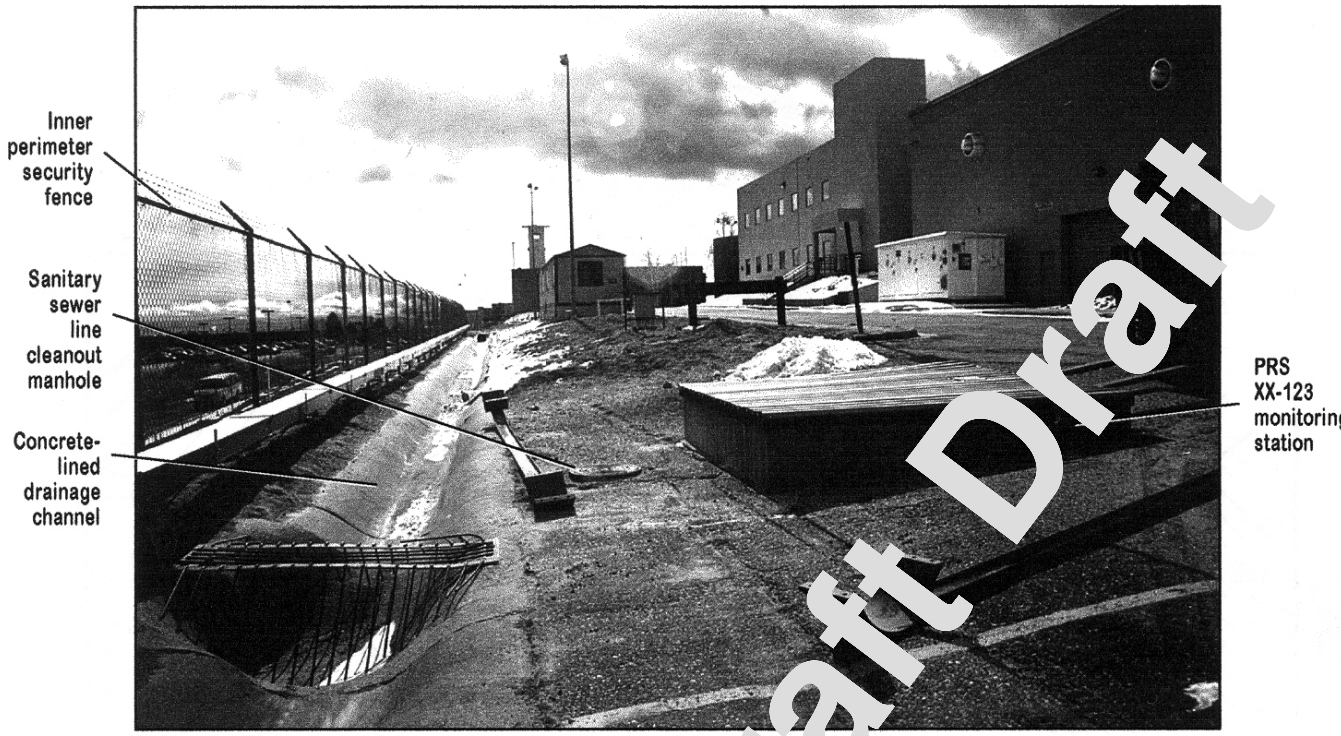
- Provide the PRS type (e.g., tank, dry well, firing site, etc.).
- Indicate whether the PRS is active or inactive.
- Provide the geographical location descriptor for the PRS (e.g., mesa top; mesa edge; canyon bottom; on, near, or in a water course; valley margin; flood plain; alluvial fan; colluvium; etc.).
- Explain the relationship of the PRS to the facility, TA, or other general area that contains it.
- Describe the location of the PRS (e.g., proximity to roads, location within the TA, location on the mesa top, etc.)
- If known, provide the total surface area of the PRS based on the extent of contamination. If the extent of contamination is unknown, provide an approximate estimate or state that a discussion of the extent of contamination is included in Section 2.3.5, Revised Site Conceptual Model.
- Identify all PRS components (e.g., leach fields, outfalls, inlet pipes, outlet pipes, manholes, etc.) and their construction materials. For each component, provide the dimensions and discuss the general physical condition and integrity. Discuss the spatial relationship of the PRS components.
- Identify nearby structures and features (e.g., buildings, tanks, roads, fences, paved areas, curbing, drainage features, etc.), and discuss their spatial relationship to the PRS components.
- Include a figure (or multiple figures as needed) following Example Figures 2.2-1 and 2.2-2, and state that it shows the location of the PRS relative to its TA. Multiple figures may be used if necessary. Address the following in the figure:
  - Clearly delineate the PRS boundaries. Note that the PRS boundary in the Facility for Information Management, Analysis, and Display (FIMAD) is usually a preliminary guess. The PRS boundary should be updated based on the estimated lateral extent of contamination if it has been determined.
  - Individually identify all of the PRS components and the associated structures and features.
  - Provide labeled coordinate tics for New Mexico State Plane Coordinates.
- Include photographs of the site, and state that the photographs show the PRS in the context of the surrounding area. All components and structures associated with the PRS should be labeled on the photographs. Follow Example Figures 2.2-3 and 2.2-4.



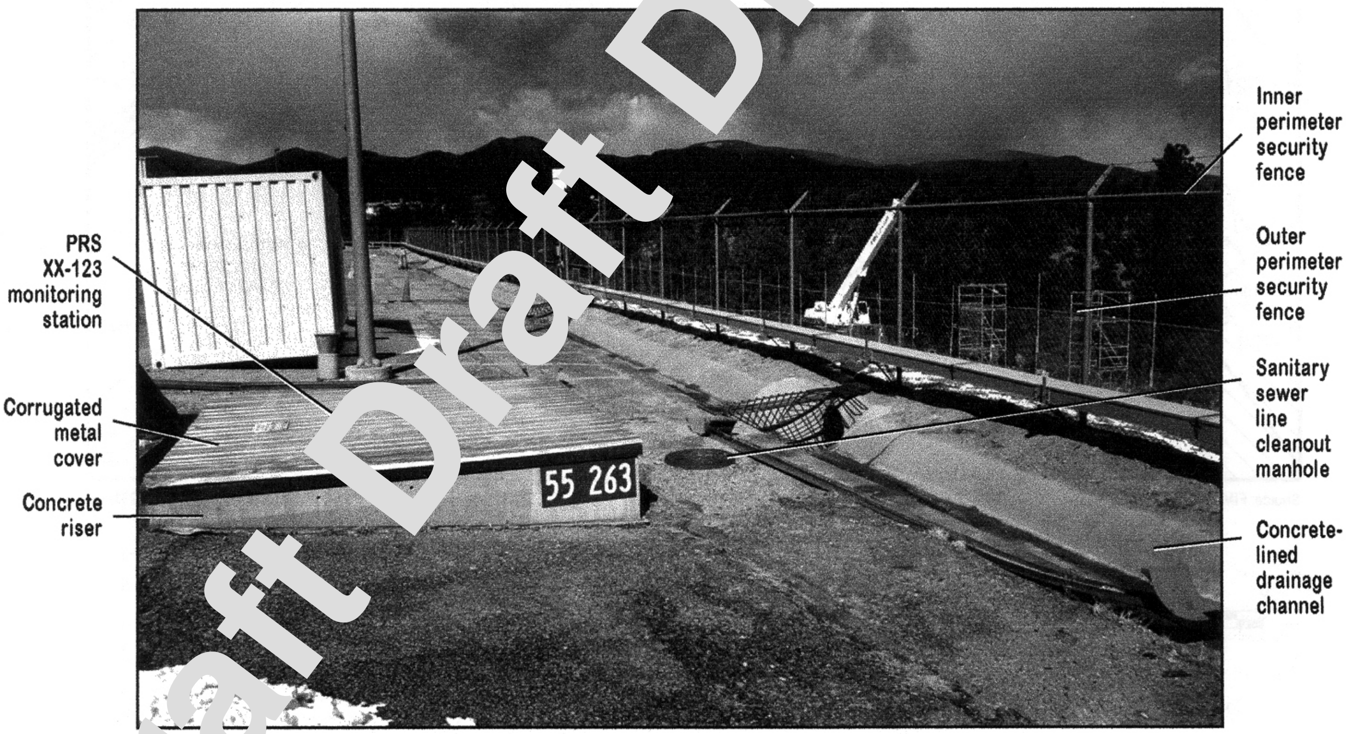
Example Figure 2.2-1. Location of PRS XX-123 and associated physical features near TA-XX.



Example Figure 2.2-2. Engineering features and utilities in the vicinity of PRS XX-123.



Example Figure 2.2-3. Photograph of PRS XX-123 looking east.



Example Figure 2.2-4. Photograph of PRS XX-123 looking west.

Land Use

- Discuss the current and anticipated future operations and land use of the PRS, all of the PRS components, and the associated structures and features. This information can be found in the 1995 update of the LANL Site Development Plan (LANL 1995, ER ID 57224). Briefly discuss the accessibility of the PRS. Discuss proposed Environmental Management (EM)/ER decontamination and decommissioning (D&D) activities or facility management activities and their potential impact on the PRS. Follow the example below:

  "TA-12 is an industrial area currently used for plutonium research and processing. LANL does not anticipate any change from this industrial use for the operational life of the Laboratory (LANL 1995, ER ID 57224, pp. 11–12). TA-12 is a high-security area with restricted access. It is surrounded by two chain link fences, one of which is topped with barbed wire. These security measures effectively eliminate the possibility of inadvertent site intrusion. No D&D activities are currently proposed for this site."

Relation to Other PRSs

- Identify other PRSs that potentially affect the recommendations for the subject PRS (e.g., nearby outfalls, firing sites, stack emissions, etc.), and provide the operational time frames for these PRSs. If this does not apply, state that this is an isolated unit.

Environment

Discuss PRS-specific climatic information that differs from the information in Appendix B-2.0, Climate, or that might influence the decision for the PRS (e.g., wind direction for a firing site). State that detailed information is included in Appendix B-2.0.

Describe the PRS-specific geomorphology, surface geology, and topography, including PRS-specific features beyond those described in Appendix B-3.0, Geology. Address the following items:

- Provide the soil types and depth to bedrock, and state that descriptions of the soil types are included in Appendix B-3.2, Soils. If known, describe the soil properties (e.g., permeability, porosity, grain size distribution, etc.), and include an assessment of whether contaminants have affected these properties.

- If it is relevant to the conceptual model, describe the occurrence of A, B, and C horizons.

- Describe the percent and type of vegetative cover, and provide the average slope of the site. This information should be consistent with the LANL ER Administrative Procedure (AP) 4.5 assessments included in Appendix B-4.2.1, and also with the ecological scoping checklist included in Appendix F-2.0. The ecological scoping checklist should be used to develop the information in Section 2.4.2.2(a), Scoping.

- Discuss topographic features where contaminants may collect at the PRS.

Describe the PRS-specific hydrology including PRS-specific features beyond those described in Appendix B-4.0, Hydrology. Address the following items:

- Identify the watershed into which the site drains and whether the stream is ephemeral, perennial, or intermittent at the location of the PRS.

- Include a figure that shows all drainages, wetlands, springs, and streams within or adjacent to the PRS that represent potentially impacted media or are important to the conceptual model. If appropriate, this figure may be combined with Figure 2.2-1 and referred to here (see Example Figure 2.2-1). In addition to the drainages, wetlands, springs, and streams, include the following in the figure:
  - relevant groundwater and surface water monitoring stations,
  - other PRSs that potentially affect the recommendations for the subject PRS, and
  - active and inactive local water-supply and production wells.
- If applicable, discuss the potential for interflow in the soil or tuff. If interflow is a suspected contaminant migration pathway, be sure to evaluate its significance in Section 2.3.5, Revised Site Conceptual Model.
- Describe man-made or natural hydraulic structures or features that might affect the site hydrology (e.g., pipelines; French drains; ditches; unlined ponds; septic tanks; NPDES outfalls; retention areas; topographic influences; geologic features such as fractures, surge beds, and faults; etc.).
- Describe run-on and runoff at the PRS (including direction) and evidence of erosion. This information should be consistent with the LANL-ER-AP-4.5 assessments included in Appendix B-4.2.1.
- Indicate whether the PRS includes debris in a watercourse. Contact the Regulatory Compliance Focus Area (Steve Veenis at 662-0606, sveenis@merrick.com) for a determination. If there is no debris in a watercourse at the PRS, state so. This information should be consistent with the LANL-ER-AP-4.5 assessments included in Appendix B-4.2.1.

Cultural and Biological Resources

- Indicate whether PRS-specific cultural resources are present. If none are present, state so. State that general information regarding cultural resources at the facility, TA, or other general area is included in Appendix B-6.0.
- Indicate whether PRS-specific biological resources have been observed or are potentially present (e.g., threatened and endangered species, habitats, etc. as identified in the ecological scoping checklist). If none are present, state so. State that general information regarding ecological resources at the facility, TA, or other general area is included in Appendix B-5.0. State that the ecological scoping checklist is included in Appendix F-2.0.

2.2.2 Operational History

This section should be a complete, stand-alone description of the PRS-specific operational history. Include all activities associated with the PRS (e.g., stack emissions, dispersion from firing sites, activities in buildings that contributed to septic tanks, etc.). Do not simply refer to the work plan or other archival documents (see the General Guidelines for guidance on referencing archival documents).

Address the following items:

- Describe past operations at the PRS, including basic operational activities, maintenance activities, cleaning and storage of equipment, and waste management practices (including whether there was treatment, storage, or disposal of hazardous wastes at the PRS). Provide dates and durations for these activities. Discuss the processes and chemicals used at the PRS that may have contributed to contamination.
- Describe past land use at the PRS (when relevant, include land use for surrounding and/or adjacent areas).
- If the PRS is active, describe current operations and include a discussion of current waste management practices that affect the PRS.
- Provide the volumes and periods of known releases or discharges that occurred at the PRS, including both permitted and unpermitted releases or discharges (e.g., stacks, spills, etc.). Include information on quantity, physical form (i.e., solid, liquid, or gas), physical description (e.g., powder, oily sludge, etc.), and general chemical class (e.g., acid, base, solvent, etc.). If there are data for the release or discharge, include the data here. If the history of releases or discharges is unknown, state so.

2.3 Investigatory Activities

2.3.1 Summary

This section should briefly state what is included under Section 2.3. It should not exceed two short paragraphs. Use the following example:

> "Section 2.3 describes the investigatory activities for PRS 12-345, including previous investigations (Section 2.3.2), the preliminary conceptual model that guided the RFI field work (Section 2.3.3), and the RFI field activities (Section 2.3.4.2). A review of the RFI data is also presented (Section 2.3.4.3) followed by a description of how the conceptual model for PRS 12-345 was revised based on information gained during the RFI (Section 2.3.5)."

2.3.2 Previous Investigations

This section should describe investigations that occurred at the PRS before the RFI. This section should not include RFI work, even if the work was conducted in multiple phases. All RFI activities and results should be discussed in Section 2.3.4, Field Investigation and Data Evaluation. Do not simply refer to the work plan or other archival documents for information regarding the previous investigations (see the General Guidelines for guidance on referencing archival documents).

Address the following items:

- Summarize the investigation history of the PRS, including all previous geophysical, analytical, and biological investigations. Include both ER investigations and non-ER investigations (e.g., ongoing LANL Environmental Surveillance work, etc.). Provide the dates of field work for all previous investigations, and identify the organization conducting the investigation (e.g., Environmental Safety and Health [ESH], ER, etc.).

- If remedial activities have occurred (e.g., Underground Storage Tank [UST] Bureau-required cleanups, Toxic Substances Control Act [TSCA] cleanups, interim measures, stabilization activities, etc.), describe these activities and indicate the RCRA corrective action status of the PRS (i.e., Phase I, Phase II, voluntary corrective action [VCA], voluntary corrective measure [VCM], etc.).

- Discuss the data and results of each investigation. Include a summary table of the analytical results (use judgment as to format). If broader data such as surveillance data, field screening data, and boring logs exist for the PRS, do one of the following: If the data are pertinent to the PRS decision, state that the data are included in Appendix D-4.0, Non-RFI Data, and include them there; if the data are not pertinent to the PRS decision, cite the document in which the data set is reported.

- If data from previous investigations are used directly in the data review, screening assessment, and risk assessment, state that the data are included in Appendix D-3.0, Other Applicable RFI Results, and include the data there.

- If relevant, include and refer to a figure (or multiple figures if needed) showing sampling locations for each investigation. Use judgment as to format.

If no previous investigations have been performed at the PRS, state so.

2.3.3 Preliminary Conceptual Model

This section should present the preliminary conceptual model of contaminant occurrence and distribution at the site. This model is based on archival information and/or previous field investigations. This model should have been presented in detail in the SAP, and it should be summarized here to allow the reader to evaluate and interpret results in the intended context.

Address the following items:

- Briefly summarize relevant information on the history and setting of the PRS, and state that details are included in Section 2.2, Description and Operational History.

- If there are data from investigations previous to the RFI, explain how these data were used in developing and supporting the site conceptual model.

- Describe the expected nature and extent (both vertical and horizontal) of contamination. Discuss aspects of the environmental fate of contaminants, as it is understood based on information previous to the RFI, that are relevant to the PRS decision.

Investigatory Approach

- Summarize the rationale for the sampling design based on the preliminary conceptual model, and state the questions to be answered by the data.

2.3.4 Field Investigation and Data Evaluation

2.3.4.1 Summary

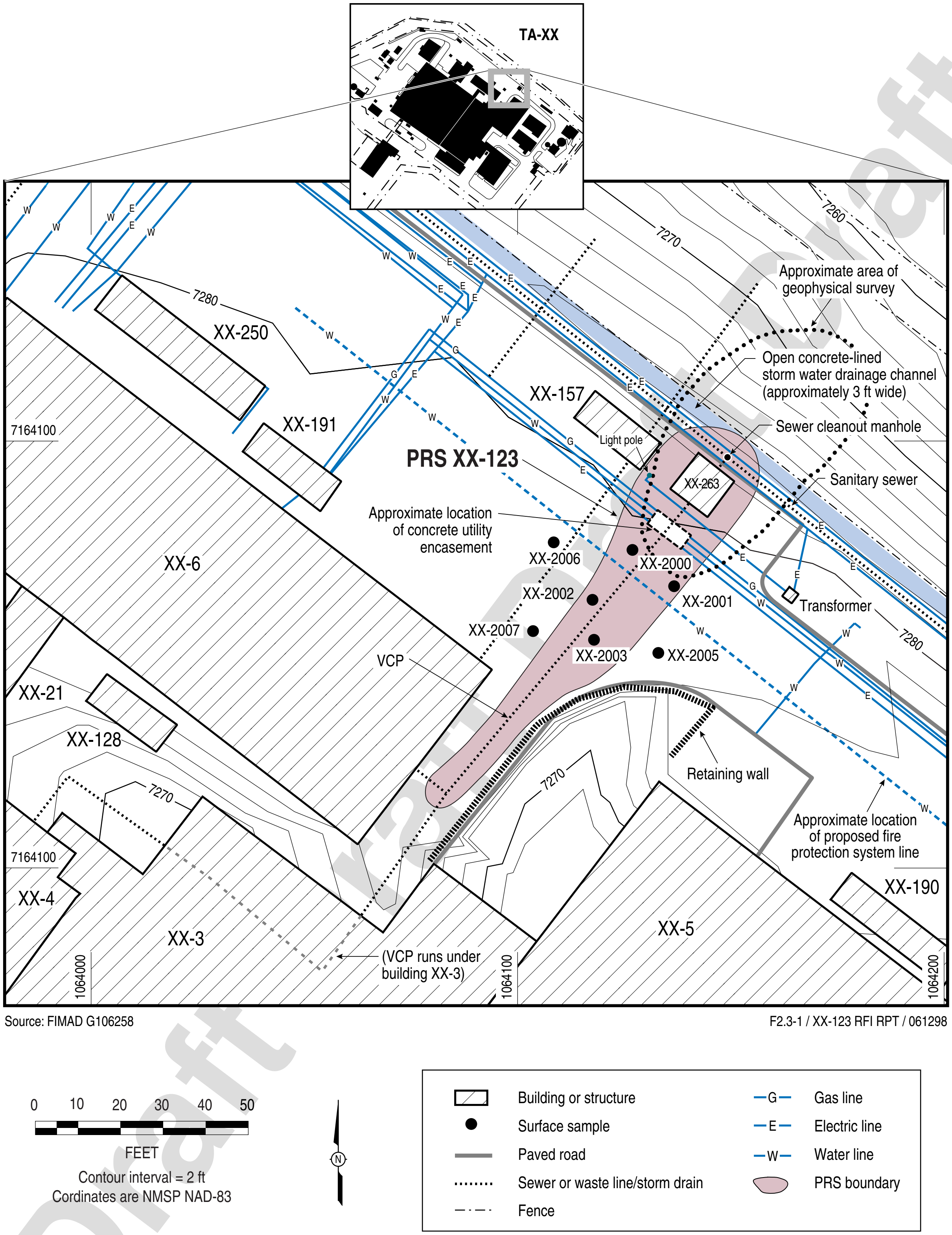
This section should briefly state what is included under Section 2.3.4.1. Use the following example:

> "Section 2.3.4 describes the field investigation and data evaluation for PRS 12-345. The field investigation is discussed in Section 2.3.4.2, and the data review is included in Section 2.3.4.3."

2.3.4.2 Field Investigation

This section should describe the investigation activities. Address the following items:

- Provide the start and finish dates of the RFI field work (sampling may include one or more seasons).
- Describe the prevailing climatic conditions during sampling.
- Identify and reference the standard operating procedures (SOPs) and field procedures that were followed. Discuss deviations from the SOPs and procedures.
- Discuss deviations from the work plan or SAP that occurred during field work. Indicate whether the deviation was reported and approved and by whom (e.g., EPA, NMED, etc.). If applicable, state that the approval letter is included in Appendix G-1.2, Other Regulatory Documents, and include it there. Address the following items:
  - Indicate what was supposed to have been done based on the SAP.
  - Clearly describe the deviation.
  - Explain why the deviation was necessary.
  - Discuss the impact of the deviation on the success of the field activities.
- Identify the organizations (e.g., the ER Project team) responsible for performing the sampling.
- Summarize the nonsampling activities (e.g., core and/or borehole logging, periodic flow measurements, geophysical surveys, geomorphological surveys, etc.).
- Include a figure following Example Figure 2.3-1, and state that it shows sample locations (including field duplicate samples) and the area where nonsampling investigations (such as geophysical investigations) were conducted. If it does not detract from the presentation, use different symbols to distinguish between surface and subsurface samples.
- In the text, summarize the sampling activities, including the number of samples collected for both field screening measurements and fixed laboratory analyses, the media they were collected from, the types of samples collected, etc. If portions of the PRS were not sampled, say so and state why (e.g., the PRS was active, etc.). Indicate the rate of field QA/QC sample collection for each matrix.



Example Figure 2.3-1. Locations of PRS XX-123 samples and areas of nonsampling investigation.

- Include a table following Example Table 2.3-1, and state that it summarizes the samples collected during this investigation that were submitted for fixed-laboratory analysis. Include both analytical and QA/QC samples, the analytical suites requested for each analytical sample, and the request number. State that additional information such as the analytical laboratory name was submitted to the AA in electronic format as discussed in Appendix D-2.0, RFI Analytical Results.

EXAMPLE TABLE 2.3-1

PRS 12-345

SUMMARY OF SAMPLES COLLECTED FOR FIXED-LABORATORY ANALYSIS[a]

Location ID	Sample ID	Sample Type	Depth (ft)	Media*	VOCs	SVOCs	Inorganic Chemicals	Radionuclides
12-0001	0212-97-1285	Grab	0–0.5	Soil	11111	11111	13212	NA[b]
12 -0002	0212-97-1286	Grab	0.5–1	Qbt 3	11111	11111	13212	NA
12 -0003	0212-97-4691	Grab	0–0.5	Soil	11211	11211	13212	13222
12 -0004	0212-97-4692	Grab	0.5–1	Soil	11211	11211	13212	13222
12 -0004	0212-97-4693	Grab/duplicate	0.5–1	Soil	11111	11111	13212	13222
12 -0005	0212-97-4700	Grab	0–0.5	Soil	11211	11211	13212	13222
NA	0212-97-4701	Trip blank	NA	NA	11234	11234	13212	13222
12 -0008	AAA1000	Grab	0.5–1	Soil	11111	11111	13212	13222

a. Numbers in the cells for each analytical suite are request numbers.
b. NA = Not applicable.
*Indicate the specific soil master horizon or, if appropriate, the geologic subunit.

Note: The information in this table is example data. Footnotes designated by letters are part of the example. Footnotes designated by asterisks are guidance for preparing the table.

- If composite samples (either horizontal or vertical) were collected for the PRS, state whether or not composite sampling was included in the approved work plan or SAP. If so, state that the approval documents are included in Appendix G-1.0, Documentation of Regulatory History, and include them there. If the composite sampling was not included in the work plan or SAP, then prior approval of this deviation must be obtained from the AA. Contact the Regulatory Compliance Focus Area Leader (Tori George at 5-6953, torig@lanl.gov) for guidance in cases where composite sampling was conducted without AA approval.

- In the text, describe the numbers and types of field screening measurements and/or surveys (e.g., field instrument for the detection of low-energy radiation [FIDLER], in-situ x-ray fluorescence [XRF], etc.), and discuss the QA/QC procedures and detection limits used for field screening.

- Include a table following Example Table 2.3-2, and state that it summarizes the field screening samples. Include the types of field screening performed for each field screening sample, the sampling location, and the concentration or field indicator for each measurement. It is not necessary to include data collected exclusively for health and safety purposes unless such data were used to select sampling locations. If field screening samples are paired with analytical samples, correlate this information in the table.

EXAMPLE TABLE 2.3-2
PRS 12-345
SUMMARY OF FIELD SCREENING SAMPLES COLLECTED[a]

Location ID	Screening Sample ID	Depth (ft)	Media*	HE Spot Test Result	Fixed-Laboratory Sample ID
12-0001	0212-97-0003	0–0.5	Soil	Positive	0212-97-1285
12-0002	0212-97-0034	0.5–1	Qbt 3	Negative	NA[b]
12-0003	0212-97-0051	0–0.5	Soil	Negative	0212-97-4691

a. Descriptions of the analytical methods used for this PRS can be found in Appendix C-1, Table C-1.0-1. Detection limits can be found in Appendix D-1, Table D-1.0-1.

b. NA = Not applicable.

*Indicate the specific soil master horizon or, if appropriate, the geologic subunit.

Note: The information in this table is example data. Footnotes designated by letters are part of the example. Footnotes designated by asterisks are guidance for preparing the table.

- In the text, state the rationale for selecting samples for fixed-laboratory analyses. Provide the type of field-screening instrument(s) used and the general frequency and range of levels detected for the chemicals investigated with each type of instrument. State that the correlation, if any, between field screening and fixed-laboratory results is discussed and interpreted in Section 2.3.4.3(d), Other Applicable Data.
- Indicate whether there were zones of visible staining or possible contaminant-related odors. If so, state that soil boring/logging descriptions containing photoionization detector (PID)/organic vapor analyzer (OVA) readings (as well as background PID/OVA readings for reference) are included in Appendix D-3.0, Other Applicable RFI Data, and include them there.
- Provide information concerning water encountered during drilling.
- Discuss stabilization activities conducted as part of the RFI.

2.3.4.3 Data Review

Sections 2.3.4.3(a) through 2.3.4.3(d) should present the evaluation of the PRS data set, which is aimed at determining whether a release has occurred. For inorganic chemicals and radionuclides, the data review is conducted by determining whether chemicals are present at levels exceeding background and/or fallout concentrations. Sample concentrations for inorganic chemicals and radionuclides are compared with background values (BVs) and/or fallout concentrations. For organic chemicals, the data review is conducted by identifying which organic chemicals have been detected at the PRS.

The reviews of inorganic chemicals, radionuclides, and organic chemicals are conducted separately under the following required section headings.

(a) Inorganic Chemical Comparison with Background

This section should present the comparison of inorganic chemical concentrations in RFI samples to BVs, and it should summarize the results of statistical analyses conducted for the inorganic data review. This section should contain only information relevant to background comparisons. There should be no references to screening action levels (SALs) in the text or tables. SAL comparisons (or comparisons to one-tenth of the SAL for noncarcinogens) should be discussed separately in Section 2.4, Site Assessments.

Introduce the data review for inorganic chemicals by describing the RFI data. Address the following items:

- State that Appendix D provides an abridged version of the data for the investigation, and that the complete data have been submitted to the AA in electronic format.
- Overview and interpret the QA/QC findings. Discuss data validated as having bias (in direction or relative magnitude), problems with meeting planned detection or quantitation limits, etc. If focused validation resulted in modification of routine data validation qualifiers, state that a detailed discussion of this modification is included in Appendix C, and provide one there.
- Describe conditions that occurred during sampling that may have affected the analytical results (e.g., climatic conditions). State that the details are included in Section 2.3.4.2, Field Investigation.
- Summarize the impacts of problems identified during data validation and/or focused validation and during the data quality assessment. State that a detailed discussion is included in Appendix C and/or Appendix E, and include the discussion in the appropriate section. Provide rationales for using (or not using) qualified data, and discuss the data adequacy for determining whether a release has occurred at the PRS.

Secondly, describe the background data set. Address the following items:

- Identify the background data subset with which the PRS data are compared, and cite the source (i.e., "Inorganic and Radionuclide Background Data for Soils, Canyon Sediments, and Bandelier Tuff at LANL" [LANL 1998, ER ID 58093]). Briefly state the rationale used for selecting the appropriate background data subset.
- If the analytical results are not directly comparable to the background data (e.g., if there was a difference in the analytical method or sample preparation, backfill of unknown origin, etc.), provide an explanation.
- If uranium or thorium concentrations (mass or activity) were measured during the investigation, explicitly identify the analytical method, including sample preparation, and use the appropriate BV. (Note that the analyte descriptions "total uranium" and "total thorium" are used when samples have undergone a complete digest before analysis.) If conversions are made between total and isotopic uranium, provide the LANL or PRS data that support the assumptions and conversion factors. Cite the source for the conversion factors (i.e., "Inorganic and Radionuclide Background Data for Soils, Canyon Sediments, and Bandelier Tuff at LANL" [LANL 1998, ER ID 58093]).

Thirdly, present the detected inorganic chemicals. Address the following items:

- List the inorganic chemical suites for which samples were analyzed, and state that a complete list of the analytes for each suite is included in Appendix D-1.0. Explain that this section only includes data for detected analytes, and that results for nondetected analytes are included in Appendix D-2.0.
- Summarize the frequency of detected inorganic chemicals and nondetected chemicals with detection limits exceeding BVs.
- Include a table following Example Table 2.3-a1, and state that it summarizes all inorganic chemicals detected at the PRS. If the detection limit for a nondetected inorganic chemical exceeds the BV, include the chemical in the table.

EXAMPLE TABLE 2.3-a1

PRS 12-345

FREQUENCY OF DETECTED INORGANIC CHEMICALS

Analyte	Media*	Number of Analyses	Number of Detects	Concentration Range (mg/kg)[a]	Background Value (mg/kg)	Frequency of Detects Above Background Value[b]
Aluminum	Soil	13	13	14590–24600	29200	0/13
Antimony	Soil	13	0	[0.7–1.1]	0.83	DL > BV [c] (for 12/13 results)
Arsenic	Soil	13	13	2.2–7.1	8.17	0/13
Barium	Soil	13	13	68–215	295	0/13
Cadmium	Soil	13	13	0.1–0.3	0.4	0/13
Copper	Soil	13	13	2.9–12.2	14.7	0/13
Lead	Qbt 3	13	13	11.4–30.2	22.3	1/13
Manganese	Soil	13	13	173–562	671	0/13
Mercury	Soil	13	13	[0.02]–0.06	0.1	0/13
Potassium	Soil	13	13	821–2810	3460	0/13
Silver	Soil	13	0	[0.16–0.18]	1	0/13
Sodium	Soil	13	13	148–779	915	0/13
Thallium	Soil	13	0	[0.99–1.1]	0.73	DL > BV [c]
Vanadium	Soil	13	13	8.2–30	39.6	0/13
Zinc	Soil	13	13	23.4–35.6	48.8	0/13

a. Values in square brackets indicate nondetected results.
b. Value is the ratio of the number of detected values exceeding the BV to the number of analyses.
c. The detection limit for this analyte exceeded the background value.
*Indicate the specific soil master horizon or, if appropriate, the geologic subunit.

Note: The information in this table is example data. Footnotes designated by letters are part of the example. Footnotes designated by asterisks are guidance for preparing the table.

Finally, present the inorganic chemicals with concentrations exceeding BVs. Note that inorganic chemicals that exceed BVs should be referred to as “COPCs.” All inorganic chemicals retained as COPCs require further evaluation in Section 2.4, Site Assessments. Address the following items:

- Discuss the results of statistical analyses performed to evaluate whether a release has occurred (e.g., distribution shift tests). Data for analytes with concentration ranges that fall below the BV (which represents the upper end of the background distribution) should be plotted to evaluate the data distribution and the comparability of the sample values with the background data set. When the PRS data fall within the range of the LANL background concentrations, they are consistent with and comparable to the background data set. Plots of each data set with appropriate explanations should be provided in Appendix E to demonstrate this point and validate the choice of the background data set selected for comparison with the PRS data. Summarize the statistical analyses here and state that the details are included in Appendix E.

- Consider the following when evaluating nondetected inorganic chemicals with sample-specific detection limits exceeding the BV (e.g., antimony, cadmium, and thallium).

  - Review the data on a PRS-by-PRS basis considering the analytical methods employed and the distribution of detection limits reported.

  - Determine whether the same analytical methods were used for the PRS data and the LANL background data. If different analytical methods were used, discuss the comparability of the methods, including the expected detection limits. If the data sets are not comparable for a particular chemical, carry it forward for further evaluation in Section 2.4, Site Assessments.

  - Determine whether the detection limits for the PRS data fall within or below the range of reported detection limits and detected concentrations from the background data set. If so, explain why the analyte can be eliminated as a COPC.

- Include a table following Example Table 2.3-a2 (or multiple tables as needed), and state that it presents the data for inorganic chemicals with concentrations at or exceeding BVs. Address the following items in the table:

  - Use a footnote to refer to the table in Appendix C that shows the analytical method ID and method description, and to the table in Appendix D that compiles the matrix-specific detection and/or quantitation limits.

  - Indicate units for all numerical values.

  - Include qualifiers assigned during routine and/or focused data validation (not analytical laboratory qualifiers). If results for nondetected analytes were reported with a "<" symbol (e.g., in hard-copy Chemical Science and Technology [CST] reports before April, 1995), use U qualifiers rather than a "<" symbol. Do not include chemicals for which all data are U-qualified unless one or more of the U-qualified values exceeds the BV.

EXAMPLE TABLE 2.3-a2

PRS 12-345

INORGANIC CHEMICALS WITH CONCENTRATIONS AT OR EXCEEDING BACKGROUND VALUES[a]

Analyte	Location ID	Sample ID	Sample Concentration (mg/kg)[b]	Background Value (mg/kg)	Media*	Depth (ft)
Antimony	12-2000	0212-97-0002	1 (UJ)	0.83	Soil	2–3
	12-2000	0212-97-0003	1 (UJ)		Soil	4.5–5.5
	12-2001	0212-97-0004	0.99 (UJ)		Soil	2–3
	12-2001	0212-97-0005	1.1 (UJ)		Soil	5–6
	12-2002	0212-97-0006	1 (UJ)		Soil	2–3
	12-2002	0212-97-0007	1.1 (UJ)		Soil	5–6
Lead	12-2003	0212-97-0009	30.2	22.3	Qbt 3	2–3
Thallium	12-2000	0212-97-0002	1 (U)	0.73	Soil	2–3
	12-2000	0212-97-0003	1 (U)		Soil	4.5–5.5
	12-2001	0212-97-0004	0.99 (U)		Soil	2–3
	12-2001	0212-97-0005	1.1 (U)		Soil	5–6
	12-2002	0212-97-0006	1 (U)		Soil	2–3
	12-2002	0212-97-0007	1.1 (U)		Soil	5–6

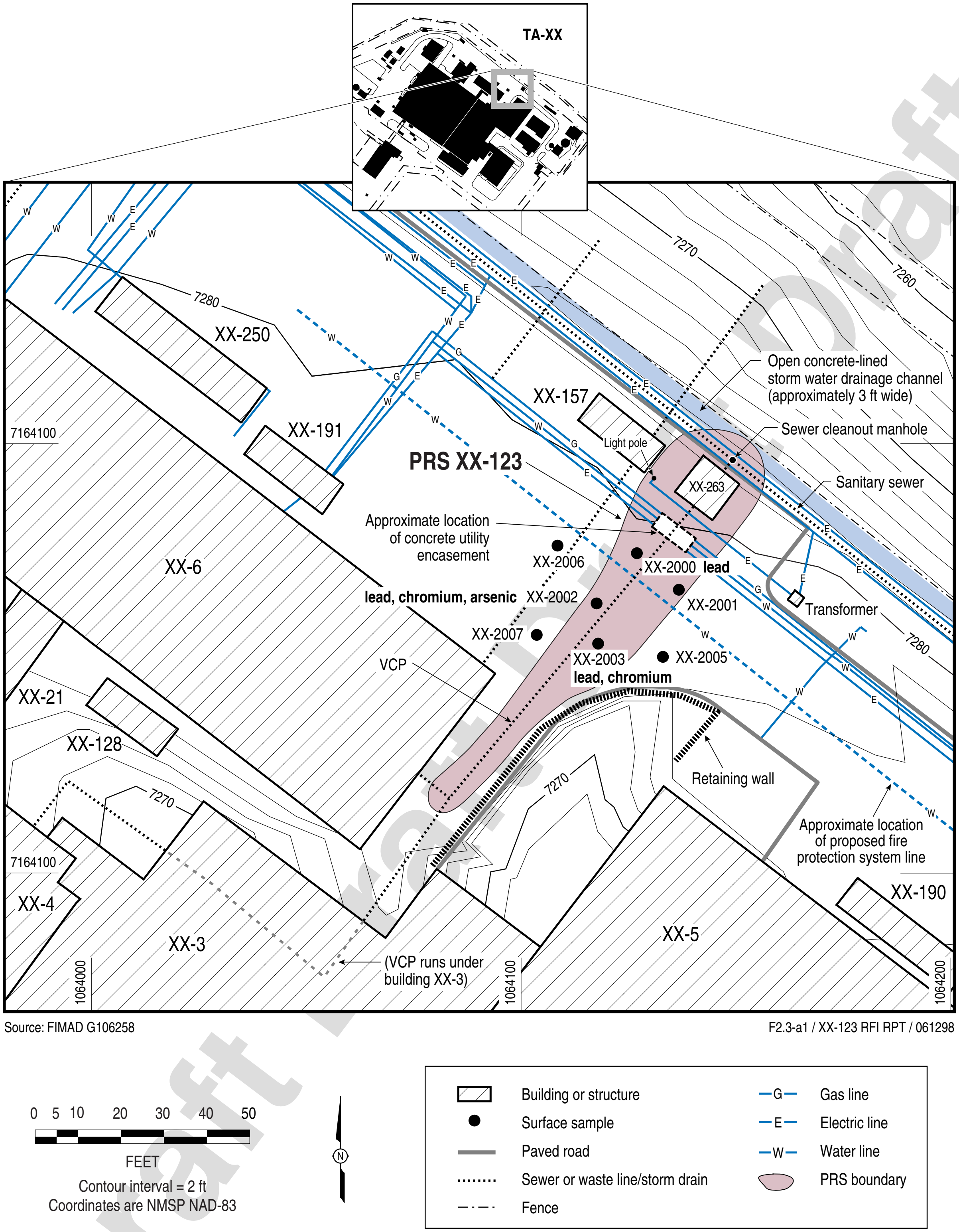
a. Descriptions of the analytical methods used for this PRS can be found in Appendix C-1, Table C-1.0-1. Detection limits can be found in Appendix D-1, Table D-1.0-1.

b. Data qualifier flags are defined in the Glossary, Appendix A-2.

*Indicate the specific soil master horizon or, if appropriate, the geologic subunit.

Note: The information in this table is example data. Footnotes designated by letters are part of the example. Footnotes designated by asterisks are guidance for preparing the table.

- Include a figure (or multiple figures as needed) following Example Figure 2.3-a1. State that the figure summarizes the inorganic chemicals retained as COPCs in the data review. Address the following items:
  - Delineate the boundaries of the PRS, individually identifying all PRS components and associated structures and features.
  - Identify locations where inorganic chemicals were retained as COPCs.
  - As appropriate, identify the location or sample ID number for each data point included in the figure (e.g., location IDs may be more appropriate for borehole sampling, while sample IDs may be more appropriate for surface samples).
- Include a table following Example Table 2.3-a3, and state that it summarizes the inorganic chemicals retained as COPCs in the data review. If no inorganic chemicals were retained as COPCs, state so in the text and do not include the table.



Example Figure 2.3-a1. Sample locations with detected inorganic chemicals in the vicinity of PRS XX-123.

EXAMPLE TABLE 2.3-a3

PRS 12-345

RESULTS OF INORGANIC DATA REVIEW

Analyte	Media*	Result	Rationale
Antimony	Soil	Eliminated	Not detected in any samples. Eliminated as COPC because sample detection limits fall within the range of nondetected values in the background data set.
Lead	Qbt 3	Retained	Retained as COPC because one sample value exceeded the BV.
Thallium	Soil	Retained	Not detected in any samples. Retained as COPC because sample detection limits exceeded the BV and fall at the upper end of the range of nondetected values in the background data set.
*Indicate the specific soil master horizon or, if appropriate, the geologic subunit.			
Note: The information in this table is example data. Footnotes designated by asterisks are guidance for preparing the table.			

- In the data review, do not eliminate chemicals as COPCs based on site history, process knowledge, or the presence or absence of other inorganic chemicals with concentrations exceeding BVs. These decisions should be introduced in Section 2.4, Site Assessments.

(b) Radionuclide Comparison with Background/Fallout Radionuclide Concentrations

This section should present the comparison of radionuclide levels in RFI samples to BVs and/or fallout concentrations, and it should summarize the results of statistical analyses conducted for the radionuclide data review. This section should contain only information relevant to background comparisons. There should be no references to SALs in the text or tables. SAL comparisons should be discussed separately in Section 2.4, Site Assessments.

Introduce the data review for radionuclides by describing the RFI data. Address the following items:

- State that Appendix D provides an abridged version of the data for the investigation, and that the complete data have been submitted to the AA in electronic format.
- Overview and interpret the QA/QC findings. Discuss data validated as having bias (in direction or relative magnitude), problems with meeting planned detection or quantitation limits, etc. If focused validation resulted in modification of routine data validation qualifiers, state that a detailed discussion of this modification is included in Appendix C, and provide one there.
- Describe conditions that occurred during sampling that may have affected the analytical results (e.g., climatic conditions). State that the details are included in Section 2.3.4.2, Field Investigation.
- Summarize the impacts of problems identified during data validation and/or focused validation and during the data quality assessment. State that a detailed discussion is included in Appendix C and/or Appendix E. Provide rationales for using (or not using) qualified data, and discuss the data adequacy for determining whether a release has occurred at the PRS.

Secondly, describe the background/fallout data set. Address the following items:

- Identify the background/fallout data subset with which the PRS data are compared, and cite the source (i.e., "Inorganic and Radionuclide Background Data for Soils, Canyon Sediments, and Bandelier Tuff at LANL" [LANL 1998, ER ID 58039]). Briefly state the rationale used for selecting the appropriate background/fallout data subset.

- If the analytical results are not directly comparable to the background/fallout data (e.g., if there was a difference in the analytical method or sample preparation, backfill of unknown origin, etc.), provide an explanation. Note that fallout radionuclide activity concentrations are compared to fallout values only if they are representative of surface (0–6 in.) materials.

- If uranium or thorium concentrations (mass or activity) were measured during the investigation, explicitly identify the analytical method, including sample preparation, and use the appropriate BV. (Note that the analyte descriptions "total uranium" and "total thorium" are used when samples have undergone a complete digest before analysis.) If conversions are made between total and isotopic uranium, provide the LANL or PRS data that support the assumptions and conversion factors. Cite the source for the conversion factors (i.e., "Inorganic and Radionuclide Background Data for Soils, Canyon Sediments, and Bandelier Tuff at LANL" [LANL 1998, ER ID 58039]).

Thirdly, present the detected radionuclides. Address the following items:

- List the radionuclide suites for which samples were analyzed, and state that a complete list of the analytes for each suite is included in Appendix D-1.0. Explain that this section only includes data for detected analytes, and that results for nondetected analytes are included in Appendix D-2.0

- Summarize the frequency of detected radionuclides.

- If gamma spectroscopy data are included, follow the procedure outlined in the appropriate SOP (in preparation) for identifying potential contaminants from the gamma spectroscopy results.

- Include a table following Example Table 2.3-b1, and state that it summarizes all radionuclides detected at the PRS. If a BV or fallout concentration is not available for a detected radionuclide, the radionuclide should still be included in the table.

EXAMPLE TABLE 2.3-b1

PRS 12-345

FREQUENCY OF DETECTED RADIONUCLIDES

Analyte	Media*	Number of Analyses	Number of Detects	Concentration Range (pCi/g)[a]	Background Value/ Fallout (pCi/g)	Frequency of Detects Above Background Value/Fallout[b]
Plutonium-239,240	Soil	13	1	[-0.003]–0.142	0.054	1/13
Ruthenium-106	Soil	13	1	[0.542] –1.32	NA	1/13
Uranium-234	Soil	13	13	0.22–1.48	2.59	0/13
Uranium-235	Soil	13	5	[0.008]–0.07	0.20	0/13
Uranium-238	Soil	13	13	0.21–0.51	2.29	0/13

a. Values in square brackets indicate nondetected results.

b. Value is the ratio of the number of detected values exceeding the BV to the number of analyses.

*Indicate the specific soil master horizon or, if appropriate, the geologic subunit.

Note: The information in this table is example data. Footnotes designated by letters are part of the example. Footnotes designated by asterisks are guidance for preparing the table.

Finally, present the radionuclides with concentrations exceeding BVs and/or fallout concentrations. Note that radionuclides that exceed BVs should be referred to as "COPCs." All radionuclides retained as COPCs require further evaluation in Section 2.4, Site Assessments. Address the following items:

- Discuss the results of statistical analyses performed to evaluate whether a release has occurred (e.g., distribution shift tests). Data for analytes with concentration ranges that fall below the BV (which represents the upper end of the background/fallout distribution) or fallout concentrations should be plotted to evaluate the data distribution and the comparability of the sample values with the background/fallout data set. When the PRS data fall within the range of the LANL background/fallout concentrations, they are consistent with and comparable to the background/fallout data set. Plots of each data set with appropriate explanations should be provided in Appendix E to demonstrate this point and validate the choice of the background/fallout data set selected for comparison with the PRS data. Summarize the statistical analyses here and state that the details are included in Appendix E.
- Include a table following Example Table 2.3-b2 (or multiple tables as needed), and state that it summarizes the radionuclides with concentrations at or exceeding BVs or fallout concentrations. Address the following items in the table:
  - Use a footnote to refer to the table in Appendix C that shows the analytical method ID and method description, and to the table in Appendix D that compiles the matrix-specific detection and/or quantitation limits.
  - Indicate units for all numerical values.
  - Include qualifiers assigned during routine and/or focused data validation (not analytical laboratory qualifiers). If results for nondetected analytes were reported

with a “<” symbol (e.g., in hard-copy CST reports before April, 1995), use U qualifiers rather than a “<” symbol. Do not include chemicals for which all data are U-qualified unless one or more of the U-qualified values exceeds the BV or fallout concentration.

EXAMPLE TABLE 2.3-b2

PRS 12-345

RADIONUCLIDES WITH CONCENTRATIONS AT OR EXCEEDING BACKGROUND VALUES/FALLOUT CONCENTRATIONS[a]

Analyte	Location ID	Sample ID	Sample Concentration (pCi/g)	Background Value/Fallout (pCi/g)	Media*	Depth (ft)
Plutonium-239,240	12-2005	0212-97-0013	0.142	0.054	Soil	2–3
Ruthenium-106	12-2005	0212-97-0013	1.32	NA[b]	Soil	2–3

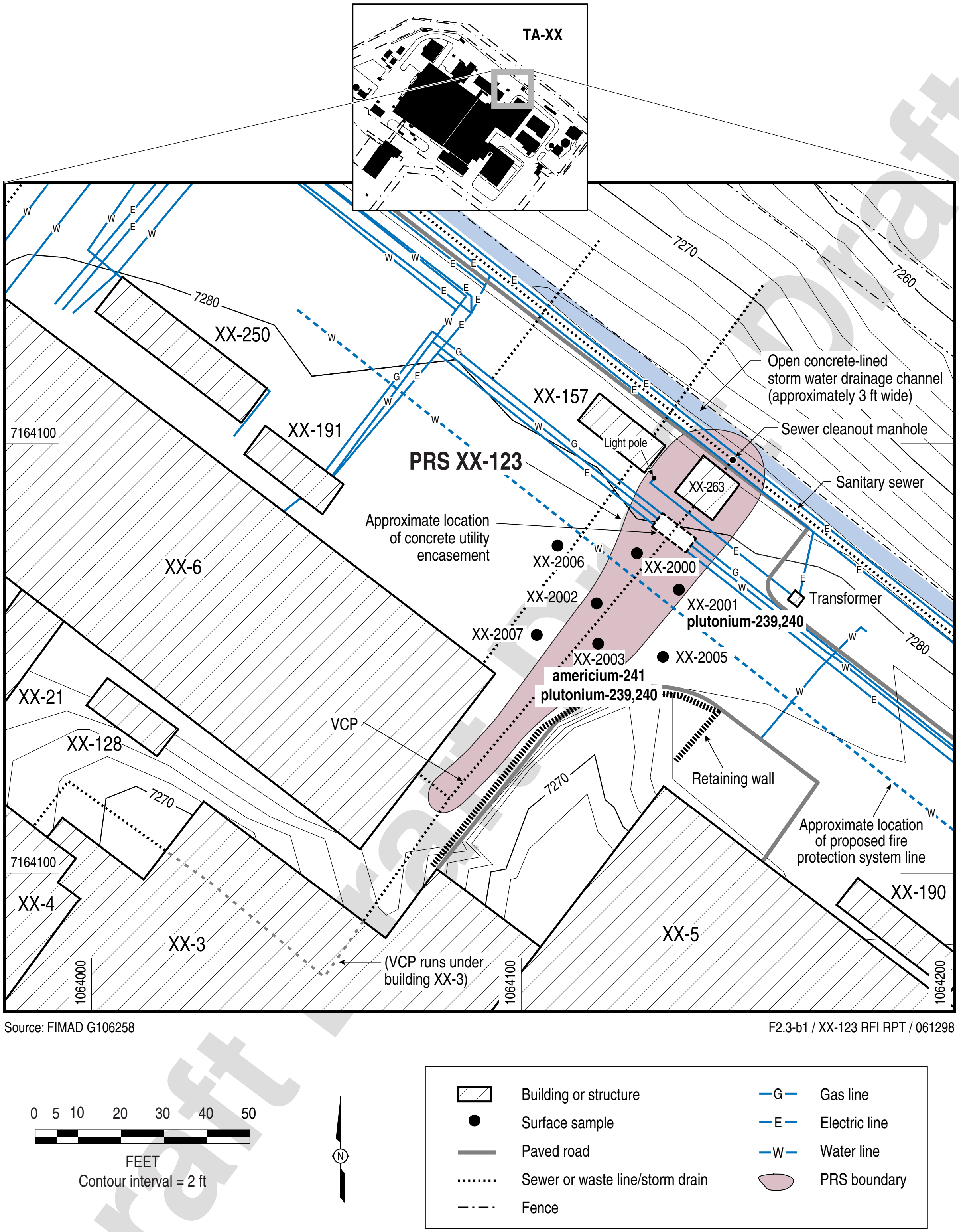
a. Descriptions of the analytical methods used for this PRS can be found in Appendix C-1, Table C-1.0-1. Detection limits can be found in Appendix D-1, Table D-1.0-1.

b. NA = Not applicable.

*Indicate the specific soil master horizon or, if appropriate, the geologic subunit.

Note: The information in this table is example data. Footnotes designated by letters are part of the example. Footnotes designated by asterisks are guidance for preparing the table.

- Include a figure (or multiple figures as needed) following Example Figure 2.3-b1, and state that it summarizes the radionuclides retained as COPCs in the data review. Address the following items:
  - Delineate the boundaries of the PRS, individually identifying all PRS components and associated structures and features.
  - Identify locations where radionuclides were retained as COPCs.
  - As appropriate, identify the location or sample ID number for each data point included in the figure (e.g., location IDs may be more appropriate for borehole sampling, while sample IDs may be more appropriate for surface samples).
- Include a table following Example Table 2.3-b3, and state that it summarizes the radionuclides retained as COPCs in the data review. If no radionuclides were retained as COPCs, state so in the text and do not include the table.



Example Figure 2.3-b1. Sample locations with radionuclides at or above background values/fallout concentrations in the vicinity of PRS XX-123.

EXAMPLE TABLE 2.3-b3

PRS 12-345

RESULTS OF RADIONUCLIDE DATA REVIEW

Analyte	Media*	Result	Rationale
Plutonium-239,240	Soil	Retained	Detected in one sample at concentration exceeding baseline fallout value.
Ruthenium-106	Soil	Retained	Detected in one sample; no background value available.
*Indicate the specific soil master horizon or, if appropriate, the geologic subunit.			
Note: The information in this table is example data. Footnotes designated by asterisks are guidance for preparing the table.			

- In the data review, do not eliminate radionuclides as COPCs based on site history, process knowledge, or the presence or absence of other chemicals with concentrations exceeding BVs and/or fallout concentrations. These decisions should be introduced in Section 2.4, Site Assessments.

(c) Evaluation of Organic Chemicals

This section should summarize the results of the data review for organic chemicals. This section should not refer to SALs in the text or tables. SAL comparisons (or comparisons to one-tenth of SAL for noncarcinogens) should be discussed separately in Section 2.4, Site Assessments.

Introduce the data review for organic chemicals by describing the RFI data. Address the following items:

- State that Appendix D provides an abridged version of the data for the investigation, and that the complete data have been submitted to the AA in electronic format.
- Overview and interpret the QA/QC findings. Discuss data validated as having bias (in direction or relative magnitude), problems with meeting planned detection or quantitation limits, etc. If focused validation resulted in modification of routine data validation qualifiers, state that a detailed discussion of this modification is included in Appendix C, and provide one there.
- Describe conditions that occurred during sampling that may have affected the analytical results (e.g., climatic conditions). State that the details are included in Section 2.3.4.2, Field Investigation.
- Summarize the impacts of problems identified during data validation and/or focused validation and during the data quality assessment. State that a detailed discussion is included in Appendix C and/or Appendix E. Provide rationales for using (or not using) qualified data, and discuss the data adequacy for determining whether a release has occurred at the PRS.

Secondly, present the detected organic chemicals. Note that detected organic chemicals should be referred to as "COPCs." All organic chemicals retained as COPCs require further evaluation in Section 2.4, Site Assessments. Address the following items:

- List the organic chemical suites for which samples were analyzed, and state that a complete list of the analytes for each suite is included in Appendix D-1.0. Explain that this section only includes data for detected analytes, and that results for nondetected analytes are included in Appendix D-2.0
- Summarize the frequency of detected organic chemicals.
- Note that detected organic chemicals may have been measured at concentrations either greater than or less than their respective estimated quantitation limits (EQLs). The EQL is not equivalent to an MDL and may be five to ten times greater than the minimum detection limit (MDL) (see EPA SW-846). EQLs and MDLs are both analyte specific and sample matrix dependent. Organic chemicals that were detected at concentrations less than the sample EQL must be included in this data review.
- Include a table following Example Table 2.3-c1, and state that it summarizes the detection frequency for detected organic chemicals at the PRS.

EXAMPLE TABLE 2.3-c1

PRS 12-345

FREQUENCY OF DETECTED ORGANIC CHEMICALS

Analyte	Media*	Number of Analyses	Number of Detects	Concentration Range (mg/kg)[a]	EQL (mg/kg)	Frequency of Detects [b]
Acetone	Soil	13	3	[0.020]–0.088	0.020	3/13
Toluene	Soil	13	2	[0.005]–0.008	0.005	2/13

a. Values in square brackets indicate nondetected results.
b. Value is the ratio of the number of detected values exceeding the BV to the number of analyses.
* Indicate the specific soil master horizon or, if appropriate, the geologic subunit.

Note: The information in this table is example data. Footnotes designated by letters are part of the example. Footnotes designated by asterisks are guidance for preparing the table.

- Include a table following Example Table 2.3-c2 (or multiple tables as needed), and state that it summarizes the results for detected organic chemicals. Address the following items in the table:
  – Use a footnote to refer to the table in Appendix C that shows the analytical method ID and method description, and to the table in Appendix D that compiles the matrix-specific detection and/or quantitation limits.
  – Indicate units for all numerical values.
  – Include qualifiers assigned during routine and/or focused data validation (not analytical laboratory qualifiers). If results for nondetected analytes were reported with a “<” symbol (e.g., in hard-copy CST reports before April, 1995), use U qualifiers rather than a “<” symbol. Do not include chemicals for which all data are U-qualified unless one or more of the U-qualified values exceeds the BV.

– Organic chemicals that are detected at concentrations less that the EQL value may be J-qualified by the laboratory. If the J-qualifier flag is not modified during focused validation, include it in the table and provide an explanation in the text.

EXAMPLE TABLE 2.3-c2

PRS 12-345

DETECTED ORGANIC CHEMICALS[a]

Analyte	Location ID	Sample ID	Sample Concentration (mg/kg)[b]	Media*	Depth (ft)
Acetone	12-2000	0212-97-0002	0.088	Soil	2–3
	12-2005	0212-97-0014	0.026	Soil	5–6.5
	12-2005	0212-97-0015	0.057	Soil	5–6.5
Toluene	12-2002	0212-97-0006	0.007 (J)	Soil	2–3
	12-2004	0212-97-0011	0.008	Soil	2–3

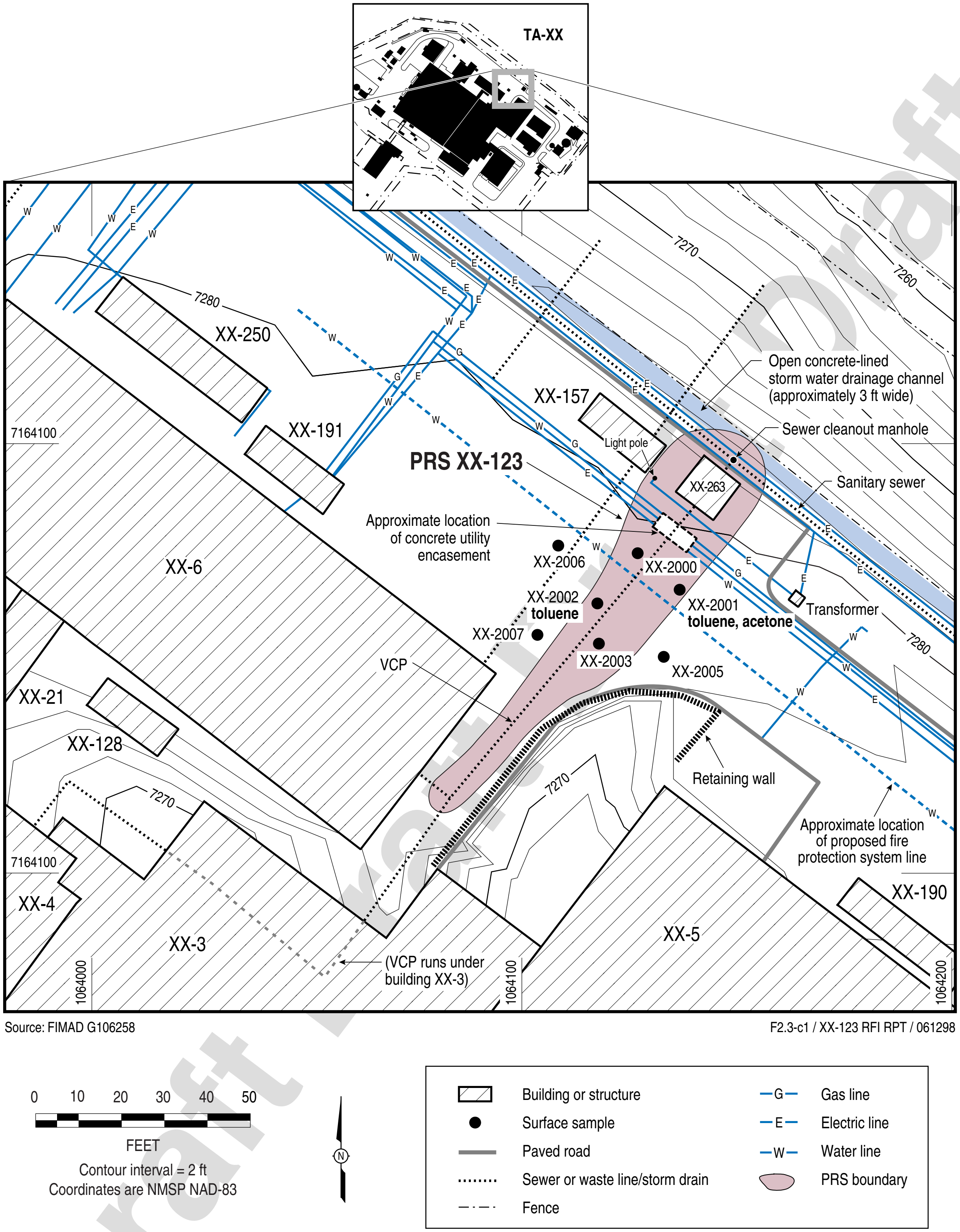
a. Descriptions of the analytical methods used for this PRS can be found in Appendix C-1, Table C-1.0-1. Detection limits can be found in Appendix D-1, Table D-1.0-1.

b. Data qualifier flags are defined in the Glossary, Appendix A-2.

* Indicate the specific soil master horizon or, if appropriate, the geologic subunit.

Note: The information in this table is example data. Footnotes designated by letters are part of the example. Footnotes designated by asterisks are guidance for preparing the table.

- Include a figure (or multiple figures as needed) following Example Figure 2.3-c1, and state that it summarizes the detected organic chemicals retained as COPCs in the data review. Address the following items:
  – Delineate the boundaries of the PRS, individually identifying all PRS components and associated structures and features.
  – Identify locations where organic chemicals were retained as COPCs.
  – As appropriate, identify the location or sample ID number for each data point included in the figure (e.g., location IDs may be more appropriate for borehole sampling, while sample IDs may be more appropriate for surface samples).
- Include a table following Example Table 2.3-c3, and state that it summarizes the detected organic chemicals retained as COPCs in the data review. If no organic chemicals were retained as COPCs, state so in the text and do not include the table.



Example Figure 2.3-c1. Sample locations with detected organic chemicals in the vicinity of PRS XX-123.

EXAMPLE TABLE 2.3-c3

PRS 12-345

RESULTS OF ORGANIC DATA REVIEW

Analyte	Media*	Result	Rationale
Acetone	Soil	Retained	Detected in three of 13 samples.
Toluene	Soil	Retained	Detected in two of 13 samples.
* Indicate the specific soil master horizon or, if appropriate, the geologic subunit.			
Note: The information in this table is example data. Footnotes designated by asterisks are guidance for preparing the table.			

- In the data review, do not eliminate chemicals as COPCs based on site history or process knowledge. These decisions should be introduced in Section 2.4, Site Assessments.

(d) Other Applicable Data

This section should provide data gathered during the RFI that are not covered in Sections 2.3.4.3(a), (b), or (c). Address the following items:

- Summarize and provide core logs, flow rates, geophysical reconstructions, etc. Use judgment as to format. State that details are included in Appendix D-3.0, Other Applicable RFI Results, and include the details there (e.g., foot-by-foot neutron logging results or fracture density calculations, daily flow rates, raw geophysical data, etc.).
- If field screening samples collected during the RFI are used to support the PRS decision (e.g., they are used for determining the extent of contamination), discuss the results and defend their adequacy for supporting the decision. If field screening samples were paired with fixed-laboratory analyses, discuss and interpret the correlation, if any, between the results. State that fixed-laboratory analytical results are presented in Tables 2.3-a2, 2.3-b2, and 2.3-c2. Summarize the QA/QC findings for field screening data, and state that details are included in Appendix C.

2.3.5 Revised Site Conceptual Model

Sections 2.3.5.1 and 2.3.5.2 should present the revised site conceptual model for contaminant occurrence and distribution at the PRS. Based on information from the RFI, these sections should present revisions or refinements to the preliminary conceptual model in Section 2.3.3.

The components of a conceptual model listed in Sections 2.3.5.1 and 2.3.5.2 are not universally applicable at all PRSs. For example, the level of detail in discussing environmental fate processes will depend on their impact to human and ecological receptors. Authors should use judgement to ensure that the level of detail in Sections 2.3.5.1 and 2.3.5.2 is appropriate to adequately address the complexity of the PRS and support the available information.

Sections 2.3.5.1 and 2.3.5.2 should accomplish the following:

- Present the refined understanding of the nature and vertical and horizontal extent of contamination.

- Provide an interpretation of the data distribution. When data are in conflict with the hypotheses stated in the preliminary conceptual model, provide an explanation.
- Provide a logical basis for conducting the site assessments described in Section 2.4, Site Assessments.
- Provide a conceptual framework for assessing data sufficiency and interpreting spatial and temporal trends in the analytical data.
- Both the conceptual model and the data should support the PRS decision presented in Section 2.5, Conclusions and Recommendations.

2.3.5.1 Nature and Extent of Contamination

This section should describe the nature (type) of contaminants at the PRS, and the spatial and/or temporal trends in contaminant concentrations in sampled environmental media.

Summarize relevant information about the operational history and physical setting from Section 2.2, Description and Operational History, and Appendix B-1.0, Operational History and Land Use. This may include the following:

- the boundaries of the investigation (e.g., the toe of the colluvial slope below an outfall, a topographic feature constraining migration, the boundary of an adjacent investigation or remedial action, etc.);
- the time period of releases at the PRS;
- the estimated types, quantities, and physical form of environmental media potentially receiving contaminant releases;
- the topography, soil properties, vegetative features, and hydrological properties of the PRS (if relevant, identify alluvial or perched aquifers; the distance to the regional aquifer; the locations of nearby springs, seeps, etc.; and the potential hydraulic interconnections between these springs, seeps, etc.); and
- anthropogenic activities that may have disturbed the PRS subsequent to releases.

Describe the current understanding of the nature and extent (both vertical and horizontal) of COPCs carried forward from Section 2.3.4.3, Data Review. This may include the following items:

- when appropriate and feasible, a graphical representation of the extent of contamination (e.g., a cross section showing vertical definition and a topographic map showing horizontal definition);
- a discussion of the adequacy of sample analyses to identify potential contaminants at the PRS;
- a discussion of whether the observed types and locations of contaminants are consistent with the preliminary conceptual model; and
- an analysis of spatial and/or temporal trends to establish extent, which might include answering questions such as whether complicating factors (e.g., variability in soil characteristics such as organic carbon content) are potentially affecting the observed

spatial distribution. State that Appendix E includes the specific statistical methods and calculations employed.

If statistical methods (e.g., kriging or some other method) are used to model contaminant concentrations, briefly discuss the methods used and why they were used. Address the following items:

- Discuss uncertainties inherent in these statistical methods and in the modeling results.
- State that a detailed description of the methodology is included in Appendix E and/or the IWP.
- If applicable, include isopleth maps of contaminant distributions here or, if they interfere with the flow of the text, state that they are in Appendix E and include them there.

Describe information gaps or uncertainties in the site conceptual model. Address the following items:

- Identify where the current understanding of the PRS remains incomplete or limited by the quantity, location, or quality of the data; the spatial variability of PRS contamination; incomplete site history; etc.
- If the horizontal and vertical extent of contamination are not fully defined by this investigation, state so and discuss the necessity and feasibility of collecting further data to adequately define the extent. Do not discuss recommendations resulting from this assessment in this section. Discuss them in Section 2.5, Conclusions and Recommendations.

2.3.5.2 Environmental Fate

This section should identify and discuss the chemical and physical aspects of environmental fate.

Discuss the consequences that environmental distribution of contaminants had on the sampling activities.

Identify and discuss the chemical and physical aspects of transport and partitioning among various environmental media. Discuss chemical and biological transformation and degradation in various environmental media, including what is known about chemical speciation, biotic and abiotic mechanisms of environmental transformation, and transfer of contaminants among environmental media. (The bioavailability of contaminants following intake should be discussed in the human health and ecological risk assessments in Sections 2.4.3.1 and 2.4.3.2 rather than in the conceptual model.) In addition, address the following items as appropriate:

- Predict and identify chemical valence states and associated complexes based on pH and redox conditions.
- Discuss the susceptibility of contaminants to chemical degradation such as hydrolysis and photolysis and the biological significance of possible breakdown products.
- Discuss the susceptibility of contaminants to biotic (microbial) degradation and the biological significance of possible breakdown products.
- Discuss the mobility (e.g., adsorption, solubility, volatility, etc.) of contaminants in relevant media. Discuss the likely fate of contaminants among these media and, if possible, their residence time in the environment.

- Describe and interpret the chemical characteristics affecting contaminant migration (including vapor pressure, solubility, organic carbon partitioning coefficient, etc.). This discussion may also include volatilization potential for individual contaminants, sorption, desorption, and bioconcentration in biota.
- Describe relevant atmospheric parameters including wind roses, measured airborne particulate concentrations, etc.
- Discuss vertical migration in the saturated zone and erosion of potentially contaminated soil as potential contaminant transport pathways.
- Evaluate the infiltration and leaching of contaminants into soil and/or tuff containing surface water. This evaluation may include, if applicable, retardation characteristics, fracture flow dynamics, etc.
- Discuss groundwater transport parameters, if applicable, such as flow direction, hydraulic conductivity, retardation factors, etc.
- Discuss the potential for transport in surface water/runoff including sheet flow and channels as identified in LANL-ER-AP-4.5. State that the complete LANL-ER-AP-4.5 assessment is included in Appendix B-4.2.1.
- Discuss the potential for uptake transport of contaminants in the food chain with particular emphasis on biomagnification.
- In a generic sense, identify pathways by which exposure can occur for both human and ecological receptors.

If relevant, discuss in detail the point at which the Canyons Focus Area (or other potential analysis area) will supplement or take over the investigation. Provide the rationale for the hand off.

2.4 Site Assessments

2.4.1 Summary

This section should list the assessments performed and briefly summarize each assessment. The results of each assessment should be summarized in no more than a few sentences. Follow the example below:

> "A human health screening assessment, a human health risk assessment, and an ecological screening assessment were conducted for PRS 12-345. The human health screening assessment identified one COPC, lead. A human health risk assessment was performed, and the results indicate that lead does not exceed the target risk level. No chemicals of potential ecological concern (COPECs) were identified in the ecological screening assessment. Therefore, no ecological risk assessment was performed.
>
> A LANL-ER-AP-4.5 surface water assessment was also conducted for PRS 12-345. The results of this assessment indicate a low erosion potential (see Appendix B-4.2.1). No groundwater issues have been identified at the site.
>
> A UST assessment was not performed because it is not applicable for PRS 12-345."

If no COPCs were carried forward from the data review and no site assessments were performed, state so. Follow the example below:

> "No COPCs were identified in the Data Review (see Section 2.3.4.3). Therefore, human health and ecological screening and risk assessments were not performed for this PRS."

2.4.2 Screening Assessments

Sections 2.4.2.1 and 2.4.2.2 should evaluate current and reasonable potential future risk to human and ecological receptors from COPCs retained in the data review. In this section, address the following items:

- State that a human health screening assessment is presented in Section 2.4.2.1 and an ecological screening assessment is presented in Section 2.4.2.2.
- State that the human health and ecological screening assessments follow the Hazardous and Radioactive Materials Bureau (HRMB) Risk-Based Decision Tree (NMED 1998, ER ID 57761) and appropriate EPA guidance. Cite the appropriate NMED and EPA documents.

If no COPCs were carried forward from data review, state that this section is not applicable.

2.4.2.1 Human Health

This section should present the human health screening assessment. If a human health risk assessment is performed, complete only parts (a) and (b). If no human health risk assessment is performed, complete parts (a) through (d).

(a) Scoping

Describe the selection of current and reasonable potential future land-use assumptions and receptors, including exposure pathways. Provide the supporting rationale. (Note that the phrase "professional judgment" is insufficient as the only supporting justification.)

(b) Screening Evaluation

Perform the screening evaluation in accordance with the HRMB Risk-Based Decision Tree and appropriate EPA guidance. Use the appropriate LANL ER screening levels (consult with an ER Project risk assessor to identify the appropriate SALs). Note that EPA guidance requires that when two or more noncarcinogens are present, one-tenth of the screening level must be used.

The COPCs addressed in this evaluation should be those identified in Section 2.3.4.3, Data Review.

(c) Uncertainty Analysis

If no human health risk assessment is performed, this section should include a qualitative uncertainty analysis to assist the reviewer in interpreting the screening outcome. This analysis should provide supporting rationale for the recommendations offered in Section 2.5, Conclusions and Recommendations.

At a minimum, the uncertainty analysis should address the following key sources of uncertainty:

- definition of the PRS physical setting (e.g., exposure assumptions such as the likelihood of exposure pathways and land uses actually occurring, the likelihood that the selected receptors will be exposed, etc.);

- the data set (e.g., media-contaminant distribution, use of laboratory or other qualified data, lack of quantitation, high detection limits, etc.); and
- environmental fate and transport models.

In addition, the following sources should be addressed if they impact the PRS decision:

- constituent toxicity values (or the lack thereof) and interactions;
- intake/exposure parameters and their assumed values; and
- multiple pathway exposure assumptions.

If a human health risk assessment is performed, omit this section.

(d) Interpretation

If no human health risk assessment is performed, summarize the human health screening assessment with an emphasis on the results of the uncertainty analysis. Interpret these results, leading to conclusions about the risk to human receptors, and supporting the recommendations in Section 2.5, Conclusions and Recommendations.

If a human health risk assessment is performed, omit this section.

2.4.2.2 Ecological

This section should present the ecological screening assessment. Complete parts (a) through (d).

(a) Scoping

Summarize the results of the preliminary ecological evaluation of the PRS, referencing relevant historical information (e.g., site biotic composition, potential receptors, toxicant pathways, etc.). Summarize relevant information from site visits and from the ecological scoping checklist. State that the completed scoping checklist is included in Appendix F-2.0. Address the following items:

- Summarize the ecological exposure model.
- Identify the presence of threatened and endangered species or other populations of special concern.

(b) Screening Evaluation

Perform the screening evaluation in accordance with the HRMB Risk-Based Decision Tree (NMED 1998, ER ID 57761). Present the results of hazard quotient and hazard index calculations and identify COPECs. Use a table if it facilitates the presentation (use judgment as to table format).

(c) Uncertainty Analysis

This section should include a qualitative uncertainty analysis to assist the reviewer in interpreting the screening outcome. This analysis should provide supporting rationale for the recommendations offered in Section 2.5, Conclusions and Recommendations.

The uncertainty analysis should focus on the key sources of uncertainty. Relevant sources of uncertainty may include but are not limited to the following:

- the presence of screening receptors (or receptors in the respective feeding guild) and their relevance to the site biota;
- the environmental monitoring data set (e.g., media-contaminant distribution, use of laboratory or other qualified data, lack of quantitation, high detection limits, etc.);
- maximum contaminant concentration per media (i.e., the likelihood that the maximum represents a reasonable or true maximum exposure concentration);
- models used to evaluate environmental fate and transport of contaminants;
- evaluated exposure pathways;
- exposure pathways eliminated from consideration (e.g., dermal contact, inhalation exposure pathway, etc.);
- chemical form or speciation of constituents present at the site;
- constituent disposition in the body and constituent uptake or transfer factor values used;
- other exposure parameter values used (e.g., size of the contaminated area relative to the receptor home range);
- constituent toxicity values and applied safety/uncertainty factors;
- cumulative (or additive) effects from exposure to multiple contaminants and through multiple pathways and routes;
- contaminant interactions (e.g., synergistic, antagonistic, etc.) other than additive; and
- other environmental factors (e.g., extreme temperatures, drought, diet, etc.) contributing to exposure and constituent toxicity.

(d) Interpretation

Summarize the ecological screening assessment with an emphasis on the results of the uncertainty analysis. Interpret these results, leading to conclusions about the risk to ecological receptors, and supporting the recommendations in Section 2.5, Conclusions and Recommendations.

2.4.3 Risk Assessments

Sections 2.4.3.1 and 2.4.3.2 should evaluate current and reasonable potential future risk to human and ecological receptors from COPCs retained in the data review. In this section, address the following items:

- State that a human health risk assessment is presented in Section 2.4.3.1 and an ecological risk assessment is presented in Section 2.4.3.2.
- State that the human health and ecological risk assessments follow the HRMB Risk-Based Decision Tree (NMED 1998, ER ID 57761) and appropriate EPA guidance. Cite the appropriate NMED and EPA documents.

If no COPCs were carried forward from data review, state that this section is not applicable.

2.4.3.1 Human Health

(a) Selection of Chemical(s) of Potential Concern

Describe how COPCs were selected for the human health risk assessment. Cite all documents that provided guidance for this selection.

(b) Exposure Assessment

Address the following items:

- Describe the appropriate land-use assumptions, including receptors, exposure pathways, and PRS-specific exposure parameters. Provide the supporting justification.
- Refer to relevant portions of the revised site conceptual model (Section 2.3.5).
- Cite Risk Assessment Guidance for Superfund (RAGS) and any other guidance for conducting the exposure assessment.
- Before using probabilistic methods in addition to deterministic calculations, contact the Regulatory Compliance Focus Area leader (Tori George at 5-6953, torig@lanl.gov) who will discuss the technical basis and applicability of these methods with the AA.
- Provide the results of modeling for predicting exposure point concentrations at different times, locations, or media than those associated with the available analytical data.

(c) Toxicity Assessment

Provide the source of the toxicity values used in the risk assessment, and summarize the derivation of these values.

Provide a toxicity profile for each COPC including, but not limited to the following:

- an assessment of contaminant absorption rates;
- an evaluation of contaminant distribution and clearance rates;
- a discussion of ambient environmental contaminant sources and normal dietary intake; and
- a toxicity evaluation consisting of a discussion of critical effects; extrapolation procedures, safety/uncertainty factors, and their technical basis; an assessment of the strength of studies underlying toxicity values; and the potential for synergistic, additive, or antagonistic effects with other PRS contaminants.

(d) Risk and Dose Characterization

Quantify risk to human health by calculating cancer risk, annual dose rate, and/or hazard quotients/indices. Risk associated with exposure to background levels of COPCs may also be calculated to assess the relative impact of PRS contamination.

(e) Uncertainty Analysis

Provide a qualitative and/or quantitative uncertainty analysis and a supporting rationale for the recommendations in Section 2.5, Conclusions and Recommendations.

Identify key model parameter assumptions (based on professional judgment and/or numerical sensitivity analyses) contributing to risk and/or dose. If more than one land-use scenario is used in the risk assessment, interpret the significance of the variability in risk and/or dose estimates. The results of the uncertainty analysis should be incorporated into the risk characterization to form the basis for the conclusions and recommendations in Section 2.5.

At a minimum, the uncertainty analysis should address the following key sources of uncertainty:

- definition of the PRS physical setting (e.g., exposure assumptions such as the likelihood of exposure pathways and land uses actually occurring, the likelihood that selected receptors will be exposed, etc.);
- data set (e.g., media-contaminant distribution, use of laboratory or other qualified data, lack of quantitation, high detection limits, etc.);
- environmental fate and transport models;
- constituent toxicity values (or the lack thereof) and interactions;
- intake/exposure parameters and their assumed values; and
- multiple pathway exposure assumptions.

(f) Interpretation

Summarize the findings of the human heath risk assessment with an emphasis on the results of the uncertainty analysis. Interpret these results, supporting conclusions regarding the risk to human receptors at the PRS. Note that all chemicals retained after the risk assessment should be referred to as chemicals of concern (COCs).

2.4.3.2 Ecological

(a) Selection of Chemical(s) of Potential Concern

Describe how COPECs were selected for the ecological risk assessment. Cite all documents that provided guidance for this selection.

(b) Exposure Assessment

Address the following items:

- Describe the appropriate land use assumptions, including habitats and food webs, receptors, exposure pathways, and PRS-specific exposure parameters. Provide the supporting justification.
- Refer to relevant portions of the revised site conceptual model discussed in Section 2.3.5.
- Cite Ecological Risk Assessment Guidance for Superfund (ERAGS) and any other guidance for conducting the exposure assessment.
- Before using probabilistic methods in addition to deterministic calculations, contact the Regulatory Compliance Focus Area leader (Tori George at 5-6953, torig@lanl.gov) who will discuss the technical basis and applicability of these methods with the AA.

- Provide the results of modeling for predicting exposure point concentrations at different times, locations, or media than those associated with the available analytical data.

(c) Toxicity Assessment

Provide the source of toxicity values used in the risk assessment, and summarize the derivation of these values.

Provide a toxicity profile for each COPEC including, but not limited to the following:

- an assessment of absorption/uptake rates and bioavailability;
- an evaluation of accumulation and clearance rates;
- a discussion of ambient environmental sources; and
- a toxicity evaluation consisting of a discussion of critical effects; extrapolation procedures, safety/uncertainty factors, and their technical basis; an assessment of the strength of studies underlying toxicity values; and the potential for synergistic, additive, or antagonistic effects with other PRS contaminants.

(d) Risk and Dose Characterization

Quantify risk to ecological receptors. Risk associated with exposure to background levels of COPECs may also be calculated to assess the relative impact of PRS contamination.

(e) Uncertainty Analysis

Provide a qualitative uncertainty analysis and a supporting rationale for the recommendations in Section 2.5, Conclusions and Recommendations.

Identify key model parameter assumptions (based on professional judgment and/or numerical sensitivity analyses) contributing to risk and/or dose. The results of the uncertainty analysis should be incorporated into the risk characterization to form the basis for the conclusions and recommendations in Section 2.5.

At a minimum, the uncertainty analysis should address the following key sources of uncertainty:

- definition of the PRS physical setting (e.g., exposure assumptions such as the likelihood of exposure pathways and land uses actually occurring, the likelihood that selected receptors will be exposed, etc.);
- data set (e.g., media-contaminant distribution, use of laboratory or other qualified data, lack of quantitation, high detection limits, etc.);
- environmental fate and transport models;
- constituent toxicity values (or the lack thereof) and interactions;
- intake/exposure parameters and their assumed values;
- multiple pathway exposure assumptions; and
- other ecological factors identified in the scoping check list.

(f) Interpretation

Summarize the findings of the ecological risk assessment with an emphasis on the results of the uncertainty analysis. Interpret these results, supporting conclusions about the risk to ecological receptors at the PRS. Discuss potential effects on populations/communities. Note that all chemicals retained after the risk assessment should be referred to as COCs.

2.4.4 Other Applicable Assessments

2.4.4.1 Surface Water

The intent of this section is to facilitate the Surface Water Quality Bureau's review of surface water issues at the PRS. This section should completely describe the surface water issues, investigations, and results for the PRS. Address the following items:

- Summarize parts A and B of the LANL-ER-AP-4.5 Surface Water Assessment for the PRS (be sure to include the score from part B). State that Parts A and B of the LANL-ER-AP-4.5 Surface Water Assessment are included in Appendix B-4.2.1, and include them there.
- State that a description of the PRS, the operational history, and the PRS-specific topography, surface geology, geomorphology, and hydrology is included Section 2.2, Description and Operational History. Also refer to relevant portions of Appendix B, Operational and Environmental Setting. Summarize any relevant information from these sections.
- Summarize activities in the field investigation that are relevant to surface water, and state that details are included in Section 2.3.4.2, Field Investigation.
- Provide a table that includes all surface water chemistry data (e.g., storm water sampling results, information about debris in a watercourse, etc.). Use judgment as to table format. Include field measurements of pH, conductivity, temperature, etc. Indicate whether samples were filtered or unfiltered. Include the applicable surface water standards for the constituents presented in the table.
- State that data from matrixes other than water are presented in Section 2.3.4.3, Data Review, and/or Appendix D-2.0, RFI Analytical Results. Summarize any relevant results from these data.
- Summarize the portions of the revised site conceptual model that are relevant to an understanding of surface water, and state that details are included in Section 2.3.5, Revised Site Conceptual Model.
- Summarize information from the human health and ecological evaluations that is relevant to surface water, and state that details are included in Sections 2.4.2.1, 2.4.2.2, 2.4.3.1, and/or 2.4.3.2.
- Discuss decisions presented in the document that are relevant to surface water, and discuss the resulting conclusions and recommendations. Discuss whether applicable surface water standards have been exceeded. Briefly discuss any proposed surface water investigations.

- Provide a Water Quality Control Commission (WQCC) 1203 Release/Discharge Notification date when applicable, and describe the subsequent corrective action.
- Include figures and tables as needed to facilitate this discussion. Use judgment as to format.

2.4.4.2 Groundwater

The intent of this section is to facilitate the Groundwater Quality Bureau's review of groundwater issues at the PRS. This section should completely describe the groundwater issues, investigations, and results for the PRS. Address the following items:

- State that a description of the PRS, the operational history, and the PRS-specific topography, surface geology, geomorphology, and hydrology is included in Section 2.2, Description and Operational History. Also refer to relevant portions of Appendix B, Operational and Environmental Setting. Summarize any relevant information from these sections.
- Summarize activities in the field investigation that are relevant to groundwater, and state that details are included in Section 2.3.4.2, Field Investigation.
- Provide a table that includes all groundwater chemistry data. Use judgment as to table format. Indicate whether samples were filtered or unfiltered. Include the applicable groundwater standards for the constituents presented in the table.
- State that data from matrixes other than water are presented in Section 2.3.4.3, Data Review, and/or Appendix D-2.0, RFI Analytical Results. Summarize any relevant results from these data.
- Summarize the portions of the revised site conceptual model that are relevant to an understanding of groundwater, and state that details are included in Section 2.3.5, Revised Site Conceptual Model.
- Summarize information from the human health and ecological evaluations that is relevant to groundwater, and state that details are included in Sections 2.4.2.1, 2.4.2.2, 2.4.3.1, and/or 2.4.3.2.
- Discuss decisions presented in the document that are relevant to groundwater, and discuss the resulting conclusions and recommendations. Discuss whether applicable groundwater standards have been exceeded. Briefly discuss any proposed groundwater investigations.
- Include figures and tables as needed to facilitate this discussion. Use judgment as to format.

2.4.4.3 Underground Storage Tanks

The annotation for this section is currently under negotiation with the UST Bureau. Please consult with Linda Nonno (5-0725, lnonno@lanl.gov) to ensure that changes to this section are reflected in your document. A finalized version will be distributed once it is available.

The intent of this section is to facilitate the UST Bureau's review of UST issues at the PRS. This section should completely describe issues that are relevant to UST investigations, and it should summarize the results for the PRS. Address the following items:

- State that a description of the PRS, the operational history, and the PRS-specific topography, surface geology, geomorphology, and hydrology is included in Section 2.2, Description and Operational History. Also refer to relevant portions of Appendix B, Operational and Environmental Setting. Summarize any relevant information from these sections.
- State that the regulatory history of the PRS, including all mandatory UST notifications and reporting, is described in Appendix G-1.0, Documentation of Regulatory History.
- Summarize activities in the field investigation that are relevant to UST investigations, and state that details are included in Section 2.3.4.2, Field Investigation.
- State that data from sampling and analysis of soil, sediments, surface water, and groundwater are presented in Section 2.3.4.3, Data Review; Section 2.4.4.1, Surface Water; Section 2.4.4.2, Groundwater; and/or Appendix D-2.0, RFI Analytical Results.
- Discuss the decisions presented in the document, how they are supported by the data, and the results of those decisions relevant to UST investigation and removal. Cite the New Mexico UST Regulations (20 NMAC 5).
- Summarize information from the human health and ecological evaluations that is relevant to the investigation and remediation of the PRS, and refer to Sections 2.4.2.1, 2.4.2.2, 2.4.3.1, and 2.4.3.2 for the details of these assessments.
- Summarize Parts A and B of the LANL-ER-AP-4.5 assessment for the PRS, and state that the LANL-ER-AP-4.5 assessment for this PRS is included in Appendix B-4.2.1.

2.4.4.4 Other

This section should include relevant information for other applicable assessments such as air quality, solid waste, etc.

2.5 Conclusions and Recommendations

This section should provide the complete conclusions and recommendations for the PRS, referencing the PRS-specific data review, screening assessments, risk assessments, and any other applicable assessments. Address the following items:

- In giving the recommendations for the PRS, indicate that a formal letter will be sent to the AA at a later date requesting the recommended action.
- Develop conclusions to provide a comprehensive and logical rationale for the recommendations. If a risk assessment was not performed, the rationale supporting the decisions should put the quantitative screening results (i.e., BV comparisons, evaluation of organic chemicals, and SAL comparisons) into a logical framework that interprets the results from the perspective of the revised site conceptual model describing contaminant distribution and potential human and ecological exposures at the PRS.
- Possible factors to be addressed in the rationale may include the following:

- *Analytical Issues.* Is the analyte list complete? Do accuracy and/or precision problems impact PRS recommendations?

- *Spatial Characterization.* Has the location of the PRS been positively identified? Are the number, location, and depth of soil samples adequate to determine nature and extent? (Consider patterns observed in the data, possible contaminant redistribution since the time the PRS was active, release mechanisms, volumes of releases, etc.) Should additional media be sampled? Are the analytical data biased high or low?

- *Environmental Fate.* (Related to spatial characterization.) Could chemical or biological degradation and/or re-speciation impact decisions? Could chemical adsorption, precipitation, dissolution, etc., impact redistribution in the environment? How could PRS-specific hydrologic and geologic conditions impact contaminant transport and hence PRS decisions?

- *Exposure and Toxicity*. How do PRS location, accessibility, and current and potential future land use affect PRS decisions? How do assumptions concerning exposure mechanisms and model parameters impact PRS decisions? How does uncertainty in contaminant toxicity impact PRS decisions?

- If the above factors were addressed in previous sections of this report (in particular if a risk assessment was performed), a brief summary of these evaluations and how they support the final recommendations is sufficient. Minimize the introduction of new information. This section should primarily interpret information from previous sections and connect it into a logical explanation to support the conclusions derived and the recommendations proposed.

- Clearly state the recommendation(s) for proposed actions and summarize the justification for these proposals.

- Provide a projected schedule of anticipated activities associated with PRSs not recommended for no further action (NFA). Provide a projected date for the submission of a request for permit modification to add PRSs to the HSWA Module of the RCRA permit. If deferral of a PRS is necessary, request AA approval.

3.0 PRS Y—PRS Y DESCRIPTOR

4.0 PRS Z—PRS Z DESCRIPTOR

Continue adding sections following this numbering scheme until all PRSs are addressed. Number the following section according to the next consecutive number.

X.0 REFERENCES

Include the following text before the reference list:

> "The following list includes all of the documents cited in the body and appendixes of this RFI report. The parenthetical information following each reference provides the author, publication date, and ER ID number, and, if applicable, the LANL ER Project Reference Library reference set number and tab number for each document. This information is also included in the citations in

the text. This information can be used to locate the documents on this list as follows.

The ER ID number is assigned by the Laboratory's ER Project to track material associated with LANL PRSs. This number can be used to locate the actual document at the ER Project's Records Processing Facility. All cited documents are assigned ER ID numbers.

The reference set number and tab number are assigned to locate material in the LANL ER Project Reference Library, which is housed at NMED HRMB, DOE, and the ER Project Office. This library is a living document that was developed to insure that the AA has all of the necessary material to review the decisions and actions proposed in documents submitted by the Laboratory's ER Project. Documents previously submitted to the AA and documents that are specific to this RFI report are not included in the Reference Library, and their citations do not include reference set and tab numbers. Documents that are specific to this RFI report are attached in Appendix G-2.0, Referenced Documents."

Following this introduction, include the reference list. The reference list below is for documents referenced in this annotated outline. For guidance on formatting references, consult with an ER Project technical editor.

EPA (US Environmental Protection Agency), April 10, 1990. Module VIII of RCRA Permit No. NM0890010515, EPA Region VI, issued to Los Alamos National Laboratory, Los Alamos, New Mexico, effective May 23, 1990, EPA Region VI, Hazardous Waste Management Division, Dallas, Texas. **(EPA 1990, ER ID 01585)**

EPA (US Environmental Protection Agency), February 1994. "USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review," EPA-540/R-94-013, Office of Solid Waste and Emergency Response, Washington, DC. **(EPA 1994, ER ID 48639)**

EPA (US Environmental Protection Agency), December 1994. "USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review: Multi-Media, Multi-Concentration (ILMO 1.0) and Low Concentration Water (OLCO 1.0)," EPA/540/R/94/090, Office of Solid Waste and Emergency Response, Washington, DC. **(EPA 1994, ER ID 48640)**

LANL (Los Alamos National Laboratory), July 1995. "Statement of Work – Analytical Support," Revision 2, RFP No. 9-XS1-Q4257, Los Alamos, New Mexico. **(LANL 1995, ER ID 49738)**

LANL (Los Alamos National Laboratory) 1995. "Site Development Plan, Annual Update 1995," Los Alamos National Laboratory Publication, LALP-95-113, Los Alamos, New Mexico. **(LANL 1995, ER ID 57224)**

LANL (Los Alamos National Laboratory), March 1996. "Quality Assurance Project Plan Requirements for Sampling and Analysis," Los Alamos National Laboratory Report LA-UR-96-441, Los Alamos, New Mexico. **(LANL 1996, ER ID 53450)**

LANL (Los Alamos National Laboratory), December 1996. "Installation Work Plan for Environmental Restoration," Revision 6, Los Alamos National Laboratory Report LA-UR-96-4629, Los Alamos, New Mexico. **(LANL 1996, ER ID 55574)**

NMED (New Mexico Environment Department), March 3, 1998. *New Mexico Environment Department RCRA Permits Management Program Document Requirement Guide*, Santa Fe, New Mexico. **(NMED 1998, ER ID 57897)**

NMED (New Mexico Environment Department), March 3, 1998. *Risk-Based Decision Tree*, Santa Fe, New Mexico. **(NMED 1998, ER ID 57761)**

Ryti, R. T, P. A. Longmire, D. E. Broxton, S. L. Reneau, and E. V. McDonald, in preparation. "Inorganic and Radionuclide Background Data for Soils, Canyon Sediments, and Bandelier Tuff at Los Alamos National Laboratory," Los Alamos National Laboratory Report, Los Alamos, New Mexico. **(LANL 1998, ER ID 58093)**

APPENDIX A LIST OF ACRONYMS AND GLOSSARY

A-1.0 LIST OF ACRONYMS

Define all acronyms used in the document. Contact an Environmental Restoration (ER) Project technical editor for a standard list of ER Project acronyms. Use the standard list, adding additional acronyms used and removing acronyms that were not used.

A-2.0 GLOSSARY

Define terms used in the document that need clarification. Contact an ER Project technical editor for a standard glossary of ER Project terms. Use the standard glossary, adding additional terms and removing terms that were not used.

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APPENDIX B OPERATIONAL AND ENVIRONMENTAL SETTING

This appendix should describe the facility, technical area (TA), or other general area in which the potential release sites (PRSs) included in this Resource Conservation and Recovery Act (RCRA) facility investigation (RFI) report are located. PRS-specific information should be included in the body of the report.

B-1.0 OPERATIONAL HISTORY AND LAND USE

Discuss the operational history (including current activities) of the facility, TA, or other general area in which the PRSs in this report are located.

- Provide the length of time that the facility or TA was operational and the associated start and end dates.
- Identify the types of PRSs included in the general area, and the types of facility processes that may have contributed to contamination at the PRSs. (The description of the operational history should support the list of potential contaminants and their release mechanisms at the PRSs in question).
- Discuss the historical use of chemicals at the facility or TA, including the estimated inventory if known.
- Discuss the current activities and land use at the facility, TA, or other general area encompassing the PRSs.

State that future and current land-use maps can be found in the 1995 update to the LANL Site Development Plan (LANL 1995, ER ID 57224).

B-2.0 CLIMATE

Identify the general climate of the area, including prevailing wind direction(s); effects of summer rains, snow melt, etc.; rate of evapotranspiration; range of temperatures; average precipitation; and other pertinent information.

B-3.0 GEOLOGY

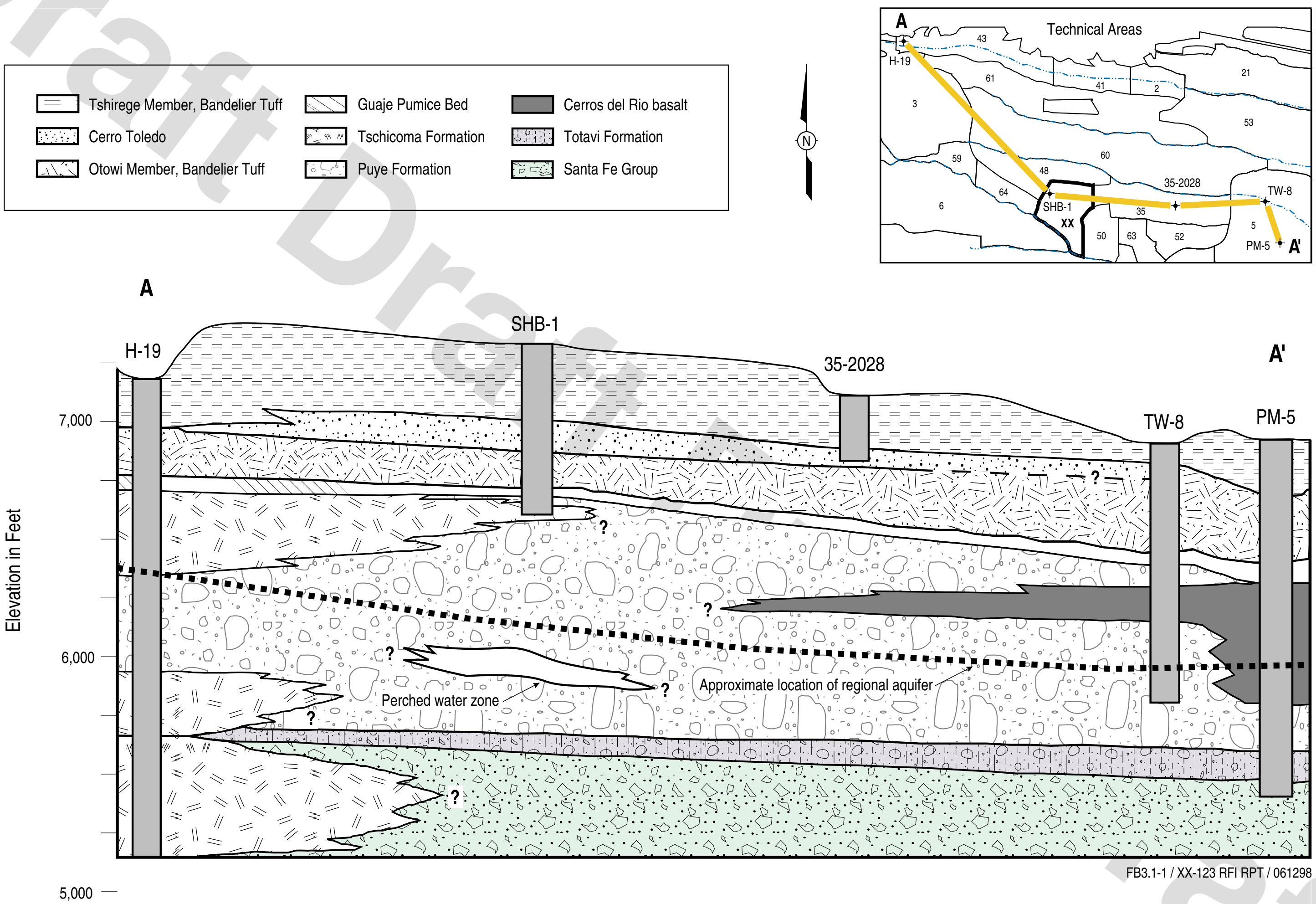
In Appendixes B-3.1 and B-3.2, describe what is currently known about the geology for the facility, TA, or other general area encompassing the PRSs. PRS-specific information should be presented in the body of the report.

Do not simply refer to the work plan; rather, present all of the relevant information. If what is known about the PRS has changed dramatically from the description in the work plan, discuss the changes and summarize or quote the work plan discussions as needed. See the General Guidelines for further guidance on using information from the work plan and other archival reference materials.

B-3.1 Geologic Setting

Address the following items:

- Provide a figure that shows a cross section of the detailed stratigraphy of the facility, TA, or other general area. If this is not available, provide a figure of the generalized stratigraphy (e.g., the entire Pajarito Plateau, a general mesa, etc.). Follow Example Figure B-3.1-1.



Example Figure B-3.1-1. Generalized stratigraphy of TA-XX.

- Describe the stratigraphy of the area, including how that information was obtained (e.g., from logs of nearby wells).
- Provide a geologic map of the area under investigation, including the structural geology if such information is available. Use judgment as to format.
- Describe the structural geology, including both local and regional structural features (e.g., folding, faulting, jointing, strike and dip, etc.).
- If applicable, discuss the paleotopography.

B-3.2 Soils

If the information is available, address the following items:

- Describe the soil types, physical and chemical properties, and major geomorphic features (e.g., large drainages, hills, etc.) at the facility, TA, or other general area.
- If applicable, discuss soil thickness and variability, and provide the depth to the soil/tuff interface.
- Provide a soils map. Use judgment as to format.

B-4.0 HYDROLOGY

B-4.1 Hydrological Conceptual Model

Discuss the hydrological conceptual model, including but not limited to the following: surface water run-on and runoff and sediment transport; erosion and surface exposure; fluid transport via the regional aquifer, alluvial aquifers, perched water, springs, and seeps; infiltration and transport in the vadose zone; and atmospheric dispersion.

B-4.2 Surface Water

Address the following items:

- Briefly discuss watershed locations.
- Discuss man-made or natural drainages, streams, wetlands, outfalls, etc. Provide the available information regarding the location, elevation, flow, velocity, depth, width, seasonal fluctuations, and proximity to the 100-year flood plain for associated streams, ditches, drains, wetlands, and channels. Provide the associated National Pollutant Discharge Elimination System (NPDES), Stormwater Permit/Plan, and/or Discharge Permit/Plan number.

B-4.2.1 LANL-ER-AP-4.5 Assessment(s)

Use the following introduction:

> "At the Laboratory, surface water runoff and sediment transport are among the potential migration pathways by which contaminants might be transported to off-site receptors. Surface water may also access subsurface contaminants exposed by soil erosion. Soil erosion is dependent on several factors, including soil

properties, the amount of vegetative cover, the slope of the contaminated area, exposure, the intensity and frequency of precipitation, and seismic activity.

The Laboratory's ER Project has developed Administrative Procedure 4.5 (AP-4.5) to assess sediment transport and erosion concerns at specific PRSs. AP-4.5 provides a basis for prioritizing and scheduling actions to control erosion of potentially contaminated soils at specific PRSs. The procedure is a two-part evaluation. Part A is a compilation of existing PRS analytical data, site maps, and knowledge-of-process information. Part B is an assessment of the erosion/sediment transport potential at the PRS. Erosion potential is numerically rated from 1 to 100 using a matrix system. PRSs that score below 40 have a low erosion potential; those that score from 40 to 60 have a medium erosion potential; and those that score above 60 have a high erosion potential. Part A of this assessment is initiated and completed by the Los Alamos National Laboratory (LANL or the Laboratory) Environmental Restoration (ER) Project; Part B is completed by the Laboratory's Water Quality and Hydrology Group (ESH-18). A Surface Water Assessment Team comprised of representatives from the ER Project, ESH-18, the Laboratory's Facility Management Group (FSS-7), and the Department of Energy (DOE) Oversight Bureau evaluates each completed assessment. If necessary, a best management practice or other action is implemented based on the results of the assessment.

The AP-4.5 assessments for the PRSs addressed in the RFI report are attached following this introduction."

If applicable, add the following statement:

"Note in Part A that if Item 10, Sample Information, is marked yes but no data are provided, it is because all applicable data are nondetected values."

Reproduce and attach Parts A and B of the LANL-ER-AP-4.5 assessments for all of the PRSs included in the document.

B-4.3 Groundwater

This section should introduce the material in the sections under Appendix B-4.3. Address the following:

- State that Appendixes B-4.3.1 through B-4.3.4 discuss the alluvial waters, perched aquifers, regional aquifer, and vadose zone in the vicinity of the facility, TA, or other general area encompassing the PRSs.
- Include a map showing the locations of alluvial wells, perched water wells, regional aquifer wells, and springs resulting from alluvial aquifer discharges, perched aquifer discharges, and regional aquifer discharges in the vicinity of the facility, TA, or other general area.
- State that the stratigraphy, the locations of perched waters, the location of the regional aquifer, the unsaturated geologic units above and between the aquifers (if applicable), and depths of perched water wells and regional aquifer wells in the vicinity of the facility, TA, or other general area are presented in Figure B-3.1-1 (see Example Figure B-3.1-1).

B-4.3.1 Alluvial Waters

For the facility, TA, or other general area, discuss alluvial waters. Address the following items:

- Describe the occurrence of alluvial water and the properties of the alluvial material (e.g., sand, clay, gravel content, or rock type).

- If known, discuss the extent (thickness and area) of any alluvial aquifers, identify the bedrock units in which the alluvial waters are perched, and discuss data concerning flow direction and gradient.

- Discuss features that may lead to channeling or localized flow of water or contaminants in the alluvial material (e.g., high permeability zones).

- Discuss alluvial wells in the area. Provide the depth of the wells, the intervals screened, and the depth to water. Also describe monitoring (chemical or hydrologic) currently being conducted in the wells. Provide available information on recharge and discharge pathways and flow rates if PRS-specific discussions were not included in the body of the report (e.g., in Section 2.2, Description and Operational History, or Section 2.3.5, Revised Site Conceptual Model).

- Discuss springs in the area resulting from alluvial aquifer discharges. Discuss available flow rate and chemical information if PRS-specific discussions were not included in the body of the report (e.g., in Section 2.2, Description and Operational History, or Section 2.3.5, Revised Site Conceptual Model).

- Refer to the figure in Appendix B-4.3, and state that it shows the locations of alluvial wells and springs resulting from alluvial aquifer discharges.

B-4.3.2 Perched Waters

For the facility, TA, or other general area, discuss perched waters. Address the following items:

- Describe perched water occurrences for each aquifer.

- If known, identify the depth, thickness, and area of the aquifer; the geologic unit in which the aquifer is located; and the geologic unit in which the aquifer is perched. Discuss the confining unit, if applicable. Also discuss the known hydraulic properties of the aquifer-bearing and perched units, and data on flow direction and gradient.

- Discuss perched water wells in the area. Provide the depth of the wells, the intervals screened, and the depth to water. Also describe monitoring (chemical or hydrologic) currently being conducted in the wells. Provide available information on recharge and discharge pathways and flow rates if PRS-specific discussions were not included in the body of the report (e.g., in Section 2.2, Description and Operational History, or Section 2.3.5, Revised Site Conceptual Model).

- Discuss springs in the area resulting from perched aquifer discharges. Discuss available flow rate and chemical information if it has not been discussed earlier (e.g., in Section 2.2, Description and Operational History, or Section 2.3.5, Revised Site Conceptual Model).

- Refer to the figure in Appendix B-4.3, and state that it shows the locations of perched water wells and springs resulting from perched aquifer discharges. Also refer to Figure B-3.1-1, and state that it shows the general stratigraphy of the site, the locations of perched waters, and the depths of perched water wells in the vicinity of the facility, TA, or other general area.

B-4.3.3 Regional Aquifer

Describe the regional aquifer. Address the following items:

- Discuss regional aquifer wells in the area. Provide the depth of the wells, the intervals screened, the depth to water, the saturated units the wells penetrate, and the uses of the wells (e.g., water supply monitoring). Use a table if it facilitates the presentation (use judgment as to format).
- If applicable, describe monitoring (chemical or hydrologic) currently being conducted at the regional aquifer wells.
- If known, discuss the relevant hydraulic properties (e.g., hydraulic conductivity, bulk density, etc.) of the regional aquifer. Also discuss data on flow direction and gradient.
- Describe the aquifer material (e.g., clay or sand content, fractured or vesicular basalt, etc.).
- Discuss the confined or unconfined nature of the regional aquifer and, if applicable, the nature of the confining units.
- Discuss applicable information on recharge and discharge pathways and flow rates if PRS-specific discussion were not included in the body of the report (e.g., in Section 2.2, Description and Operational History, or Section 2.3.5, Revised Site Conceptual Model).
- Discuss any springs in the area resulting from regional aquifer discharges. Discuss available flow rate and chemical information if PRS-specific discussion were not included in the body of the report (e.g., in Section 2.2, Description and Operational History, or Section 2.3.5, Revised Site Conceptual Model).
- Refer to the figure in Appendix B-4.3, and state that it shows the locations of regional aquifer wells and springs resulting from regional aquifer discharges. Also refer to Figure B-3.1-1, and state that it shows the general stratigraphy of the site, the location of the regional aquifer, and the depths of regional aquifer wells in the vicinity of the facility, TA, or other general area.

B-4.3.4 Vadose Zone

Address the following items:

- If applicable and not described elsewhere, identify the unsaturated geologic units above and between the aquifers. If applicable, refer to Figure B-3.1-1.
- Discuss hydraulic parameters (e.g., soil characteristic curves, matrix potentials, hydraulic conductivities, etc.) and moisture content data.
- Discuss hydrogeologic features that may influence vadose zone transport (e.g., fractures, buried soils, surge beds, or other highly permeable or impermeable units).

B-5.0 ECOLOGICAL RESOURCES

This section should describe the findings of the ecological surveys that include the PRSs discussed in this report. Address the following items:

- Briefly discuss when, by whom (e.g., Biological Resource Evaluations Team), and for which facility, TA, or other general area biological field surveys were conducted. State the reason for conducting the surveys. Cite the reports that document the surveys.
- Discuss the ecological setting, description, current status, previous surveys, current actions and investigations, and the biological survey for the site.
- Discuss the results of the biological field survey(s) conducted prior to the sampling event. Include the following items:
  - Discuss the habitats and species present or expected to be present at the site and adjacent areas.
  - Describe the biota in surface water bodies on, adjacent to, or affected by the site.
  - Indicate areas at and near the PRSs where state and federal threatened or endangered species (both proposed and listed) are located.
  - Discuss other species or habitats of special significance, such as commercially, culturally, or recreationally significant species.
  - Discuss wetlands or flood plains that are contained within the facility, TA, or other general area.
- Describe disturbed and undisturbed habitats.
- Discuss the impacts of the sampling event(s) on ecological receptors, or state that the sampling event(s) did not impact ecological receptors and discuss what steps were taken to avoid impact or to restore disturbed land.

B-6.0 CULTURAL RESOURCES

This section should discuss the results of the cultural surveys that include the PRSs discussed in this report. Address the following items:

- Briefly discuss when, by whom, and for which applicable facility, TA, or other general area cultural/archaeological surveys were conducted. State the reason for conducting the surveys. Cite the reports that document the surveys.
- Discuss the results of the cultural/archaeological surveys conducted prior to the sampling event.
- Discuss disturbed and undisturbed environments.
- Discuss the impacts of the sampling event(s) on cultural/archaeological sites that exist in the area, or state that the sampling event(s) did not impact cultural/archaeological sites and discuss what steps were taken to avoid such impacts.

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APPENDIX C RESULTS OF QUALITY ASSURANCE/QUALITY CONTROL ACTIVITIES

C-1.0 SUMMARY

This section should provide a summary of the quality assurance (QA)/quality control (QC) activities for the potential release sites (PRSs) included in this report. Introductory material to this appendix should include a description of the data set that was evaluated for this report and how the QA/QC evaluation was carried out. Field analyses should be presented first, followed by fixed laboratory analyses. Address the following items in both discussions as appropriate:

- Summarize the number of field or fixed-laboratory samples analyzed, and the number of associated field QC samples (e.g., field duplicates) and/or PRS-specific performance evaluation samples. List the PRSs for which samples were collected and analyzed.
- Summarize the analytical suites for which samples were analyzed, and state that the target analytes for each suite are listed in Appendix D-1.0, Target Analytes and Detection Limits.
- Include a table that shows the analytical suite, analytical method ID, and method description for all analyses performed (e.g., SW-846 Method 6010, inductively-coupled plasma emission spectroscopy [ICPES]). Use judgment as to format. State that detection or quantitation limits are provided in Appendix D-1.0, Target Analytes and Detection Limits.
- Indicate that sample preservation and holding time requirements are provided in Los Alamos National Laboratory (LANL) Environmental Restoration (ER) standard operating procedure (SOP) 1.02 (revision in progress). Indicate whether there were deviations from these requirements and refer to later sections of this appendix for details.
- Summarize the types of laboratories (e.g., fixed, mobile, internal, external) and, if pertinent to the data quality evaluation, and the number of laboratories used (e.g., whether analyses were performed by single or multiple external laboratories).
- State that the requirements of the sampling and analysis plan (SAP), the ER Project Quality Assurance Project Plan (QAPP), the analytical services statement of work, and/or ER SOPs were followed during analytical data collection and evaluation. Summarize deviations from these requirements.
- Briefly describe the types of QA and QC samples (both field and laboratory) or processes that were evaluated in preparing this appendix (e.g., laboratory duplicates, blank samples, etc.). State that the type and frequency of QC analyses required for fixed-laboratory analyses is described in the ER Project Statement of Work for Analytical Services (LANL 1995, ER ID 49738). State that definitions of the QA/QC sample types and processes are included in the glossary in Appendix A-2.0.
- Describe the procedure that was used for routine validation of the analytical data. If the current ER Project validation procedure was used for all data, state that this procedure is described in the Installation Work Plan (IWP). If data were collected before April 1995, describe the validation procedure that was used (e.g., Chemical Science and Technology [CST] 3 validation procedures). Emphasize that the ER data validation procedures are based on Environmental Protection Agency (EPA) National Functional Guidelines for Data Review (EPA 1994, ER ID 48639; EPA 1994, ER ID 48640).

- Briefly describe the focused validation process, stating that a more detailed description is located in the QAPP (LANL 1996, ER ID 53450). If focused validation was performed for the data set being evaluated, briefly describe why. Refer to later sections of this appendix for details.

- State that, generally, data are still usable even though qualifier flags may be applied during the routine and focused validation processes. State that definitions of laboratory qualifiers, LANL qualifiers, and focused validation qualifiers are included in the glossary in Appendix A-2.0.

Conclude this section by summarizing the results of the evaluation of QA/QC activities in general terms. The following items should be emphasized:

- Indicate whether, as a result of the evaluation of QA/QC activities, the analytical data are of sufficient quality for the intended use in this report. If qualifier flags have been applied to data, generally state the impact on data usability.

- If data were rejected for use in this report, describe those data here and the reasons for rejection. Refer to later sections of this appendix for details.

- State that the detailed results of data validation are presented in Section C-5.0, Results of Data Validation.

- State that discussions of data usability on a PRS-specific basis are also presented in the body of the report in Section 2.3.4.3, Data Review.

C-2.0 INORGANIC ANALYSES

This section should provide a detailed discussion of the QA/QC findings for inorganic analytes. Address the items under each of the following sections.

C-2.1 Field Analyses

This section should include the QA/QC results from all field analyses. As applicable, include discussions of spot tests, field screening, other field analytical methods, and field (mobile) laboratory analyses.

- State the numbers of samples analyzed for inorganic chemicals using field methods (e.g., x-ray fluorescence [XRF], mobile laboratories, spot tests, etc.). Provide the target analytes and the analytical methods or instrumental techniques used. Do not include screening measurements made for the purposes of health and safety or shipping and handling.

- Cite the ER SOP, LANL SOP, or published method that was used for the field measurements.

- Discuss the detection limits for the field methods employed with respect to background values (BVs) and screening action levels (SALs), and indicate whether detection limits were greater than these values. Refer to the appropriate table in Appendix D-1.0, Target Analytes and Detection Limits.

- If the required detection limits were not met in the field, describe which samples were affected, what caused the elevated detection limits (e.g., matrix interference due to oil contamination), and what actions were taken to try to meet the detection limit requirements.

- Discuss the results of QC activities for field methods, including the acceptance criteria.
- Describe focused validation that was performed for the field inorganic analytical results, and present the outcome.
- Discuss the usability of the field inorganic data, including potential bias (in direction or relative magnitude), as determined by the data quality evaluation.

C-2.2 Fixed Laboratory Analyses

This section can be presented either as a single discussion, or as separate discussions under separate bolded, unnumbered headings for routine and special analytical services. The following general guidance applies to both routine and special analytical services. If separate headings are used for routine and special analytical services, address these items under both headings.

- State the numbers of samples that underwent inorganic analysis at a fixed laboratory, and the analytical methods used by the fixed laboratories (e.g. SW-6010B, etc.), including sample preparation methods.
- Discuss the detection limits for the methods employed with respect to BVs and SALs, and indicate whether detection limits were greater than these values. If routine analytical services were used, state that a listing of the contractually required detection limits for routine analytical services is included in Appendix D, Analytical Suites and Results. If nonroutine analytical methods were used, refer to the appropriate table in Appendix D-1.0.
- If the analytical laboratory did not meet the required detection limits, describe which samples were affected, what caused the elevated detection limits (e.g., matrix interference due to oil contamination), and what corrective actions were taken to try to meet the detection limit requirements.
- Discuss the results for laboratory control samples, laboratory duplicates, matrix spikes, and blank samples. Discuss the results for other pertinent QC samples or processes (e.g., performance evaluation samples). Include the acceptance criteria or acceptable recovery ranges for the QC samples being discussed.
- Discuss the results of fixed laboratory inorganic analyses of field QC samples, and how interpretation of regular field sample results may be affected.
- Describe focused validation that was performed for the fixed analytical laboratory inorganic analytical results, and present the outcome.
- When holding times have been exceeded, provide the number of days over the required holding time and the potential impact on the analytical results.
- Discuss the usability of the fixed analytical laboratory inorganic data, including potential bias (in direction or relative magnitude), as determined by the data quality evaluation.

C-3.0 RADIOCHEMICAL ANALYSES

This section should provide a detailed discussion of the QA/QC findings for radionuclides. Address the items under each of the following sections.

C-3.1 Field Analyses

This section should include the QA/QC results from all field analyses. As applicable, include discussions of spot tests, field screening, other field analytical methods, and field (mobile) laboratory analyses.

- State the numbers of samples that underwent field radiochemical analysis. Provide the target analytes and the analytical methods or instrumental techniques used. Do not include screening measurements made for the purposes of health and safety or shipping and handling.
- Cite the ER SOP, LANL SOP, or published method that was used for the field measurements.
- Discuss the detection limits for the methods used with respect to BVs and SALs, and indicate whether the detection limits were greater than these values. Refer to the appropriate table in Appendix D-1.0, Target Analytes and Detection Limits.
- Describe how the detection status for radiochemical analytes analyzed by field methods was determined (e.g., comparison to minimum detectable activity, decision level concentration [DLC], 2-sigma total propagated uncertainty [TPU], etc.)
- If the required detection limits were not met in the field, describe which samples were affected, what caused the elevated detection limits (e.g., gamma spectrum interference due to high levels of uranium), and what corrective actions were taken to try to meet the detection limit requirements.
- If gamma/beta spectrometry measurements were performed in the field, describe how the results were evaluated (e.g., naturally-occurring isotopes, short-lived isotopes, etc.). Refer to the appropriate SOP (currently in preparation) for identifying specific gamma spectrometry results.
- Discuss the results of QC activities for field methods, including the acceptance criteria.
- Describe focused validation that was performed for the radiochemical analytical results from field samples, and present the outcome.
- Discuss the usability of the field radiochemical data, including potential bias (in direction or relative magnitude), as determined by the data quality evaluation.

C-3.2 Fixed Laboratory Analyses

This section can be presented either as a single discussion, or as separate discussions under separate bolded, unnumbered headings for routine and special analytical services. The following general guidance applies to both routine and special analytical services. If separate headings are used for routine and special analytical services, address these items under both headings.

- State the numbers of samples that underwent radiochemical analysis at a fixed laboratory. Provide the target analytes and the analytical methods or instrumental techniques used by the analytical laboratories (e.g., tritium by liquid scintillation counting), including sample preparation methods.

- Discuss the detection limits for the methods used with respect to BVs and SALs, and indicate whether the detection limits were greater than these values. If routine analytical services were used, state that a listing of the contractually required detection limits for routine analytical services is included in Appendix D, Analytical Suites and Results. If nonroutine analytical methods were used, refer to the appropriate table in Appendix D-1.0, Target Analytes and Detection Limits.

- Describe how the detection status for radiochemical analytes analyzed by fixed analytical laboratories was determined (e.g., comparison to minimum detectable activity, DLC, 2-sigma TPU, etc.)

- If the analytical laboratory did not meet the required detection limits, describe which samples were affected, what caused the elevated detection limits (e.g., gamma spectrum interference due to high levels of uranium), and what corrective actions were taken to try to meet the detection limit requirements.

- If gamma spectrometry measurements were performed during fixed-laboratory analysis, describe how the results were evaluated (e.g., naturally-occurring isotopes, short-lived isotopes, etc.). Refer to the appropriate SOP (currently in preparation) for identifying specific gamma spectrometry results.

- If tritium measurements were performed on soil samples, explain that results were expressed in units of pCi per gram of dry soil.

- Discuss the results for laboratory control samples, duplicate samples, and blank samples. Discuss tracer and/or carrier recoveries with respect to acceptance criteria. Discuss the results for other pertinent QC samples or processes (e.g., matrix spike, performance evaluation samples, etc.). Include the acceptance criteria or acceptable recovery ranges for the QC samples being discussed.

- Discuss the results of fixed-laboratory radiochemical analysis of field QC samples, and how interpretation of regular field sample results may be affected.

- Describe focused validation that was performed for the radiochemical analytical results from fixed-laboratory samples, and present the outcome.

- When holding times have been exceeded, include the number of days over the required holding time and the potential impact on the analytical results.

- Discuss the usability of the fixed-laboratory radiochemical data, including potential bias (in direction or relative magnitude), as determined by the data quality evaluation.

C-4.0 ORGANIC ANALYSES

This section should provide a detailed discussion of the QA/QC findings for organic analytes. Address the items under each of the following sections.

C-4.1 Field Analyses

This section should include the QA/QC results from all field analyses. As applicable, include discussions of spot tests, field screening, other field analytical methods, and field (mobile) laboratory analyses.

- State the numbers of samples that underwent field organic analysis, and the analytical methods used. Provide the target analytes and the analytical methods or instrumental techniques used. Do not include screening measurements made for the purposes of health and safety or shipping and handling.
- Cite the ER SOP, LANL SOP, or published method that was used for the field measurements.
- Discuss the detection and/or quantitation limits for the field analytical methods employed with respect to BVs and SALs, and indicate whether quantitation and/or detection limits were greater than these values. Refer to the appropriate table in Appendix D-1.0, Target Analytes and Detection Limits.
- If the required detection and/or quantitation limits were not met in the field, describe which samples were affected, what caused the elevated detection limits (e.g., matrix interference due to oil contamination), and what corrective actions were taken to try to meet the detection and/or quantitation limit requirements.
- Discuss the results of QC activities for field methods including acceptance criteria.
- Describe focused validation that was performed for the field organic analytical results, and the outcome.
- Discuss the usability of the field organic data, including potential bias (in direction or relative magnitude for the individual analytical suite), as determined by the data quality evaluation.

C-4.2 Fixed Laboratory Analyses

This section should be presented as separate discussions under separate bolded, unnumbered headings for individual analytical suites (i.e. semivolatile organic compounds [SVOCs], volatile organic compounds [VOCs], polychlorinated biphenyls [PCBs], etc.). Address the following general guidance under all of the subdivisions.

- State the numbers of samples that underwent fixed-laboratory organic analysis, and the analytical methods used by the laboratories (e.g., SW-8270B) including sample preparation methods.
- Discuss the detection and/or quantitation limits for the fixed-laboratory methods employed with respect to BVs and SALs, and indicate whether quantitation and/or detection limits were greater than these values. Provide a statement that quantitation limits are generally five to ten times the method detection limit. If routine analytical services were used, state that a listing of the contractually required detection and/or quantitation limits for routine analytical services is included in Appendix D, Analytical Suites and Results. If nonroutine analytical methods were used, refer to the appropriate table in Appendix D-1.0, Target Analytes and Detection Limits.

- If the analytical laboratory did not meet required detection and/or quantitation limits, describe which samples were affected, what caused the elevated detection limits (e.g., matrix interference due to oil contamination), and what corrective actions were taken to try to meet the detection and/or quantitation limit requirements.

- Discuss the results for blank sample analysis, with particular emphasis on false positive results in regular field samples. Discuss surrogate recoveries with respect to acceptance criteria. Discuss the results for other pertinent QC samples or processes (e.g., matrix spikes/matrix spike duplicates [MS/MSD], performance evaluation samples, etc.). Include the acceptance criteria or acceptable recovery ranges for the QC sample being discussed.

- Discuss the results of fixed-laboratory organic analyses of field QC samples, and how interpretation of regular field sample results may be affected.

- Describe focused validation that was performed for the fixed-laboratory organic analytical results, and present the outcome.

- When holding times have been exceeded, include the number of days over the required holding time and the potential impact on the analytical results.

- Discuss the usability of the fixed-laboratory organic data, including potential bias (in direction or relative magnitude for the individual analytical suite), as determined by the data quality evaluation.

C-5.0 RESULTS OF DATA VALIDATION

For each PRS included in the report, provide a table presenting data qualifiers that were applied as a result of the data validation process. Use judgment as to table format. Provide bolded headings for each PRS in the report. Follow each heading either with a table or a statement that no data qualifiers were applied for the PRS.

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APPENDIX D ANALYTICAL SUITES AND RESULTS

D-1.0 TARGET ANALYTES AND DETECTION LIMITS

This section should present tables of the target analytes and detection or quantitation limits for all analyses conducted for the Resource Conservation and Recovery Act (RCRA) facility investigation (RFI). Present separate tables for field analyses and fixed-laboratory analyses. Use judgment as to table format. Address the following in the tables:

- Provide information for both routine and nonroutine analytical suites for which samples were analyzed during the RFI.
- Include each target analyte, the matrix analyzed, the method ID, and the detection or quantitation limit for that analysis.

Routine analytical suites are described in the Quality Assurance Project Plan (QAPP) and include volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), pesticides/polychlorinated biphenyls (PCBs), high explosives (HE), metals, and selected radionuclides. The tables provided in this appendix may need to be modified from those presented in the QAPP because target analytes in several suites have changed with subsequent contract laboratory statements of work. For example, the inorganic suite changed from 11 to 21 analytes in mid-1994. When in doubt, check the target analyte list in one of the data packages associated with this investigation.

D-2.0 RFI ANALYTICAL RESULTS

This section should present the analytical data for the PRSs included in the RFI report. Analytical data must be provided in both electronic and hard-copy formats. A hard copy of the data must be included as an attachment to each copy of the report. In addition, one electronic copy of the data must accompany the hard copy reports submitted to New Mexico Environment Department (NMED) Hazardous and Radioactive Materials Bureau (HRMB), Department of Energy (DOE), and the Los Alamos National Laboratory (LANL or the Laboratory) Environmental Restoration (ER) Project Records Processing Facility (RPF).

Address the following items in the text of this appendix:

- State that an abridged version of all of the analytical data collected during the RFI are included as an attachment to this report. State that more detailed data have been submitted in electronic format to NMED HRMB, DOE, and the LANL ER Project RPF. State that the copies of the report that include electronic data have the notation "Data disks included with this copy" clearly displayed on the cover.
- State the number of disks on which the electronic data are saved, and the software package and version used to store the data. The data should be formatted in spreadsheets and saved as Excel 4.0.
- Provide the name for each disk, and list the files that each disk contains.
- State that the electronic data are available in the Facility for Information Management, Analysis, and Display (FIMAD). If the data are not available in FIMAD, explain why and provide a method for non-Laboratory readers to obtain the data.

- Be sure that FIMAD personnel have verified all FIMAD data for accuracy (i.e., for data collected after April 1995, ensure that the electronic data have been compared with the hard copy data package from the analytical laboratory) before these data are submitted.
- Be sure that the data reported in this appendix agree with the data presented in the body of this report.
- State that the hard copy data are attached at the end of the report.

The hard copy data should address the following items (use judgment as to table format):

- Present field and fixed-laboratory analytical data in separate tables. Different sample matrixes and analytical suites may also be presented in separate tables.
- Indicate when data are not available or not applicable (i.e., do not leave any table cells blank). If a data qualifier field is blank because no qualifier flag is required, write "None" in the cell.
- Include all chemical results (even nondetected values) for both field and fixed-laboratory measurements.
- Include all data that are not available in electronic form (e.g., non-FIMAD data).
- Include all results for measured physical or physiochemical parameters (e.g., grain size, turbidity, suspended solids, etc.).
- Include all groundwater analytical data collected during the RFI for the PRSs included in this report and areas down-gradient from these PRSs.
- Include the following fields in the hard copy data:
    - PRS number,
    - Location ID,
    - Sample ID,
    - Depth and units,
    - Sample medium (as defined in FIMAD),
    - Analyte name,
    - Sample results and units (use consistent units for all results), and
    - RFI data validation qualifiers (i.e., the qualifier flag that appears on the data in the tables in the body of this report, which is based on the analytical laboratory data qualifier, the LANL data qualifier, and/or the result of focused data validation).

The electronic copy of the data should include the following items (use judgment as to format):

- Present field and fixed-laboratory analytical data in separate electronic files. Different sample matrixes and analytical suites may also be presented in separate files.
- Indicate when data are not available or not applicable (i.e., do not leave any table cells blank). If a data qualifier field is blank because no qualifier flag is required, write "None" in the cell.
- Include all chemical results (even nondetected values) for both field and fixed-laboratory measurements.
- Include all quality control (QC) data (e.g., results from matrix spike samples, surrogate compounds, etc.).
- Include all results for measured physical or physiochemical parameters (e.g., grain size, turbidity, suspended solids, etc.).
- Include all groundwater analytical data collected during the RFI for the PRSs included in this report and areas down-gradient from these PRSs.
- Include the following fields in the electronic data:
  - PRS number,
  - Location ID,
  - Sample ID,
  - Collection date for each sample,
  - Depth and units,
  - Sample matrix (as defined in FIMAD),
  - Sample medium (as defined in FIMAD),
  - Request number,
  - Date of submittal to the analytical laboratory for each sample (if available in FIMAD),
  - Date of analysis (if available in FIMAD),
  - Analytical suite,
  - Analytical laboratory name,
  - Analyte name,
  - Sample results and units (use consistent units for all results),
  - Analytical laboratory data qualifiers,

– LANL data validation qualifiers, and

– RFI data validation qualifiers (i.e., the qualifier flag that appears on the data in the tables in the body of this report, which is based on the analytical laboratory data qualifier, the LANL data qualifier, and/or the result of focused data validation).

D-3.0 OTHER APPLICABLE RFI RESULTS

This section should include details of RFI results not covered under Appendix D-2.0, including core logs, flow rates, geophysical reconstructions, foot-by-foot neutron logging results or fracture density calculations, daily flow rates, raw geophysical data, etc. Use judgement as to whether to include these items in the appendix or as an attachment.

D-4.0 NON-RFI DATA

Include data that were considered in making the PRS decision but were not collected as part of the RFI or by the ER Project. Submit them as part of the electronic data set described in Appendix D-2.0, or, If data are not available in electronic form, include hard copies. Use judgement as to whether to include these items in the appendix or as part of the attachment described in Appendix D-2.0.

Examples of data that might be included in this section are data from the LANL environmental surveillance reports, non-RFI groundwater analytical data from areas down-gradient from PRSs included in this report, and historical data used directly in the data review, screening, and risk assessments.

In both the hard copy and electronic data, address the following items:

- Be sure that the data reported in this appendix agree with the data presented in the body of this report.

- Indicate when data are not available or not applicable (i.e., do not leave any table cells blank).

APPENDIX E STATISTICAL ANALYSES

This appendix should include the details of all statistical calculations discussed in the body of the report. The details presented here should be clearly and simply written (i.e., the public should not have difficulty understanding what was done and why). Use a technical editor to improve the clarity of this appendix. Definitions for unclear terms should be provided in the glossary in Appendix A-2.0.

If a number of different statistical calculations are necessary, using different subsets of the data and/or different data preparation, break this appendix into the appropriate sections using unnumbered, bold headings. Statistical analyses that might be presented in this section include the following:

- exploratory data analysis, including explanations of graphics that are not self-explanatory (e.g., probability or box plots);
- summary statistics (e.g., estimates of mean contaminant levels or quantiles of the distribution of contaminant levels) and confidence bounds for these estimates;
- statistical comparisons of data sets (e.g., two-sample tests comparing PRS data with background data or comparisons between two subsets of PRS data); and
- statistical data extrapolation, including explanations of algorithms used to generate contour plots or other displays that extrapolate information from the actual samples to unsampled locations and/or times.

Address the following items for each statistical test:

- Completely specify all data sets used (the reviewer should be able to reconstruct each potential release site (PRS) data set from this specification and the information in Appendix D).
- Describe all data preparation steps, including the treatment of below-detection-level, zero, and negative values for various statistical procedures, and the detection and possible elimination of outliers.
- Assess the applicability of a statistical procedure to the given data set, evaluating the assumptions on which that procedure is based and why other more standard procedures are not applicable.
- Describe computational algorithms, either explicitly or by reference, in enough detail to allow the reviewer to reproduce the result (within sampling error, if a randomized procedure is used.)

If no statistical calculations are performed, state that no statistical calculations were performed for the PRSs being reported.

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APPENDIX F RISK ASSESSMENT CALCULATIONS

F-1.0 HUMAN HEALTH

This appendix should include supporting risk assessment calculations and/or spreadsheets for the human health risk assessments discussed in the body of the report. Include all supporting calculations in enough detail for the reviewer to reproduce the risk assessment results. Also present and provide references for all parameters used in the risk calculations.

If no supporting calculations are necessary, state that no quantitative risk assessment was performed for the PRSs being reported.

If more than one risk assessment calculation is necessary, break this appendix into the appropriate sections using unnumbered, bold headings.

F-2.0 ECOLOGICAL

This appendix should include the ecological scoping checklist for each of the PRSs described in the report. It should also include supporting risk assessment calculations and/or spreadsheets for the ecological risk assessments discussed in the body of the report. Include all supporting calculations in enough detail for the reviewer to reproduce the risk assessment results. Also present and provide references for all parameters used in the risk calculations.

If no supporting calculations are necessary, state that no quantitative risk assessment was performed for the PRSs being reported.

If more than one risk assessment calculation is necessary, break this appendix into the appropriate sections using unnumbered, bold headings.

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APPENDIX G RELEVANT DOCUMENTS

G-1.0 DOCUMENTATION OF REGULATORY HISTORY

G-1.1 Corrective Action History

This section should summarize the corrective action history for each potential release site (PRS). Address the following items:

- Provide a chronological list of each Administrative Authority (AA) action (e.g., notices of deficiency [NODs], requests for supplemental information [RSIs], requests for additional work, approvals, etc.) and each Los Alamos National Laboratory (LANL) response.
- Include the date from each action letter and response letter.
- Use a table format if it facilitates the presentation (use judgment as to format).
- Verify the information in this list with the Environmental Restoration (ER) Project deliverable and NOD databases. Note that electronic information is not available for work plans that have already been approved by the AA. For more information, contact the Regulatory Compliance Focus Area leader (Tori George at 5-6953, torig@lanl.gov).
- Cite the AA action letters and LANL responses, and include them (without errata sheets or attachments) in the appropriate reference set of the LANL ER Project Reference Library (see the General Guidelines for information about this library).

G-1.2 Other Regulatory Documents

This section should summarize the applicable AA documents that are not covered in Appendix G-1.1. This includes but is not limited to approvals of site deferrals, correspondence regarding underground storage tank (UST) remediations, approval of deviations from sampling plans, etc. Address the following items:

- Provide a chronological list of each AA action and each LANL response.
- Include the date from each action letter and response letter.
- Use a table format if it facilitates the presentation (use judgment as to format).
- Cite the AA action letters and LANL responses, and include them (without errata sheets or attachments) in the appropriate reference set of the LANL ER Project Reference Library (see the General Guidelines for information about this library).

G-2.0 REFERENCED DOCUMENTS

In this section, attach archival and technical documents referenced in this report that do not belong in the reference set. These documents should be specific only to this RFI report. Archival or technical documents that might apply to other reports should be submitted as part of the appropriate reference set of the LANL ER Project Reference Library (see the General Guidelines for information about this library).

Appendix E

Annual Work Schedule for the Environmental Restoration Project at Los Alamos National Laboratory

Table E-1
Los Alamos National Laboratory/Environmental Restoration Fiscal Year 2000 Work Schedule[a]

Regulatory Deliverable	PRS Number	Unit Description	SOP 2.01[b] Score	Due Date/ Submit. Date
RFI Report	0-030(g)	Septic system near old Catholic Church	47.2	Sept.00
RFI Report	21-005	Disposal pit	17.5	Jan.00
RFI Report	73-005-99	LA Airport Aggregate 73-2 (South of 502)	56	Jun.00
	73-002-99	Steam cleaning facility (septic tanks and drainline)		
	73-005-99	Surface disposal site		
SAP	21-029	Soil contamination area	67	Mar.00
Integrated SAP	35-003(a)-99	Wastewater treatment facility	32.5	July 00
	35-003(j)-99	Wastewater treatment facility	34.6	
	35-003(p)	Former air filter building	50.8	
	35-004(a)	Storage area	3.6	
	35-004(b)	Storage area	22.3	
	35-004(g)	Container storage area	3.6	
	35-004(h)	Container storage area	50.8	
	35-004(m)	Container storage area	3.6	
	35-008	Surface disposal and landfill	61	
	35-009(a)	Septic system	22.3	
	35-009(b)	Septic system	3.6	
	35-009(c)	Septic system	18.3	
	35-009(d)	Septic system	32.8	
	35-009(e)	Septic system	18.3	
	35-014(a)	Operational release	10.6	
	35-014(b)	Leaking drum	TBD[c]	
	35-014(e)	Oil spill	61	
	35-014(f)	TPH soil contamination	3.6	
	35-014(g)	Oil spill	39.8	
	35-015(a)	Waste oil treatment system	3.6	
	35-016(a)	Drains and outfalls	92	
	36-016(b)	Outfall	96	
	35-016(c)	Outfall	47.2	
	35-016(d)	Outfall	76.5	
	35-016(e)	Outfall	72	
	35-016(f)	Storm drain	76.5	
	35-016(g)	Outfall	68.3	
	35-016(h)	Storm drain	76.5	
	35-016(i)	Storm drain	61	
	35-016(j)	Storm drain	24	
	35-016(k)	Drains and outfalls	53	
	35-016(l)	Storm drain	64	

Table E-1 (continued)

Regulatory Deliverable	PRS Number	Unit Description	SOP 2.01[b] Score	Due Date/ Submit. Date
Integrated SAP (continued)	35-016(m)	Drains and outfalls	72	
	35-016(n)	Storm drain	42.8	
	35-016(o)	Drains and outfalls	60.3	
	35-016(p)	Outfall	60.3	
	35-016(q)	Drains and outfalls	92	
	35-018(a)	PCB transformer site	15.8	
Waste Minimization and Pollution Prevention Awareness Plan	Project-wide	n/a[d]	n/a	Dec. 1, 1999

[a] The work listed on this schedule is subject to modification.

[b] SOP 2.01 = Standard Operating Procedure 2.01, "Surface Water Site Assessments."

[c] TBD = to be determined.

[d] n/a = not applicable.

Table E-2
Los Alamos National Laboratory/Environmental Restoration Fiscal Year 2001 Work Schedule[a]

Regulatory Deliverable	PRS Number	Unit Description	SOP 2.01[b] Score
CMS Report	16-021(c)-99	260 Outfall	73.3
Closure Report	16-018	Material disposal area (MDA P)	69.3
RFI Report	16-021(c)-99	260 Outfall	73.3
RFI Report	21-029	Soil contamination	67
VCM Report	21-027(d)-99	Drainline	15.8
SAP	21-003-99	Container storage	33.3
	21-024(e)	Septic system	14
VCM Plan	73-001(a)-99	LA Airport Landfill Aggregate 73-1	85.5
	73-001(b)-99	LA Airport Landfill Aggregate 73-1	TBD[c]
Waste Minimization and Pollution Prevention Awareness Plan	Project-wide	n/a[d]	n/a

[a] The work listed on this schedule is subject to modification.

[b] SOP 2.01 = Standard Operating Procedure 2.01, "Surface Water Site Assessments."

[c] TBD = to be determined.

[d] n/a = not applicable.

Table E-3
Los Alamos National Laboratory/Environmental Restoration Fiscal Year 2002 Work Schedule[a]

Regulatory Deliverable	PRS Number	Unit Description	SOP 2.01[b] Score
SAP	21-015	Material disposal area (MDA B)	17.9
SAP	21-016(a)-99	Material disposal area (MDA T)	54
SAP	50-001(a)	RCRA waste treatment facility	TBD[c]
	50-002(a)	Underground tank	TBD
	50-002(b)	Underground tank	TBD
	50-002(c)	Underground tank	TBD
	50-004(a)	Waste lines	TBD
	50-004(b)	Underground tanks	TBD
	50-004(c)	Waste lines	TBD
	50-006(a)	Operational release	77.8
	50-006(c)	Operational release	TBD
	50-006(d)	Effluent discharge	89
	50-011(a)	Septic system	TBD
CMS Workplan	54-004	Material disposal area (MDA H) (except shaft 9)	TBD
	54-006	Material disposal area (MDA L) (storage shaft)	TBD
	54-013(b)-99	Material disposal area (MDA G) (disposal pit)	TBD
Phase 2 SAP	49-001(a)	Material disposal area (MDA AB) (exp. shafts)	59.2
	49-001(b)	Material disposal area (MDA AB) (exp. shafts)	59.2
	49-001(c)	Material disposal area (MDA AB) (exp. shafts)	59.2
	49-001(d)	Material disposal area (MDA AB) (exp. shafts)	59.2
	49-001(e)	Material disposal area (MDA AB) (exp. shafts)	59.2
	49-001(f)	Material disposal area (MDA AB) (exp. shafts)	59.2
	49-001(g)	Material disposal area (MDA AB) (exp. shafts)	59.2
	49-003	Leach field	59.2
	49-004	Burn site and landfill (Area 6)	TBD
	49-005(a)	Landfill (east of Area 10)	TBD
Permit Modification	54-005	Material disposal area (MDA J)	TBD
Waste Minimization and Pollution Prevention Awareness Plan	Project-wide	n/a[d]	n/a

[a] The work listed on this schedule is subject to modification.

[b] SOP 2.01 = Standard Operating Procedure 2.01, “Surface Water Site Assessments.”

[c] TBD = to be determined.

[d] n/a = not applicable.

Table E-4
Los Alamos National Laboratory/Environmental Restoration Fiscal Year 2003 Work Schedule[a]

Regulatory Deliverable	PRS Number	Unit Description	SOP 2.01[b] Score
RFI Report	21-003-99	Container storage	33.3
	21-024(c)	Septic system	14
RFI Report	35-004(a)	Storage areas	3.6
	35-004(b)	Storage areas	22.3
	35-004(g)	Container storage area	3.6
	35-004(h)	Container storage area	50.8
	35-009(a)	Septic system	22.3
	35-009(b)	Septic system	3.6
	35-009(c)	Septic system	18.3
	35-009(d)	Septic system	32.8
	35-009(e)	Septic system	18.3
	35-014(b)	Leaking drum	TBD[c]
	35-016(m)	Drains and outfalls	72
RFI Report	53-002(a)-99	Inactive lagoon	47.8
	53-006(b)-99	Underground tank	3.6
	53-006(d)-99	Underground tank	3.6
RFI Report		Upper Sandia (no PRS designation for this site)	
SAP	00-011(a)	Mortar impact area	TBD
	00-011(c)	Mortar impact area	TBD
	00-011(d)	Mortar impact area	TBD
	00-011(e)	Mortar impact area	TBD
SAP	21-018(a)	Material disposal area (MDA V) (laundry facility)	TBD
Integrated SAP	TAs-3, -48, -50, -60		
	03-034(a)	Tank and/or assoc. equip.-rad. liquid waste tanks	TBD
	03-049(a)	Outfall	TBD
	03-049(b)	Operational release	TBD
	03-054(e)	Outfall	89
	48-002(a)	Container storage area	15.3
	48-002(b)	Container storage area	15.3
	48-003	Septic system	65.5
	48-005	Waste lines	TBD
	48-007(a)	Drains and outfalls	55.8
	48-007(b)	Drains and outfalls	49.3
	48-007(c)	Drains and outfalls	69.5
	48-007(d)	Drains and outfalls	55.8
	48-007(f)	Drains and outfalls	76.5
	48-010	Surface impoundment	80.3
	50-006(d)	Effluent discharge	89

Table E-4 (continued)

Regulatory Deliverable	PRS Number	Unit Description	SOP 2.01[b] Score
Integrated SAP	TAs-4, -52	Mortandad/Cañada del Buey	
	04-003(a)	Outfall	57.3
	52-001(d)	UHTREX equipment	TBD
Integrated SAP	TAs-3, -32, -41, -43		
	03-038(a)	Acid tank	8.8
	03-038(b)	Acid tank	35.5
	26-001	Surface disposal site	TBD
	26-002(a)	Tank and associated equipment	TBD
	26-002(b)	Industrial or sanitary wastewater treatment	TBD
	26-003	Septic tank	TBD
	32-001	Incinerator (former location)	3.6
	32-002(a)	Septic tank (former location); drainlines	15.8
	32-002(b)	Septic system	15.8
	41-001	Septic system	TBD
	41-002(a)-99	Wastewater treatment facility	33
	43-001(a1)	Waste lines (pre-1981)	TBD
	43-002	Incinerator	TBD
Integrated SAP	05-003	Former calibration chamber	TBD
	05-004	Former septic system	49.7
	05-005(b)	Former outfall	27
	05-006(c)	Soil contamination beneath former buildings	27
Integrated SAP	46-002	Surface impoundment	3.6
	46-004(b2)	Operational release	27.5
	46-004(c2)	Outfall	30.5
	46-004(d)-99	Sump	30.5
	46-004(d2)-99	Stack emissions	56
	46-004(m)	Outfall	30.5
	46-004(u)	Outfall	30.5
	46-004(v)	Outfall	30.5
	46-004(x)	Outfall	30.5
	46-004(y)	Outfall	30.5
	46-004(z)	Outfall	30.5
	46-006(a)	Operational release	30.5
	46-006(b)	Operational release	10.6
	46-006(c)	Operational release	30.3
	46-006(f)	Storage area	34.6
	46-006(g)	Operational release	TBD
	46-007	Operational release	22.8
	46-008(b)	Storage area	22.8
	46-010(d)	Operational release	TBD
VCM Plan	16-019	MDA R	40.7

Table E-4 (continued)

Regulatory Deliverable	PRS Number	Unit Description	SOP 2.01[b] Score
VCM Plan	16-007(a)-99	TA-16 pond area	8.8
	16-008(a)-99	TA-16 pond area	10.6
Waste Minimization and Pollution Prevention Awareness Plan	Project-wide	n/a[d]	n/a

[a] The work listed on this schedule is subject to modification.

[b] SOP 2.01 = Standard Operating Procedure 2.01, “Surface Water Site Assessments.”

[c] TBD = to be determined.

[d] n/a = not applicable.

Table E-5
Los Alamos National Laboratory/Environmental Restoration Fiscal Year 2004 Work Schedule[a]

Regulatory Deliverable	PRS Number	Unit Description	SOP 2.01[b] Score
RFI Report	02-005	Omega West Reactor (systematic leak cooling tower blowdown)	19.6
	02-006(a)	Omega West Reactor (ind. or san. wastewater treat.)	15.3
	02-006(b)	Omega West Reactor (ind. or san. wastewater treat.)	15.6
	02-007	Omega West Reactor (septic system)	27.3
	02-008(a)	Omega West Reactor (outfall)	31.8
	02-009(a)	Omega West Reactor (non-intentional release)	26
	02-009(b)	Omega West Reactor (non-intentional release)	20.8
	02-009(c)	Omega West Reactor (non-intentional release)	27.3
RFI Report	49-001(a)	MDA AB (experimental shafts)	TBD[c]
	49-001(b)	MDA AB (experimental shafts)	34.6
	49-001(c)	MDA AB (experimental shafts)	17.5
	49-001(d)	MDA AB (experimental shafts)	17.5
	49-001(e)	MDA AB (experimental shafts)	TBD
	49-001(f)	MDA AB (experimental shafts)	TBD
	49-001(g)	MDA AB (experimental shafts)	59.2
	49-003	Leach field	36.8
	49-004	Burn site and landfill (Area 6)	TBD
	49-005(a)	Landfill (east of Area 10)	TBD

Table E-5 (continued)

Regulatory Deliverable	PRS Number	Unit Description	SOP 2.01[b] Score
RFI Report	50-001(a)	Waste treatment facility	TBD
	50-002(a)	Underground tanks	TBD
	50-002(b)	Underground tanks	TBD
	50-002(c)	Underground tanks	TBD
	50-004(a)	Waste lines	TBD
	50-004(b)	Underground tanks	TBD
	50-004(c)	Waste lines	TBD
	50-006(a)	Operational release	77.8
	50-006(c)	Operational release	TBD
	50-006(d)	Lagoons, filter bed system, outfall	20.8
	50-011(a)	Septic system	TBD
Integrated SAP	TAs-4, -5, -52, -63		
	04-001-99	Firing site; surface disposal	43.9
	04-003(b)	Outfall	51.5
	05-001(a)-99	Former firing site; canyonside disposal	23.5
	05-005(a)	Former French drain	15.3
	05-006(b)	Soil contamination beneath former buildings	15.3
	05-006(e)	Soil contamination beneath former buildings	15.3
	05-006(h)	Soil contamination beneath former buildings	15.3
	52-002(a)	Septic system	3.6
	63-001(a)	Septic system	24
	63-001(b)	Septic system	24
Integrated SAP	TAs-42, -55		
	42-001(a)-99	Incinerator	65.8
Surface CMI Plan	16-021(c)-99	260 Outfall	38.6
CMS Report	16-021(c)-99	260 Outfall	38.6
CMS Report	54-004	Material disposal area (MDA H) (except shaft 9)	TBD
	54-006	Material disposal area (MDA L) (storage shaft)	TBD
	54-013(b)-99	Material disposal area (MDA G) (disposal pit)	TBD
Waste Minimization and Pollution Prevention Awareness Plan	Project-wide	n/a[d]	n/a

[a] The work listed on this schedule is subject to modification.

[b] SOP 2.01 = Standard Operating Procedure 2.01, “Surface Water Site Assessments.”

[c] TBD = to be determined.

[d] n/a = not applicable.